

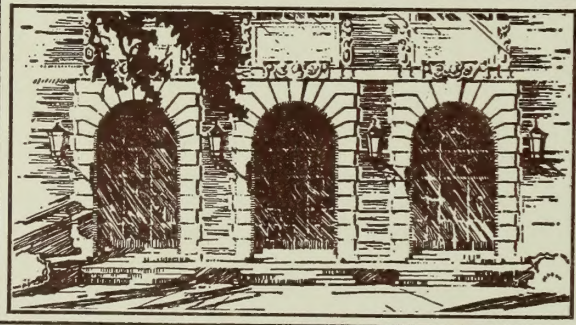
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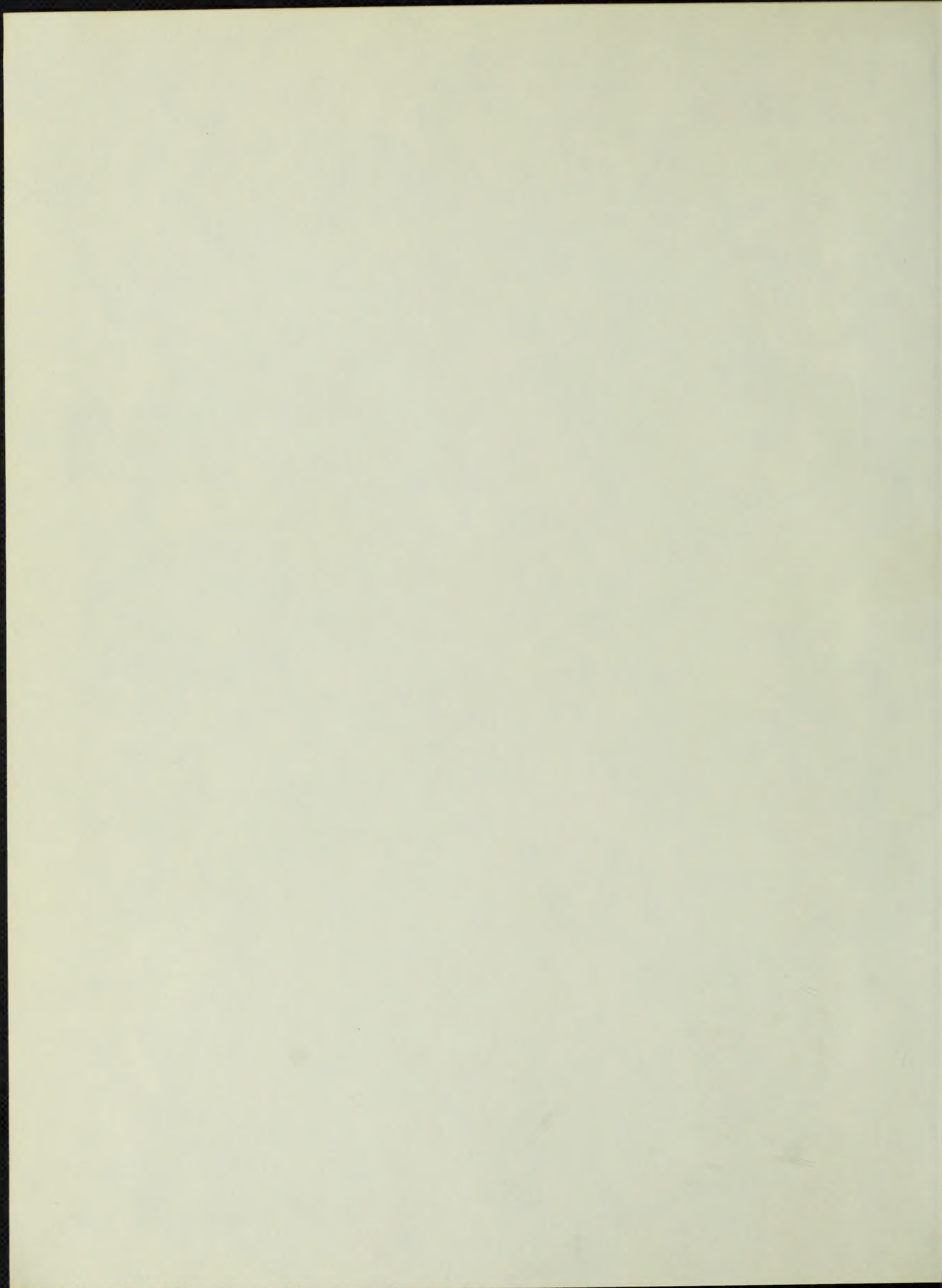
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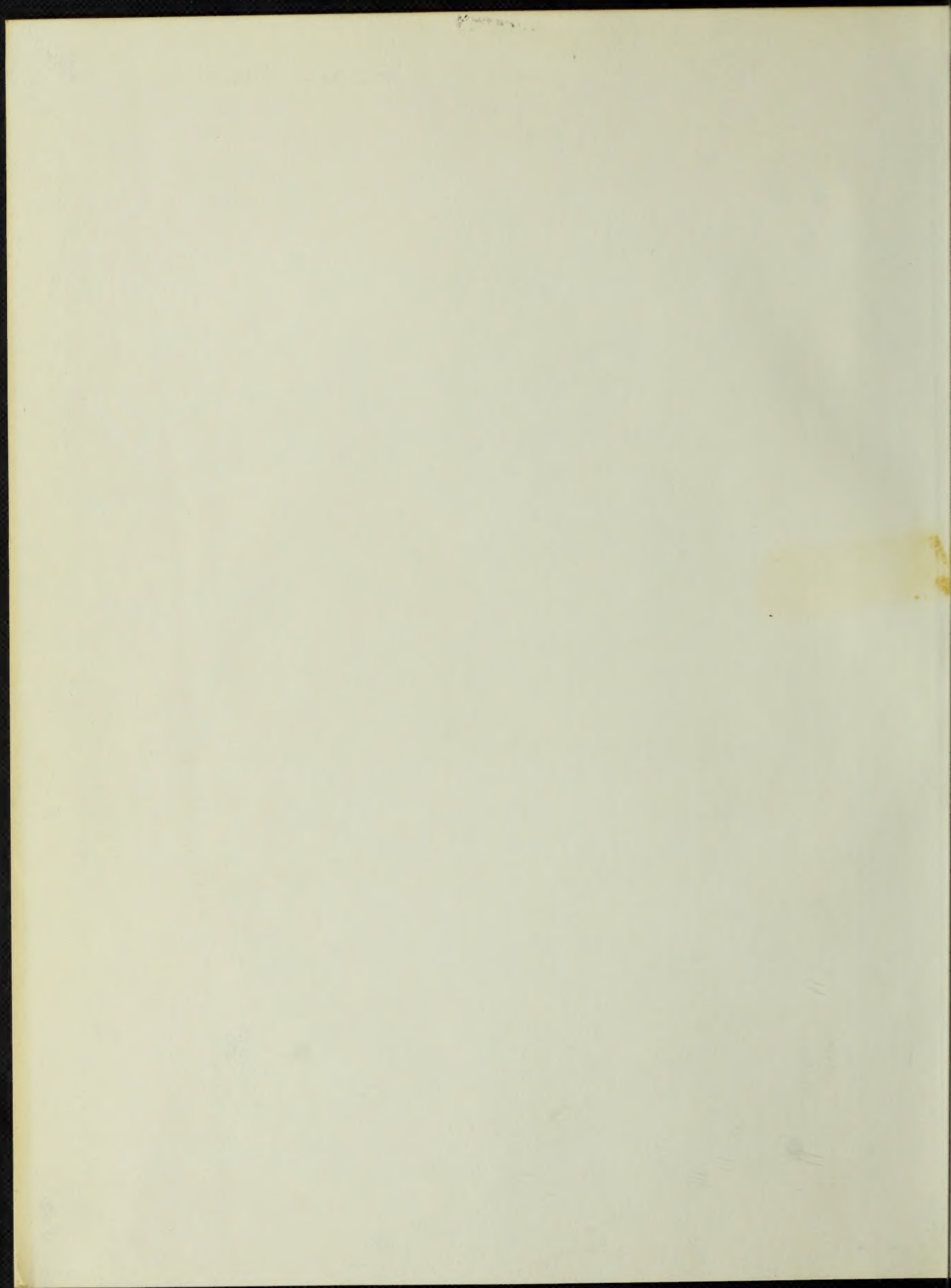
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Abstract Nos. 2901-3600

**Vol. 10
No. 8**

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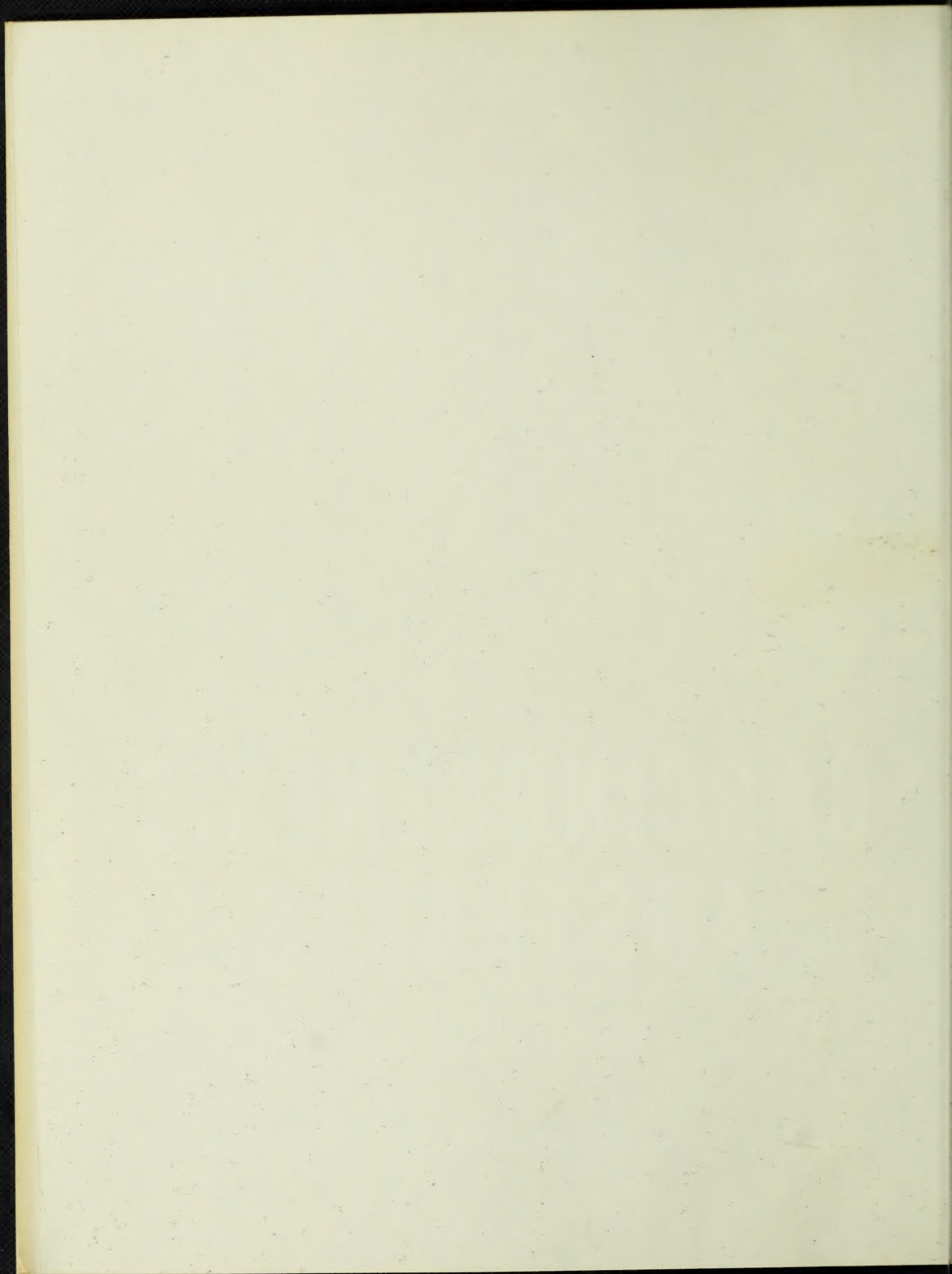
Abstract Nos. 2901-3600

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**CARCINOGENESIS
ABSTRACTS**

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE • National Institutes of Health



CARCINOGENESIS ABSTRACTS

A monthly publication of the

National Cancer Institute

Editor

Robert Love, M.D.
Jefferson Medical College, Philadelphia

Associate Editor

George P. Studzinski, M.D.
Jefferson Medical College, Philadelphia

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Elizabeth Weisburger, Ph.D.

Sidney Siegel, Ph.D.

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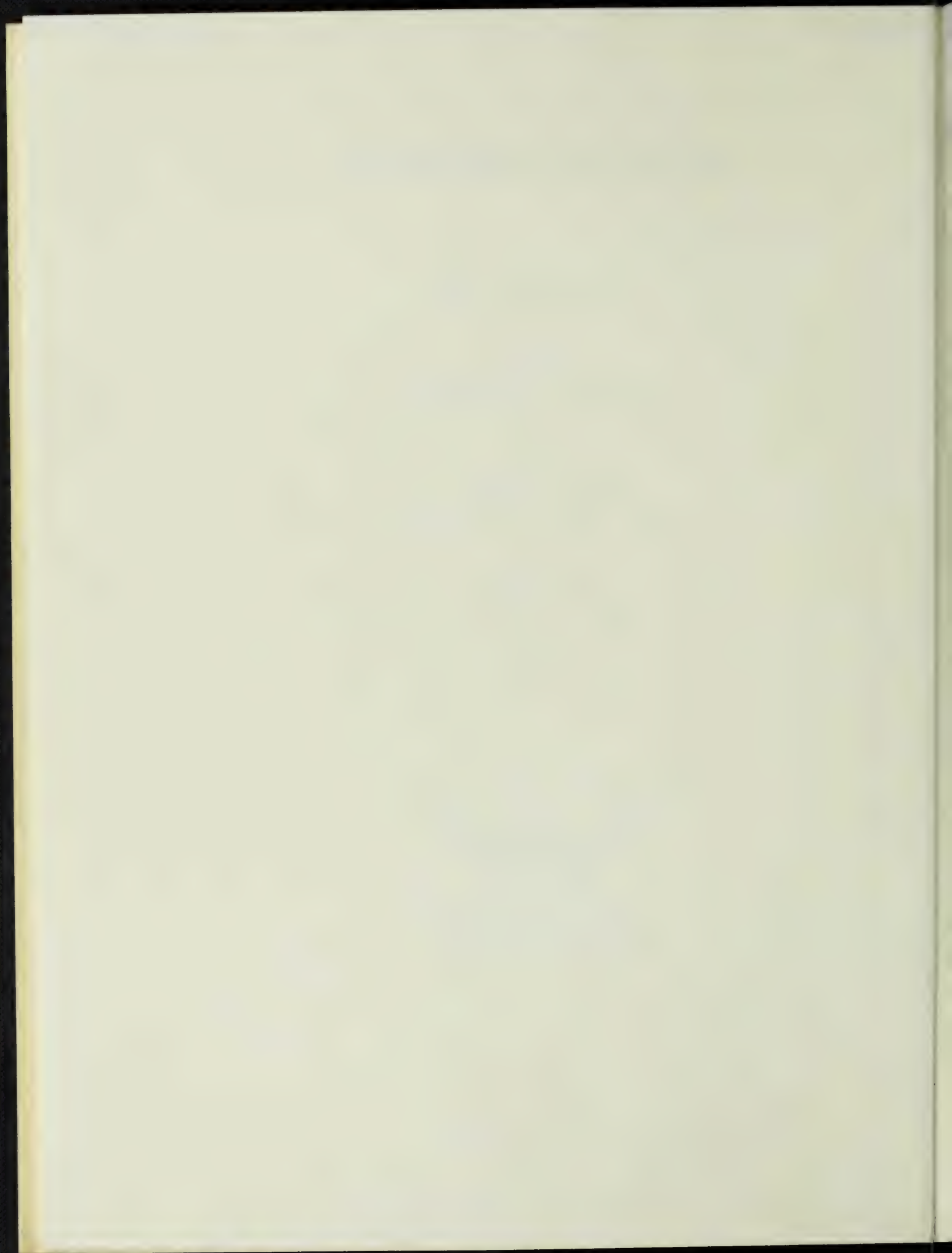
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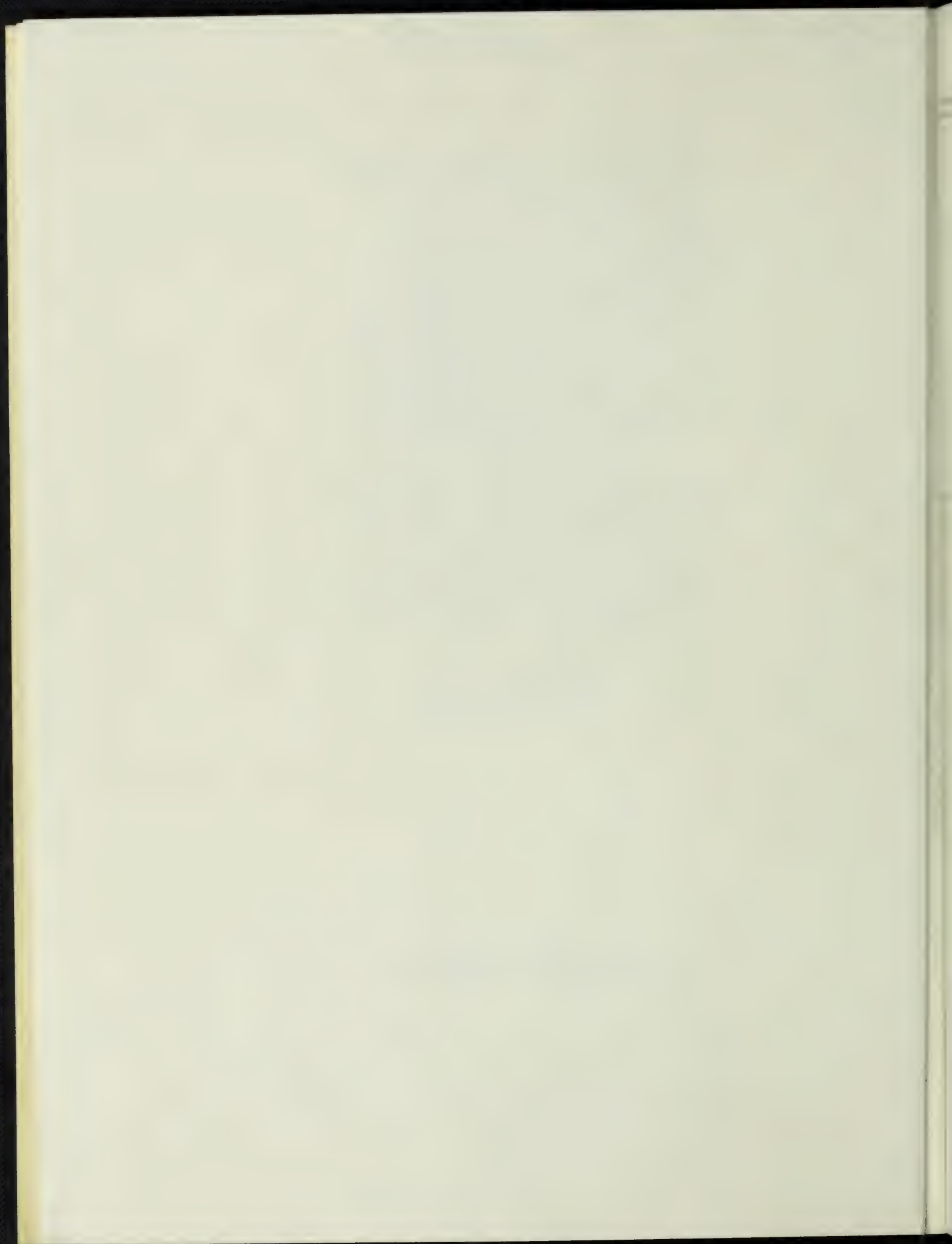
PREFACE

Carcinogenesis Abstracts is a publication of the National Cancer Institute. The journal serves as a vehicle through which current documentation of carcinogenesis research highlights are compiled, condensed, and disseminated on a regular basis. It represents an integral part of the Institute's program of fostering and supporting coordinated research into cancer etiology. Issues of *Carcinogenesis Abstracts* normally contain three-hundred-fifty abstracts and three-hundred-fifty citations (unaccompanied by corresponding abstracts). Abstracts and citations refer to the current scientific literature that describes the most significant carcinogenesis research carried on at the National Cancer Institute, other governmental agencies, and private institutions. *Carcinogenesis Abstracts* is intended to be a highly useful current awareness tool for scientists engaged in carcinogenesis research or related areas. The great number and diversity of publications relevant to carcinogenesis make imperative the availability of this service to investigators whose work requires that they keep abreast with current developments in the field.

Carcinogenesis Abstracts is normally published monthly. Volume X covers the scientific literature published from July 1971 through Dec 1972. A cumulative subject and author index for Volume X will be published shortly after the final regular issue. This journal is available free of charge to libraries and to individuals who have a professional interest in carcinogenesis. Requests for *Carcinogenesis Abstracts* from qualified individuals should include statements of their relationship to carcinogenesis research. All correspondence should be addressed as follows.

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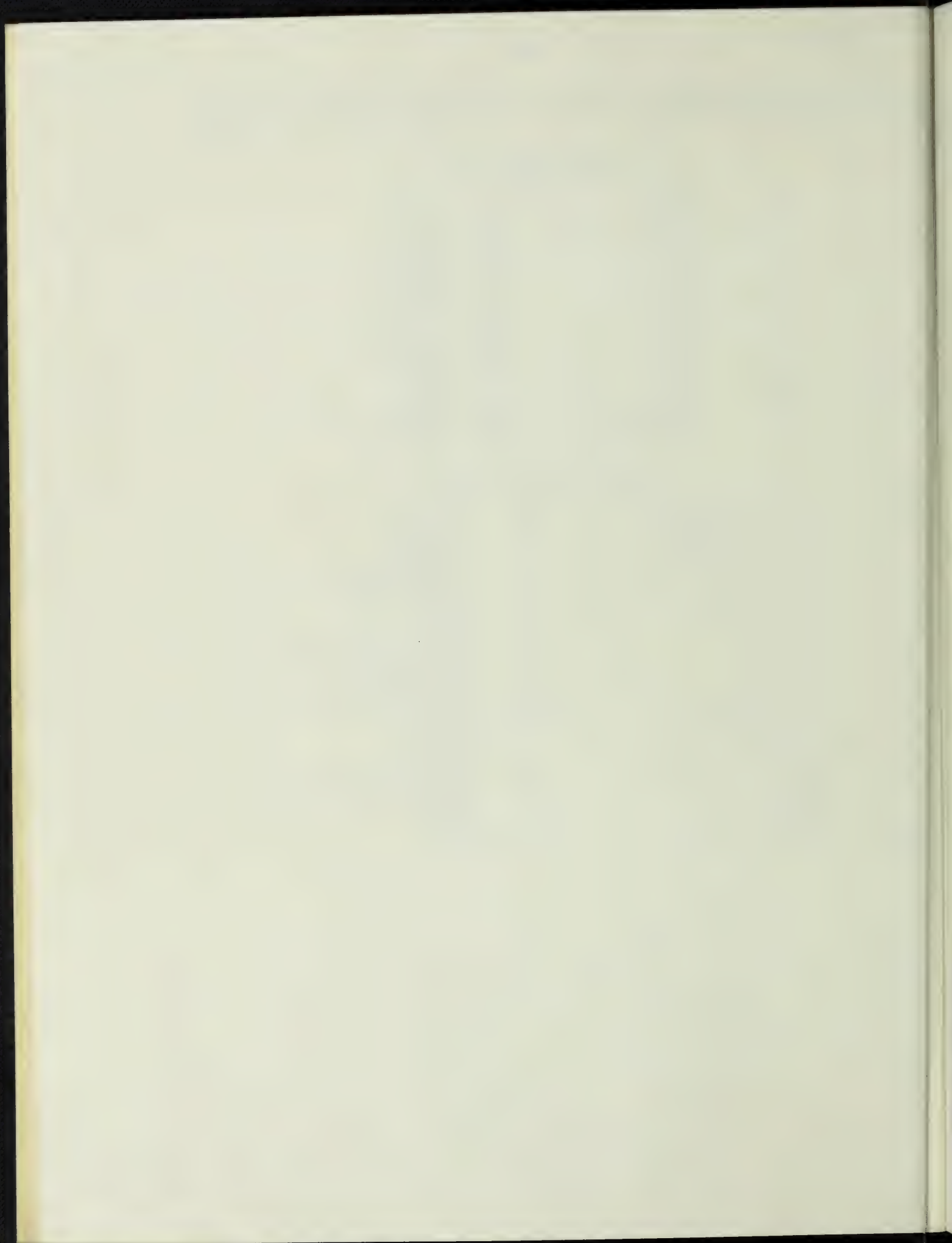
Journal names are abbreviated according to the list of abbreviations used by *Index Medicus*. For journals not covered by *Index Medicus*, the abbreviations (with some modifications) found in *World Medical Periodicals*, 3rd Edition, are used.

LANGUAGE ABBREVIATIONS

Afr.	Afrikaans	It.	Italian
Ar.	Arabic	Jap.	Japanese
Bul.	Bulgarian	Kor.	Korean
Ch.	Chinese	Latv.	Latvian
Cz.	Czech	Lith.	Lithuanian
Dan.	Danish	Nor.	Norwegian
Dut.	Dutch	Pol.	Polish
E.	English	Por.	Portuguese
Eston.	Estonian	Rum.	Rumanian
Fin.	Finnish	Rus.	Russian
Fl.	Flemish	Ser.	Serbo-Croatian
Fr.	French	Sl.	Slovak
Ger.	German	Sp.	Spanish
Gr.	Greek	Sw.	Swedish
Heb.	Hebrew	Th.	Thai
Hun.	Hungarian	Turk.	Turkish
Ic.	Icelandic	Uk.	Ukrainian
Ind.	Indonesian	Viet.	Vietnamese

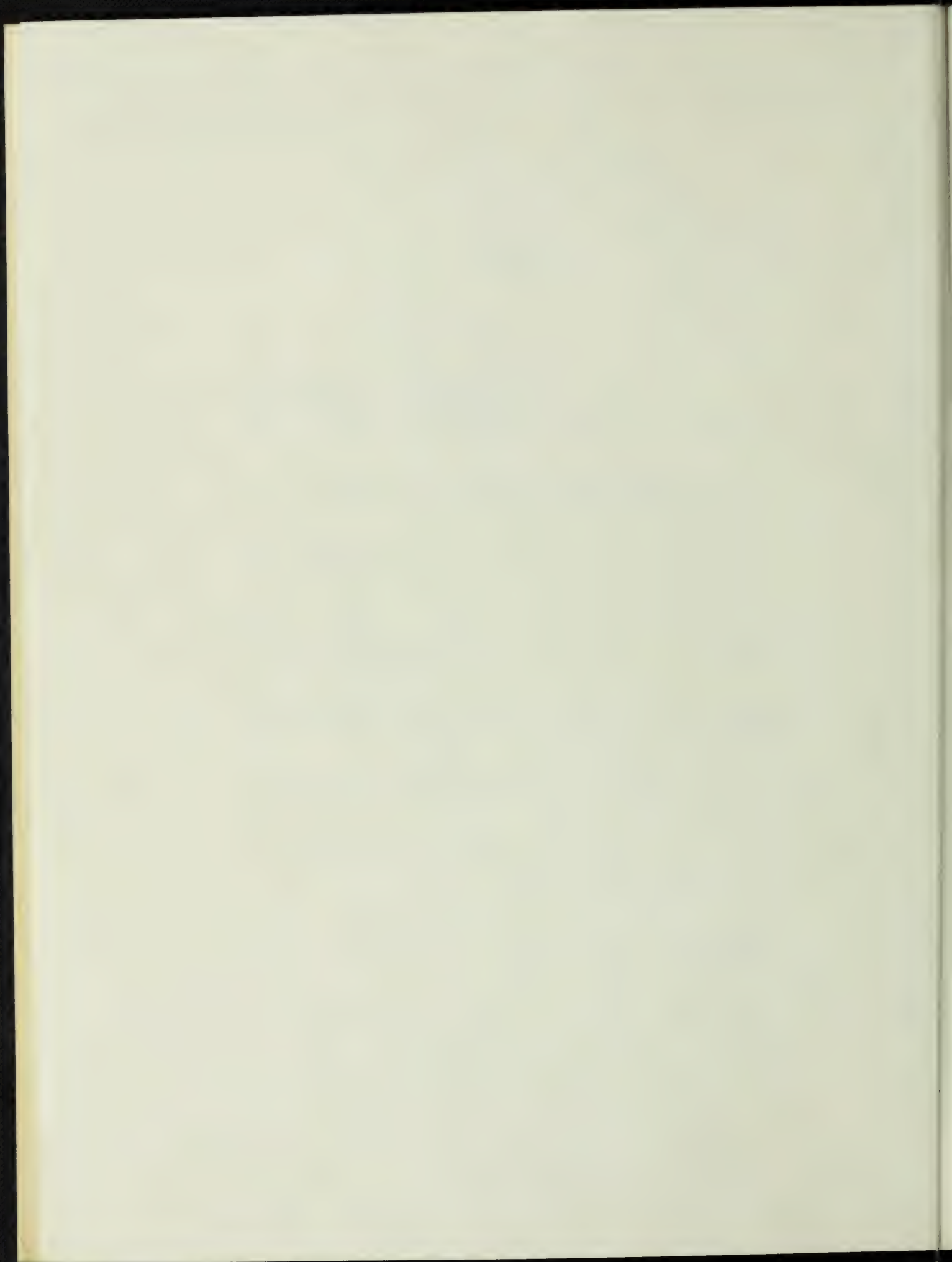
ABBREVIATIONS USED IN ABSTRACTS

ACTH	adrenocorticotrophic hormone	mg	milligram(s)
ADP	adenosine diphosphate	min	minute(s)
AMP	adenosine monophosphate	ml	milliliter(s)
ATP	adenosine triphosphate	mm	millimeter(s)
C	degrees centigrade	MTD	maximum tolerated dose
cm	centimeter(s)	ng	nanogram (10^{-9})
CNS	central nervous system	pg	picogram (10^{-12})
cpm	counts per minute	p.o.	orally
DNA	deoxyribonucleic acid	ppm	parts per million
e.g.	for example	r	Roentgen
g	gram(s)	RBC	red blood cells (erythrocytes), red blood count
µg	microgram(s)	resp.	respectively
hr	hour(s)	Rev.	review (only in citations)
i.m.	intramuscular	RNA	ribonucleic acid
i.p.	intraperitoneal	s.c.	subcutaneous
IU	international unit(s)	sec	second(s)
i.v.	intravenous	U	unit(s)
kg	kilogram(s)	UV	ultraviolet
LD ₅₀	median lethal dose(s)	WBC	white blood cells (leukocytes), white blood count
m	meter(s)	wk	week(s)
M	molar	wt	weight
mEq	milliequivalent(s)	yr	year(s)
mM	millimolar		
µM	micromolar		
mC, µC	milli-,microcurie(s)		



CONTENTS

	Cross Reference Abbreviations	Abstracts, Citations	Page
REVIEW.....	(Rev).....	2901-2922	471
CHEMICAL CARCINOGENESIS.....	(Chem).....	2923-3025	475
PHYSICAL CARCINOGENESIS.....	(Phys).....	3026-3032	500
VIRAL CARCINOGENESIS.....	(Viral).....	3033-3155	502
IMMUNOLOGY.....	(Immun).....	3156-3229	532
PATHOGENESIS.....	(Path).....	3230-3245	548
EPIDEMIOLOGY AND BIOMETRY.....	(Epid-Biom).....	3246-3290	551
MISCELLANEOUS.....	(Misc).....	3291-3600	560
AUTHOR INDEX.....			i
SUBJECT INDEX.....			xxi



001 LESS HARMFUL WAYS OF SMOKING. (E.) Wynder, E. L. (Amer. Hlth. Fdn., New York, N.Y.) and D. Hoffmann. - *J Nat Cancer Inst* 48(6):1749-1758, 1972.

Data on the relationship of cancer and smoking are reviewed, and evidence that different smoking habits are associated with different cancer risks is presented. Although cigar and pipe smokers are at less risk of developing lung cancer than cigarette smokers, excessive pipe and cigar smoking enhances cancer risk. Furthermore, cigar and pipe smokers have a high risk for cancer of the upper alimentary tract. Harmful agents in tobacco smoke are of three types: tumor initiators (including polycyclic aromatic hydrocarbons), tumor accelerators (including 9-methylcarbazole and 1-methylindole) and tumor promoters (including phenol). Smoke from high-nitrate tobacco, from terpene-free tobacco stems, and from cigarettes made of reconstituted tobacco sheets appears to be less carcinogenic than smoke from conventional cigarettes. Reducing the amount of smoke coming in contact with lung tissue also appears to reduce cancer risk. In one study it has been shown that filter cigarette smokers of at least ten years duration have lower risks of developing lung cancer than non-filter smokers. The diminished risk for lung cancer among pipe and cigar smokers compared to cigarette smokers is probably related to diminished depth of inhalation of tobacco smoke among pipe and cigar smokers. The importance of monitoring human smoking habits in the evaluation of smoking hazards is stressed. (27 references)

2902 THE NECROPSY FINDINGS IN CARCINOMA OF THE BRONCHUS. (E.) Line, D. H. (Hammersmith Hosp., London, England) and T. J. Deeley. *Brit J Dis Chest* 65:238-242, 1971.

The findings in 680 necropsies in which a carcinoma of the bronchus was found are reviewed. Data were obtained from a highly selected group of patients who had bronchial carcinoma, died in a hospital, and had a routine necropsy examination. Histological diagnosis showed that 38% of the cases were squamous cell carcinoma, 28% were oat cell, 26% were anaplastic, and 8% were adenocarcinoma. The most common site of primary involvement was the upper lobes. The right middle lobe was rarely involved. The right side showed slightly more involvement (54%) than the left (46%). Four percent of the cases has primary carcinomas at sites other than the lung. Metastatic spread in this series was slightly more common by hematogenous than by lymphatic routes for each of the four histological types. For each histological type, the incidence of soft tissue metastases was greater than that of bone metastases. Metastases were more common with oat cell tumors and less frequent with squamous cell tumors. Squamous cell tumors also had the highest incidence of "solitary metastases". The incidence of metastases in adenocarcinomatous lesions was relatively high. In nine percent of the cases (primary squamous cell) there were no metastases. Metastases occurred most frequently in the lymph nodes (hilar nodes in

83%), liver (40% of all cases), adrenals, bones (most common in vertebrae, 25%) and brain (most common site was the cerebellum, 76%). Bone and brain metastases were most common with oat cell and adenocarcinomas. (8 references)

2903 IMMUNOLOGICAL PROBLEMS IN ONCOLOGY. (It.) Gazzera, G. (European Org. Res. Treatment Cancer, Torino, Italy). *G Batt Virol Immun* 64(1-4): 37-80, 1971.

No matter whether tumors are spontaneous or produced by chemical carcinogens or viruses, specific tumor antigens are produced which vary from one tumor to another. These antigens cause a delayed antibody response in the host and can overcome his immune defense, in which case the tumor develops. When experimental tumors are transplanted and then removed surgically, the inoculated animal and the original host both become immune to the tumor. The main obstacles to heteroimmunization are that the specific antigen is probably present in a very small fraction of impure preparations of malignant tissues, that it cannot produce immunization, and that the chemical composition and cell site of these specific antigens are not known in many cases. When newborn animals are inoculated with oncogenic viruses, they develop tumors because they are not yet able to produce antibodies against the tumors. Some normal adults, however, have antibodies, suggesting that they were probably infected under normal conditions. Neoplastic cell transformations are associated with changes in cellular antigenic determinants resulting in the loss or reduction of isoantigens or the acquisition of new antigens. There are five mechanisms by which the tumor cell can escape from immunological control: (1) insufficient liberation of antigen, (2) the development of tumors in a favored site, (3) potentiation of antibodies, (4) immune-specific depression, and (5) immune tolerance. The use of immunotherapy in the treatment of tumors in man is discussed. (137 references)

2904 THEORY ON ATOMIC ENERGY LEVEL CHANGES AS A CAUSE OF CANCER: THE ROLE OF ^{40}K IN CARCINOGENESIS. (Sp.) Guiglia, S. F. (French Hosp. Los Angeles, California). *Folia Clin Int* 21(10):611-612, 1971.

Loss of aluminum by red blood cells (RBC) makes it possible for ^{40}K to pass into the serum and be absorbed by radiosensitive tissue. The protective action of Al may be due to its capacity to decrease the kinetic energy of ionized particles which come into contact with it. ^{40}K in the RBC may have a carcinogenic effect resulting from (1) absorption of radiation by the cells due to the proximity of the RBC, (2) phagocytosis of RBC by the cells, or (3) preferential absorption of ^{40}K from the pool of RBC. The gamma rays emitted by ^{40}K can interact with tissue and produce Compton electrons. (No references)

2905 THE VIRAL ETIOLOGY OF CERTAIN OSTEOGENIC
OSTEOSARCOMAS: A CRITICAL REVIEW. (Rev.)

Latarjet, R. (Curie Fdn., Paris, France). *Bull Cancer (Paris)* 58(2):277-286, 1971.

Studies published since 1966 on the viral origin of certain osteogenic osteosarcomas are reviewed. Cell-free extracts of human osteogenic osteosarcomas induced tumors of the same type when injected into newborn hamsters. The serum of patients contained a specific neoantigen of these tumors. If these findings are confirmed beyond a doubt then this is the first carcinogenic virus detected in man. That certain tumors produced by 90Sr in mice contain FBJ (Finkel) virus has been confirmed ultramicroscopically and by the induction of osteosarcomas by these extracts. The sarcomas induced by osteophilic radioactive elements are probably due to a preexisting virus in the bones of mice whose activity is inhibited under normal conditions. Spontaneous bone tumors in rodents occur rarely. A cell-free extract from a spontaneous vertebral osteosarcoma in a male CFI mouse, injected into newborn CFI mice, produced vertebral osteosarcoma in 280 days and a second one 60 days later. With subsequent passages the induction time was reduced to 84 days; 21% of the mice developed bone tumors in various sites. Electron microscopy showed oncornavirus type virions in the extract resembling those producing leukemia or sarcomas in birds and rodents. In a subsequent series of 106 mice, 35% contracted osteosarcomas. Bone tumors produced by the murine leukemia-sarcoma virus, characteristics of the FBJ virus, and findings on the viral etiology of human osteosarcomas are described. Therapy of tumors induced by a virus theoretically should be an antiviral therapy, possibly the administration of a non-carcinogenic virus resembling the causative virus which progressively displaces it. Partial success was achieved by this procedure on humans. (21 references)

2906 RECENT RESEARCH IN BURKITT'S LYMPHOMA.

(E.) Ziegler, J. L. (Uganda Cancer Inst., Kampala) and S. K. Kyalwazi. *E Afr Med J* 48(11):670-675, 1971.

The clinical features of Burkitt's lymphoma have permitted its separation into four stages: I, single facial tumor; II, two or more facial tumors; III, intrathoracic, intra-abdominal or osseous tumor; IV, tumor cells in the cerebrospinal fluid and/or bone marrow. The current treatment of choice is repeated i.v. administration of cyclophosphamide (Endoxan) at two to three wk intervals until complete remission. About 80% of all treated patients attain complete remission after one or two doses, while 15% die, usually due to extensive disease or complications. About 5% show a partial response to therapy. Class IV patients should receive methotrexate. Radiation therapy should be restricted to patients with localized disease. Surgical excision of large tumors should be attempted, if feasible, before further therapy. Two types of relapse occur—early and late. Early relapses, which

are seen in one-third of those achieving full remission and occur within ten wk of initial therapy, usually involve the same anatomic site and frequently involve the central nervous system (CNS). Early relapses generally occur in patients of class III or IV; their response to subsequent therapy is usually partial or transient with a median survival of 34 wk. Late relapses involve tumors at other than the primary site (excluding the CNS) and can be as successfully treated as the original tumor. It has been suggested that early recurrence is due to regrowth of the primary tumor, whereas late recurrence is due to reinduction of tumor. The high percentage of long term remissions has implied that the host's immunological responses may assist in eliminating residual tumor following therapy. Although a search for tumor-specific humoral antibodies has been unrewarding, antibodies directed against Epstein-Barr (EB) virus have been found. In addition, a tumor-specific delayed hypersensitivity reaction has been found in some patients during clinical remission, but not during relapse. Although EB virus is the prime etiological candidate, the geographic association of Burkitt's lymphoma with malaria suggests another possible etiology of the disease. (18 references)

2907 DEPRESSION OF THE LOCAL RESPONSE IN PRE-CANCEROUS CONDITIONS: A SCHEME OF ONCO-GENESIS. (Sp.)

Sadoff, L. (Dept. Med. "Kaiser Fdn. Hosp.", Los Angeles, Calif.). *Folia Clin Int* 21(10):615-620, 1971.

It is known that children, patients treated with immunosuppressive agents, patients with immune deficiencies, and elderly subjects are prone to cancer. Many infectious diseases have also been associated with a predisposition to cancer which is attributed to a saturation of the immune system. Thus, malaria is associated with Burkitt's lymphoma, syphilitic glossitis with tongue cancer, and pulmonary tuberculosis with lung cancer. Some autoimmune diseases are also associated with a predisposition to cancer. Thus, pulmonary scleroderma is associated with bronchopulmonary carcinoma, pernicious anemia with gastric adenocarcinoma, and ulcerative colitis with adenocarcinoma of the colon. Some physical and chemical carcinogens act as foreign bodies and induce a macrophage response in the host, e.g. tobacco smoke produced functional impairment of alveolar macrophages. In order to unify the viral and immunological theories about the origin of cancer, it is suggested that oncogenic viruses produce a change in the immune system which results in cancer. To test the hypothesis that the local cellular immune response is depressed in precancerous states, tuberculin skin tests were made directly over scars from burns and on smallpox vaccinations in normal subjects; control tests were run at the same site on the opposite arm. In all cases the skin reaction was less pronounced on the scars than on the control site, suggesting that cellular immunity is decreased in injured skin and perhaps in other organs with lesions or changes. These results are being quantified for publication elsewhere. (No references)

2908 MECHANISMS OF ESTABLISHMENT OF TUMOR METASTASES. (E.) Wood, S., Jr. (No affiliation). *Pathobiol Ann* 1:281-308, 1971.

The endogenous factors that might control tumor metastases are discussed. Investigations reported were primarily focused on direct observations through cinemicrographic techniques of the sequences occurring *in vivo*. The sequence of metastatic establishment is presented diagrammatically, including the lodgement, survival, and growth of cells from a primary neoplasm. Extensive time-lapse analyses of cellular behavior served as a means for documenting the locomotion of individual cancer cells, thus providing new and fundamentally informative data. In observing the relationship between thrombosis and cancer, indications were found that anticoagulants or plasmin reduce the frequency of metastases forming from blood-borne cancer cells. It is suggested that progress in cell research will be greatly accelerated with the development of less cumbersome study techniques. (69 references)

2909 VIRUSES AND BREAST CANCER: INTRODUCTORY REMARKS. (E.) Dmochowski, L. (U. Texas M. D. Anderson Hosp. Tumor Inst., Houston). *Cancer* 28(6):1404-1405, 1971.

Mouse mammary cancer is a systemic disease produced by diverse factors such as genes, or genetic factors; hormones; a virus (or viruses); and environmental factors. They all are closely interrelated and in their interplay lead eventually to the clinical appearance of breast cancer in these animals. It is known that a virus of characteristic morphology, the type B particle, transmitted in mothers' milk is the causative factor, if all other factors already mentioned are present. The virus is present in most organs of the animals, including the blood. The virus is present in the organs, including mammary glands and milk, long before clinical symptoms of neoplasia are observed. The virus, or type B particle, is also present in breast cancer cells of mice and can be maintained for prolonged periods of time in tumor cells grown in tissue culture. Attempts to find susceptible cells which can be transformed *in vitro* by the virus have so far failed. The only cells which support the growth of the virus *in vitro* are tumor cells and only cells of a few breast tumors have produced stable cell lines after tedious and extensive trials. Although the presence of the type B particle does not necessarily indicate future development of neoplasia in the host, a correlation does exist between high numbers of type B particles in milk of animals and high incidence of breast cancer in mice. In addition to milk, the type B virus particles are present in testicular tissues and in the spermatic fluid, which is infectious to female mice of a suitable susceptible genetic constitution. The virus has not been found in the egg or sperm itself, although the viral genome can apparently be transmitted in the sex cells of mice of at least one strain. Breast cancer cells of mice contain viral antigens which can be detected by immunologic techniques. Further, the type B virus particles contain RNA-dependent DNA polymerase.

Thus, these particles belong to the group of viruses known as oncogenic, or so-called oncornaviruses. (No references)

2910 AN EPIGENETIC MECHANISM FOR CARCINOGENESIS. (E.) Tsanev, R. (Bulgarian Acad. Sci., Sofia) and B. Sendov. *Z Krebsforsch* 76(4):299-319, 1971.

This review compares the main characteristics in the process of cytodifferentiation with those of carcinogenesis. Their multiphasic aspects are described and on the basis of available biochemical data a proposed molecular mechanism for blocking and de-blocking in normal cellular activity is presented. A detailed discussion of a computer reproduction of the functional interrelations of the neoplastic process includes consideration of hereditary patterns, mitotic activity, preneoplastic changes, and a mathematical description of the computer process itself. (30 references)

2911 PRIMARY MELANOBLASTOMA OF THE CEREBRAL LEPTOMENINGES. (Cz.) Triska, J. (Karolinska U. Prague, Czechoslovakia). *Cesk Neurol* 35(68):31-33, 1972. (17 references)

2912 SARCOMATOUS DEGENERATION IN PAGET'S DISEASE OF THE SACRUM: CASE REPORT. (Fr.) Bolla, M. (U. Hosp. Ctr. Grenoble, France), F. Jacquot, C. Vrousos and P. Vuillemin. *Bull Cancer (Paris)* 58(3):411-436, 1971. (74 references)

2913 THE TUMOR PROBLEM. (Ger.) Bauer, K. H. (Heidelberg, Germany). *Langenbeck Arch Chir* 329:250-264, 1971. (15 references)

2914 ON THE IMMUNOLOGY OF CANCER. (Ger.) Grundmann, E. (Wuppertal, Germany). *Langenbeck Arch Chir* 329:264-275, 1971. (31 references)

2915 MOLECULAR ASPECTS OF CARCINOGENESIS. (Ger.) Preussmann, R. (Heidelberg, Germany). *Langenbeck Arch Chir* 329:286-293, 1971. (24 references)

2916 PATHOLOGIC-ANATOMICAL ASPECTS OF HORMONE-SECRETING TUMORS. (Ger.) Beckler, V. (Berlin, Germany). *Langenbeck Arch Chir* 329:426-437, 1971. (25 references)

2917 ADENOMA OF SEBACEOUS GLANDS. (Rus.) Apatenko, A. K. (Moscow, USSR). *Vestn Derm Vener* 45(12):35-39, 1971. (15 references)

2918 EPITHELIAL LESIONS OF THE CERVIX UTERI: CYTOLOGY, HISTOLOGY, NOMENCLATURE AND SYNONYMS. (Fr.) Brux, J. de. (Inst. Pathol. Cytol., Paris, France). *Rev Franc Gynec* 66(11-12):653-669, 1971. (23 references)

2919 A CRITICAL REVUE OF EXPERIMENTALLY PRODUCED LEYDIG CELL TUMOURS PARTICULARLY IN THE RAT. (Fr.) Lacassagne, A. (Radium Inst. Paris, France). *Bull Cancer (Paris)* 58(2):235-276, 1971. (158 references)

2920 CARCINOID TUMOR OF RECTUM. (E.) Tiedemann, R. N. (New York Hosp.-Cornell Med. Ctr., New York), R. M. McDivitt and B. Thorbjarnarson. *New York J Med* 28:559-563, 1972. (14 references)

2921 BIOASSAY METHODS IN THE DEVELOPMENT OF LESS HARMFUL CIGARETTES: ASSETS AND LIABILITIES. (E.) Homburger, F. (Bio-Res. Inst., Cambridge, Mass.). *J Nat Cancer Inst* 48(6):1833-1840, 1972. (23 references)

2922 IMPROVED CIGARETTES--COMMENTS ON THE STATE OF THE ART, 1971. (E.) Tiggelbeck, D. (Pittsburgh Activated Carbon Div., Calgon Corp., Pa.). *J Nat Cancer Inst* 48(6):1825-1832, 1972. (21 references)

23 THE INFLUENCE OF CARCINOGENIC DOSAGE AND OF SEX ON THE INDUCTION OF EPITHELIOMAS AND SARCOMAS IN THE DORSAL SKIN OF RATS. (E.) Cherry, C. (Strangeways Res. Lab., Cambridge, England) and Glucksmann. *Brit J Cancer* 25(3):544-564, 1971.

Studies extending over 15 yrs, male and female hooded Lister rats, castrated at age 3-4 wk in some cases, were given 7,12-dimethylbenz(a)anthracene (DMBA) topically (1% solution) beginning at age 8 wk. Rats were given 4, 5, 10, 20 or 40 weekly doses of DMBA, and the induction of skin tumors was observed. Hypertrophy, hyperplasia and adenomas of sebaceous glands were seen in almost all rats given one or more doses of DMBA. The histogenesis of epidermal tumors proceeded via hyperplasia of interfollicular regions to the formation of papillomas. Malignant changes to squamous cell tumors occurred in papillomatous regions. Rats given four DMBA doses failed to produce skin tumors, and five doses increased tumor production. Ten DMBA doses, however, produced a marked increase in tumor development over four and five doses; rats given ten doses showed more tumors per rat and a higher carcinoma-to-papilloma ratio than rats given fewer doses. Squamous carcinoma incidence in male and female intact and castrate rats was similar at all dose levels. Tumor induction increased with number of DMBA doses to 20 doses, and decreased in intact rats given 40 doses. The optimal dose -- 20 doses -- produced more sarcomas in male than female rats. Progression to malignancy was fast for sarcomas, slow for basal cell tumors. Malignant precursor lesions and fibromas occurred in only 1% of rats given DMBA. Forty percent of rats at all dose levels had sarcomas, 64% had basal cell papillomas and 9% had basal cell carcinomas. Sixty-six percent of all rats developed squamous cell carcinomas, while 1% developed squamous cell papillomas.

24 MORPHOLOGICAL AND BIOCHEMICAL STUDY IN X-RAY- AND DIBUTYRYL CYCLIC AMP-INDUCED DIFFERENTIATED NEUROBLASTOMA CELLS. (E.) Prasad, N. (U. Colorado Med. Ctr., Denver) and A. Karnadakis. *Exp Cell Res* 70(1):27-32, 1972.

Mouse neuroblastoma cells (NB) were cultured from the primary tumor and exposed to 800 Rads X-irradiation (total dosage, delivered in a single dose or in four doses) or to dibutyryl adenosine 3':5'-cyclic monophosphate (DBcAMP) (0.5 mM). X-irradiation and DBcAMP induced morphological differentiation of NB cells, as evidenced by axon formation. Appreciable increases in number of differentiated cells were seen by 24 hr after X-irradiation or DBcAMP; the maximum number of differentiated cells was seen three days posttreatment. Differentiated cells showed morphological maturation as evidenced by increases in cellular and nuclear size. NB cells in the presence of DBcAMP continued to grow at a slightly reduced rate for two days; by three days they had reached a plateau phase. The removal of DBcAMP and re-addition of fresh growth medium at day four posttreatment did not cause renewal of cell division. The number of differentiated cells did not change after removal of DBcAMP, either, indicating that the change to morphological differentiation

was irreversible. Na-butyrate, 3':5'-cyclic AMP, 5' AMP, ATP, ADP and 3':5' cyclic guanosine monophosphate inhibited growth of NB cells but did not produce morphological differentiation. Acetylcholinesterase activity per NB cell was ten times higher in X-irradiated or DBcAMP-treated cells. Na-butyrate and 3':5'-cyclic AMP also increased acetylcholinesterase activity in NB cells.

2925 INHERITED SUSCEPTIBILITY OF INBRED STRAINS OF SYRIAN HAMSTERS TO INDUCTION OF SUBCUTANEOUS SARCOMAS AND MAMMARY AND GASTROINTESTINAL CARCINOMAS BY SUBCUTANEOUS AND GASTRIC ADMINISTRATION OF POLYNUCLEAR HYDROCARBONS. (E.) Homburger, F. (Bio-Res. Inst., Cambridge, Mass.), S.-S. Hsueh, C. S. Kerr and A. B. Russfield. *Cancer Res* 32(2):360-366, 1972.

BIO Syrian hamsters of 12 inbred strains, and hamsters in one randomly bred strain, were given s.c. injections of 500 µg of 3-methylcholanthrene (MC), benzo(a)pyrene (BP), 7,12-dimethylbenz(a)anthracene (DMBA), or benz(a)anthracene (BA); other animals were fed 5 mg MC by stomach tube. The development of tumors in the inbred strains was observed. DMBA induced nodules in all strains within three wks; MC, BP and BA did not elicit immediate local reactions. Sarcomas at the injection site ultimately developed in most strains given MC, DMBA or BP. BA, however, produced no tumors at the injection site. Ten percent of females in one strain developed bronchiolar adenocarcinomas associated with BA injection. Marked differences in susceptibility and in rate of tumor formation were evident in the different strains. The same three lines were always more susceptible than others to the carcinogens. MC feeding caused gastric and intestinal tumors in three inbred lines but caused no gastric tumors in the randomly bred line. Susceptibility of MC-fed animals to mammary tumors was higher in inbred animals than in noninbred animals. Ovarian and uterine tumors also appeared in MC-fed hamsters. Tumor incidence following MC feeding varied widely among hamster strains. It was concluded that genetic constitution determines the responsiveness of hamsters to carcinogens.

2926 PARTIAL PURIFICATION AND CHARACTERIZATION OF TWO ENZYMES FROM GUINEA-PIG LIVER MICROSOMES THAT HYDROLYZE CARCINOGENIC AMIDES 2-ACETYLAMINOFLUORENE AND N-HYDROXY-2-ACETYLAMINOFLUORENE. (E.) Järvinen, M. (Dept. Anatomy, U. Turku, Finland), R. S. S. Santti and V. K. Kopsu-Havu. *Biochem Pharm* 20: 2971-2982, 1971.

Two enzymes capable of deacylating carcinogenic compounds N-hydroxy-2-acetylaminofluorene (N-hydroxy-AAF) and 2-acetylaminofluorene (AAF) were liberated with sonication from guinea pig liver microsomes. The enzymes were separated by fractionation with ammonium sulfate and chromatography on Sephadex and hydroxylapatite or DEAE-cellulose. The Enzyme I (mol. wt. 200,000) hydrolyzed N-hydroxy-AAF 265 times faster than AAF, while Enzyme II (mol. wt. 41,000) hydrolyzed AAF about 1.4 times faster than N-hydroxy-AAF. Both enzymes hydrolyzed the acylamido derivatives of fluo-

rene and naphthalene faster than those of benzene. Substitution of the acyl hydrogen atoms enhanced markedly the hydrolysis rates. Both enzymes hydrolyzed readily ester substrates, e.g. tyrosine ethyl ester and 1-naphthyl acetate, and were inhibited by the organic phosphorus compounds.

- 2927 ON THE BIOCHEMICAL MECHANISM OF TUMORIGENESIS IN MOUSE SKIN: IV. METHODS FOR DETERMINATION OF FATE AND DISTRIBUTION OF PHORBOL ESTER TPA. (E.) Kreibich, G. (German Cancer Res. Ctr., Heidelberg), I. Witte and E. Hecker. *Z Krebsforsch* 76(2):113-123, 1971.

Female NMRI mice were treated on their back skin with a single application of the tritium-labelled phorbol ester A_1 (TPA- $20\text{-}^3\text{H}$). The distribution of the radioactivity in the skin ("epidermal fraction" and "connective tissue fraction") and internal organs (liver, kidney, spleen) at different time intervals after administration of the phorbol ester was investigated. In mice which were kept singly and prevented from licking their back skin about 65% of the total radioactivity administered was detectable in the treated area 12 hours after application of TPA- $20\text{-}^3\text{H}$. The rest of the radioactivity was found in the carcass (20%) and in the cage (15%). In mice which were not prevented from licking 12 hours after administration of TPA- $20\text{-}^3\text{H}$ only 15% of the activity administered was found in the treated skin area, 40% in the carcass and 40% in the cage. The radioactivity extractable from the "epidermal fraction" (10%) of such mice consisted of unchanged TPA (8%) and of metabolic products (2%). One of the metabolites may be either phorbol-13-acetate or 12-O-tetradecanoyl-phorbol. Possible pathways of metabolism of phorbol esters as well as the problem of the "ultimate tumor promoter" are discussed.

- 2928 ARYL HYDROCARBON HYDROXYLASE AND POLYCYCLIC HYDROCARBON TUMORIGENESIS: EFFECT OF THE ENZYME INHIBITOR 7,8-BENZOFLOAVONE ON TUMORIGENESIS AND MACROMOLECULE BINDING. (E.) Kinoshita, N. (Natl. Cancer Inst., Bethesda, Md.) and H. V. Gelboin. *Proc Nat Acad Sci USA* 69(4):824-828, 1972.

Male NIH Swiss mice were given single or repeated topical applications of 100 nmol 7,12-dimethylbenz(a)anthracene (DMBA) or benzo(a)pyrene; some mice were given topical 7,8-benzoflavone in the carcinogen solution or in acetone following carcinogen painting. In three experiments, 7,8-benzoflavone given together with a single dose of DMBA inhibited DMBA tumorigenesis by 80, 55 and 74%. 7,8-Benzoflavone had little effect on benzo(a)pyrene tumorigenesis (40% inhibition in one case, none in two other cases). In some cases, 7,8-benzoflavone stimulated benzo(a)pyrene tumorigenesis by about 2-fold. 7,8-Benzoflavone inhibited tumorigenesis by repeated doses of DMBA by 74, 69 and 30% resp., in three experiments, while 7,8-benzoflavone did not inhibit, or enhanced 3-6 fold, tumorigenesis by repeated benzo(a)pyrene doses. It was

found that 7,8-benzoflavone inhibited the binding of DMBA to DNA, RNA and protein in mouse skin. 7,8-benzoflavone inhibited binding of benzo(a)pyrene to DNA and protein to about the same extent as it inhibited DMBA binding to DNA and protein; benzo(a)pyrene binding to DNA, however, was not as markedly reduced by 7,8-benzoflavone as was DMBA binding to DNA.

- 2929 INHIBITION BY ERGOCORNICINE OF INITIATION AND GROWTH OF 7,12-DIMETHYLBENZANTHRAcene-INDUCED MAMMARY TUMORS IN RATS: EFFECT OF TUMOR SIZE. (E.) Clemen, J. A. (R) Lilly Company, Indianapolis, Ind.) and C. J. Sliger. *Cancer Res* 32:659-662, 1972.

Fifty-eight female Sprague-Dawley rats were treated with ergocornine (0.4 mg, s.c. daily) beginning 11 days before a single i.v. injection of 5 mg 7,12-dimethylbenzanthracene (DMBA); ergocornine treatment was continued for five days after DMBA treatment. After mammary tumors induced by DMBA appeared, 33 tumor-bearing rats were selected; some of these were given continued ergocornine treatments and others (controls) were treated with corn oil. Ergocornine significantly inhibited mammary tumor induction by DMBA. Ergocornine also caused significant regression of developed mammary tumors; 62% of mammary tumors on ergocornine-treated rats regressed completely. Two months after termination of ergocornine treatment, 64% of regressed tumors were found not to have recurred. Tumors of about 1.8 cm³ in volume and smaller regressed rapidly with ergocornine, while tumors of about 14.1 cm³ were not inhibited by ergocornine. Growth inhibition and regression to various degrees were seen in tumors between 1.8-14.1 cm³ in volume. Apparently mammary tumors start to lose their hormone dependence as they grow larger, eventually losing hormone dependence completely in some cases.

- 2930 ACUTE EFFECTS OF HEPATOCARCINOGENS ON MOUSE-LIVER MICROSOMAL ANTIGENS. (E.) Ingleton, P. M. (Dept. Zool., U. Sheffield, England). *Europ J Cancer* 7(6):501-504, 1971.

Female Strong A mice were given a single i.p. injection of 10 mg 2':3 dimethyl-4-aminoazobenzene (o-AAT), an hepatocarcinogen. A submicrosomal fraction of the liver was prepared which consisted essentially of endoplasmic reticulum membranes (M fraction); the effect of o-AAT on antigens in the M fraction was examined using Ouchterlony's double diffusion with rabbit antisera to the M fraction (anti-M) and to the M fraction of livers from mice given o-AAT (anti-DM). Forty-eight hrs after o-AAT injection, a slow-diffusing antigenic component had disappeared from the M fraction. When anti-DM was tested against the M fraction of livers from o-AAT-treated mice, a new precipitin line developed. A similar decrease in one M fraction antigen and increase in another was also seen in the M-fractions of livers from mice given o-AAT in diet for two wks. The non-carcinogenic 4:5' dimethyl-2-aminoazobenzene did not affect the antigenic character of the liver M fraction.

2931 INFLUENCE OF BLOOD TRANSFUSION ON INDUCTION OF HEPATOMA IN RATS FED 4-(DIMETHYLAMINO)-AZOBENZENE. (E.) Tsukada, Y. (Hokkaido U. Sch. Med., Japan). *Gann* 63(1):131-133, 1972.

Male Donryu rats were fed on a diet containing 0.06% 4-(dimethylamino)azobenzene (DAB) for 19 wks and given transfusions of blood from rats resistant to transplantation of ascites tumor one or more times/wk for 21 wks (Group 1). Other rats were fed DAB and given transfusions of blood from normal donors (Group 2), or were given either DAB and no transfusion (Group 3), or neither transfusion nor DAB (Group 4). Eleven of 30 Group 1 rats, 17 of 50 Group 2 rats, and 21 of 50 Group 3 rats developed hepatomas by 524 days after the start of the experiment. Thirty-five percent of transfused rats (Groups 1 and 2) developed hepatomas compared to a 43% hepatoma incidence in untransfused, DAB-fed rats.

2932 THE DEVELOPMENTAL, NODULIGENIC, AND TUMORIGENIC POTENTIALS OF TRANSPLANTED MAMMARY GLANDS AND PRIMARY DUCTS FROM C3H MICE PREVIOUSLY FED A PHENYLALANINE-DEFICIENT DIET. (E.) Hui, Y. H. (Cancer Res. Genetics Lab. U. California, Berkeley), K. B. DeOme and G. M. Briggs. *Cancer Res* 32(1):57-60, 1972.

Virgin female C3H/Crgl mice were fed diets containing deficient amounts of phenylalanine (0.90 or 0.120%) for 19-20 wk; half the mice in the phenylalanine-deficient groups were given pituitary isografts under the left kidney capsule. A control group was fed a stock diet and given no pituitary grafts. The phenylalanine-deficient mice served as donors of mammary gland tissue grafts to five wk old virgin C3H/Crgl mice (hosts). Hosts were given a whole-gland mammary transplant and two primary duct transplants. The whole inguinal mammary glands were sutured onto the abdominal body wall, and the primary duct transplants were transplanted into gland-free into gland-free inguinal fat pads. In addition, hosts received pituitary isografts. When host were 16-17 wk old, pituitary grafts were destroyed; mice were killed six wk later and the development of mammary glands, hyperplastic alveolar nodules and mammary tumors was observed. All but two of 130 whole-gland transplants, all outgrowths from transplanted primary ducts, and all host mammary glands, developed nodules, regardless of the dietary or hormonal status of transplant donors. Tumors did not develop in host glands or in outgrowths from primary duct transplants and whole-gland transplants taken from control donors. Thirty tumors developed in 214 whole-gland transplants and outgrowths from primary ducts taken from phenylalanine-deficient mice. Tumor incidence was higher in transplants taken from donors fed phenylalanine-deficient diets and stimulated by pituitary isografts than in transplants from phenylalanine-deficient unstimulated donors. Transplanted mammary glands and primary duct outgrowths were well developed and resembled host glands. Evidently, phenylalanine deficiency did not permanently impair the developmental noduligenic or tumorigenic capacities of donor mammary glands.

2933 THE INTERACTION OF (³H)ETHYL CARBAMATE WITH NUCLEIC ACIDS OF REGENERATING MOUSE LIVER. (E.) Lawson, T. A. (U. Queensland Sch. Med., Australia) and A. W. Pound. *Chem-Biol Interactions* 4(5):329-341, 1971/72.

The binding of urethane (ethyl carbamate) to liver nucleic acids of Crackembush mice was examined by observing levels of binding to DNA and RNA in liver regenerating after partial hepatectomy. Initially, 20 mg of unlabeled urethane were given to intact and partially hepatectomized mice, and DNA and RNA synthesis were observed. DNA and RNA synthesis were reduced in intact and in partially hepatectomized mice given urethane. Mitosis was also inhibited in liver cells by urethane. In urethane binding experiments, a single dose of 50 μ Ci ³H-urethane was given to four groups of mice: non-hepatectomized controls (group A), and mice hepatectomized 18, 28 and 38 hr before urethane treatment (groups B, C and D, resp.). Four to 16 hr after urethane, mice were killed and liver DNA and RNA were isolated and examined for radioactivity. Maximum specific activities for DNA were lower in hepatectomized than in intact mice; values for DNA activity in groups A, B, C and D, resp., were 130, 90, 72 and 39 mCi/g. Binding of urethane to DNA persisted longest in group B. Urethane binding to RNA was greater in hepatectomized than in intact mice. When three doses of labeled urethane were given to intact and hepatectomized mice (30, 150 and 300 μ Ci) binding to DNA varied with dose in the approximate ratio of 1:5:10. This suggested that it was not restoration of liver mass which was responsible for lower levels of urethane binding to DNA in groups B, C and D. Altered urethane metabolism did not appear to account for different levels of binding.

2934 INITIAL CELL CYCLE DELAY AND DEPRESSION OF MACROMOLECULAR SYNTHESIS OF PRIMARY MOUSE EMBRYO CELLS TREATED WITH METHYLNITROSOUREA IN MASS CULTURE. (E.) Frei, J. V. (Fac. Med., U. Western Ontario, London, Canada) and J. Oliver. *Exp Cell Res* 70(1):49-56, 1972.

Inbred Swiss CFW/D mouse embryo cell cultures were treated with 0.2 ml of methylnitrosourea (MNUA) in concentrations of 0.5-3.0 mM and the effect of MNUA on the cell cycle was observed. MNUA caused cells to proliferate less rapidly than untreated cells; this effect was due to a slowing down of the cell cycle, and not to cell killing. The slowing down of the mouse embryo cell cycle by MNUA was not associated with the entry of cells into the S phase; neither the G₁ nor the G₂ phases were affected by MNUA. MNUA treatment decreased the loss of cells from the monolayer culture, possibly by decreasing cell death. Macromolecular synthesis by mouse embryo cells was depressed by MNUA. At a 1.5 mM MNUA concentration, DNA synthesis in cells (as measured by ³H-thymidine uptake) was decreased by 78%, RNA synthesis by 56%, and protein synthesis by 72%. Depression of macromolecular synthesis by MNUA was approximately pro-

portional to MNUA dose. DNA synthesis in MNUA-treated cells remained depressed for three days. It is concluded that MNUA acts to delay proliferation of mouse embryo cells by prolonging the S phase of the cell cycle.

- 2935 THE EFFECT BOTH OF TIME AND DOSE APPLIED ON TUMOUR INCIDENCE RATE IN BENZOPYRENE SKIN PAINTING EXPERIMENTS. (E.) Lee, P. N. (Tobacco Res. Council Lab., Harlow Hill, England) and J. A. O'Neill. *Brit J Cancer* 24(4):759-770, 1971.

In two separate experiments using 1200 and 160 specific pathogen-free mice resp., mice were painted with benzo(a)pyrene (BP) in amounts of 6, 12, 24 or 48 g/wk, or with 1, 3, 9 or 27 g every fourth day. Tumor development was observed for 69 wk posttreatment. Figures on tumor incidence were subjected to statistical analyses to test the hypothesis that when a constant repetitive dose of carcinogen is applied to a target area, the incidence rate of tumors is proportional to $(t-w)^{k-1}$, where t is time and w and k are constants. A model in which the tumor incidence by BP is proportional both to $(t-w)^{k-1}$ and to $(\text{dose})^2$ showed a very good fit on the data yielded by the experiments.

- 2936 SCISSIONS OF PROTEINS LINKING DNA IN CULTURED MAMMALIAN CELLS INDUCED BY 4-NITROQUINOLINE 1-OXIDE AND THEIR REPAIR. (E.) Ide, T. (Inst. Med. Sci., U. Tokyo, Japan) and T. Andoh. *Cancer Res* 32 (6):1236-1242, 1972.

The rejoining of double-strand scissions of DNA induced by 4-nitroquinoline 1-oxide (4NQO) was studied in cultured mouse cells, strains FM3A and L-P3. FM3A cells were ten times more sensitive to the effects of 4NQO than were L-P3 cells, as 10^{-6} M 4NQO caused a decrease in the sedimentation rate of DNA of FM3A cells in sucrose gradients comparable to that caused by 10^{-5} M 4NQO in L-P3 cells. The scissions caused by a low 4NQO concentration in FM3A were completely re-joined on incubation for 24 hr in medium without 4NQO ("recovery incubation"). However, at 4NQO concentrations greater than 3×10^{-6} M, the extent of breakage increased and repair was incomplete after 24 hr. 4NQO-treated cells in which the DNA double-strand scissions had been repaired were able to grow at a rate comparable to that of untreated cells. However, as the unrepaired DNA fraction increased with increasing 4NQO concentrations, the viability of the cells decreased. It is suggested that the 4NQO-induced cell death was due to the irreparable damage to DNA. Treatment of cellular DNA with Pronase caused a decrease in the sedimentation rate equivalent to that caused by treatment of cells with 10^{-5} or 10^{-6} M 4NQO or that caused by treatment with Pronase plus 4NQO. This suggested that the site on DNA cleaved by Pronase was the same as that cleaved by 4NQO and further indicated that this site was a peptide linkage. Treatment of FM3A or L-P3 cells with higher concentrations of 4NQO resulted in a greater decrease in the sedimentation rate of DNA than treatment of control DNA with Pronase

alone, suggesting that the 4NQO had produced nucleotide breaks in addition to the peptide linkage breaks induced by lower concentrations.

- 2937 PRELIMINARY STUDIES OF TOLERANCE TO CONTACT SENSITIZATION IN CARCINOGEN-FED GUINEA PIGS. (A.) Pomeranz, J. P. (Case Western Reserve U. Sch. Med., Cleveland, Ohio). *J Nat Cancer Inst* 48(5):1513-1517, 1972.

Random bred male Hartley strain guinea pigs were fed 50, 75 or 100 mg 7,12-dimethylbenz(a)anthracene (DMBA) in 1.5 ml corn oil. Additional animals were fed 50 or 100 mg 3-methylcholanthrene (MCA) or benzo(a)pyrene (BP) in 2.5 ml and 5 ml corn oil resp. Three wk after ingestion, the recipients and controls (fed corn oil alone) were immunized with foot-pad injections of the same carcinogen (200 μ g DMBA, 300 μ g BP or 300 μ g MCA) mixed with Freund's complete adjuvant. Two wk later, all animals were tested for contact sensitivity by application of 0.1, 0.5 or 1.0% concentrations of the same carcinogens in acetone-olive oil, 4:1. Fifty percent of the DMBA-fed animals and 66% of the BP-fed recipients had negative or trace contact reactions to topical application of a 1% concentration of the same chemical in acetone-olive oil. In contrast, all controls showed cutaneous contact hypersensitivity to the carcinogen, even when more dilute concentrations were applied. Seventy-seven percent of the MC-fed animals showed no hypersensitivity response. All but one animal in all the experimental and control groups showed tuberculin sensitivity upon injection of purified protein derivative. The absence of a cutaneous hypersensitivity response in the experimental animals was comparable to the tolerant state induced by feeding simple chemical haptens, in terms of specificity and resistance.

- 2938 DELIMITATION OF INHIBITORY AND ENHANCING EFFECT OF HISTONE ON TUMOR GROWTH. (E.) Gillissen, G. (Med. Faculty, Technische Hochschule, Aachen, West Germany) and K. Schweizer. *Z Krebsforsch* 77:57-63, 1972.

The inhibitory and enhancing effects of unfractionated total histone extracted from calf thymus nuclei on the growth of two solid Ehrlich ascites tumors, EAT/Hoechst and EAT/Stol, were studied *in vivo*. Treatment of mice by s.c. injection of histone containing 100 μ g nitrogen daily for ten days, starting on the day of implantation of EAT/Hoechst, or treatment with 100 or 250 μ g histone-N on days 4, 5 and 6 after tumor implantation, either inhibited tumor growth by five-fold or caused regression of palpable tumors in 50% of the animals. The effect of histone on EAT/Stol under these conditions was not significant. The difference in susceptibility between the two growing tumors was attributed to a faster growth rate of the histone-sensitive EAT/Hoechst. Histone injection after day nine, when tumor growth rate had decreased, showed no effect on subsequent tumor growth. Pretreatment of

mice with six s.c. injections every other day of histone followed by implantation of EAT/Hoechst one wk after the last injection enhanced tumor growth by 50% compared with controls. This finding was consistent with the view that enhancement of tumor growth might be due to the previously demonstrated immunosuppressive effect of histone.

2939 SOME FACTORS INFLUENCING THE RESPIRATORY TOXICITY OF CIGARETTE SMOKE. (E.)

Dalhamn, T. (Inst. Hyg., U. Uppsala, Sweden). *J Nat Cancer Inst* 48(6):1821-1824, 1972.

The toxicity of cigarette smoke was determined on the secretion-transporting mechanism of the respiratory tract as reflected in ciliary movements. Previously published results showed that with greater volumes of inhaled cigarette smoke, fewer inhalations were required to inhibit ciliary movement in cats. With a constant inhalation volume, longer intervals between inhalations produced smaller toxic effects. Cats exposed to inhalations from cigarettes with cellulose acetate filters or carbon filters required approximately twice as many inhalations to produce ciliostasis as did cats exposed to inhalations from standard nonfilter control cigarettes. In the experiments reported on in this paper, eight different types of cigarettes were smoked by cats. Statistical analysis showed that ciliotoxicity was best correlated with the content of tar which explained 52.5% of the variation in toxicity. Acrolein was the only other component of cigarette smoke which showed a significant degree of correlation with ciliotoxicity. Nicotine, acetaldehyde, carbon monoxide, hydrogen cyanide, nitrogen oxides and pH of the smoke had no apparent effect. Experiments indicated that all substances analyzed were retained to a far greater extent in the lungs than in the mouth.

2940 CARCINOGENICITY OF 7H-DIBENZO[c,g]CARBAZOLE IN THE RESPIRATORY TRACT OF HAMSTERS. (E.)

Sellakumar, A. (U. Nebraska Med. Ctr., Omaha) and P. Shubik. *J Nat Cancer Inst* 48(6):1641-1646, 1972.

Male Syrian golden hamsters received either 15 or 30 weekly intratracheal installations of 7H-dibenzo[c,g]carbazole (7H-DBC) suspended with an equal volume of hematite in saline. A third group served as untreated controls. In the group treated for 15 wk (45 mg 7H-DBC total), 30 of 35 animals at risk (86%) had respiratory tract tumors. Fifty percent of the tumors were squamous cell carcinomas, with the first tumors appearing in the bronchus as early as the 15th wk. The hamsters treated for 30 wk (15 mg 7H-DBC total) had an 89% incidence of respiratory tract tumors (40 of 45 animals at risk). In this group, 64% of the animals bore a total of 51 squamous cell carcinomas, with the first tumors appearing in the trachea at the 30th wk. Other tumors induced in both groups included adenocarcinomas, anaplastic carcinomas, adenomas, papillomas, polyps and fibrosarcomas. Most tumors in both groups arose from the epithelium of the bronchi and trachea; a few arose in the larynx. No other tumors were seen except for

papillomas of the forestomach. Although the respiratory tract tumors did not metastasize into other organs, the bronchogenic carcinomas did metastasize as small nodules into the lungs. No tumors were seen in the control group.

2941 PREFERENTIAL BINDING OF 2-ACETYLAMINOFLUORENE TO RAT LIVER rRNA DURING EARLY STAGES OF HEPATOCARCINOGENESIS. (E.) Irving, C. C. (VA Hosp., Memphis, Tennessee) and R. A. Veazey. *Biochem Biophys Res Commun* 47(5):1159-1164, 1972.

The binding of 2-acetyl-amino-fluorene-9-¹⁴C (AAF-¹⁴C) to different nucleic acid moieties was studied in partially purified rat liver homogenates. AAF had been shown to induce a high incidence of liver tumors in male rats. In one series of experiments male and female Holtzman rats were fed a grain diet containing 0.04% AAF-¹⁴C. Binding of AAF-¹⁴C to liver DNA was the same (300-400 pmoles/mg) for both sexes although a maximum was reached faster in male rats. Binding to tRNA was transitory in male rats reaching a maximum of 200-250 pmoles/mg by three days and declining rapidly thereafter with a half-life of 1.5 days. The most significant sex difference was observed in the amount of AAF-¹⁴C bound to liver rRNA. In male rats, rRNA specific activity increased to 350 pmoles/mg by two wk and fell gradually thereafter with a half-life of three days. Liver rRNA specific activity of female rats increased very slowly and reached a maximum value of only 100-150 pmoles/mg at 4-8 wk. Simultaneous administration of 3-methylcholanthrene (0.005%), which was previously shown to inhibit AAF tumor induction in male rats, resulted in a 35-40% decrease in binding of AAF-¹⁴C to liver rRNA and DNA as opposed to a 50% increase in the binding of carcinogen to liver tRNA. These data support the concept that binding of AAF to liver rRNA, but not to liver tRNA, might be involved in hepatocarcinogenesis.

2942 HORMONAL CARCINOGENESIS WITH SPECIAL EMPHASIS ON THE INDUCTION OF MAMMARY TUMOURS IN MICE. (E.) Boot, L. M. (Netherlands Cancer Inst., Amsterdam). *Rev Roum Endocrinol* 8(3):225-228, 1971.

Three model systems are described in which excessive hormone production has definitely been associated with the induction of neoplasms. The first and simplest system involves the induction of thyroid tumors by disturbing the normal inhibition of TSH production by the hypophysis. Such procedures as subtotal thyroidectomy, iodine deficiency, or treatment with goitrogenic drugs lead to excess TSH release which in turn stimulates the thyroid producing hyperplasia and, ultimately, neoplasia. The second example, the induction of ovarian tumors, is almost as simple and also involves disturbance of the hypophyseal feedback mechanisms. When an ovary or a part of an ovary is transplanted to the spleen, the estrogens produced by the ovary are metabolized by the liver and do not reach the hypophysis. This results in excessive production

of FSH and LH which leads to abnormal growth of the ovarian graft and ultimately, again, to tumor formation. Of the two hormones, LH appears to be the more important as treatment with anti-LH, but not anti-FSH, serum prevents tumor formation. The third system, the induction of mammary tumors in female mice, also involves the pituitary feedback system but the mechanism is more complex than that of the first two systems. In this system, the hypophysis is transplanted to a site (the kidney) away from the sella turcica. The leads to uninhibited production of prolactin, an excess of progesterone, and the induction of mammary tumors. FSH and LH are not produced and are apparently not involved in this system. The degree of mammary tumor response depends on the mouse strain or hybrid used, the site and number of pituitaries implanted, and the age and sex of the donors.

- 2943 BLASTOMOGENESIS IN RATS WITH PERSISTENT ESTRUS. (Rus.) Anisimov, V. N. (N. N. Petrov Res. Inst. Oncol., Leningrad, USSR). *Vop Onkol* 17(8):67-75, 1971.

Tumor development in persistent estrus associated with estrogen deficiency, and the effect of such a state on tumorigenesis induced by 20-methylcholanthrene (MC) were studied in four groups of white hybrid female rats: 68 normal virgin rats (Group I), 66 virgin rats with constant estrus induced by auto-transplantation of the ovary in the tail after castration (Group II), 27 virgin rats with persistent estrus induced by the same method and which received MC in peach oil (5-10 mg i.p. for 30-35 days six times a week) starting five weeks after the operation (Group III), and 26 intact virgin rats which received the same dose of MC in peach oil (Group IV). The rats were 6-16 months old. The rats were autopsied for microscopic examination of tumor growths 6-36 months after the beginning of the experiment. Tumors developed more in Group II (43/66) and Group III (10/27) than in the control group (18/68). The number of malignant tumors was higher in Group II (17) and Group III (5) than in the control (3/68). Adenocarcinoma of the uterus was observed in Group II (1) and Group III (1), while it was not seen in the other two groups. The concentration of follicle stimulating hormone in the pituitary increased and excretion of total estrogens decreased with age in intact rats. Analogous age variations were seen in rats with persistent estrus, but they were more pronounced. MC induced a similar number of tumors in Group III and Group IV, but the incidence of multiple neoplasms was higher in Group IV (5/26) than in Group III (2/27). In animals with persistent estrus, MC did not induce mammary tumors, but it increased the incidence of mammary fibroadenoma (20) and adenocarcinoma (8) in rats with normal estrus. MC administered to rats with normal estrus inhibited pregnandiol and total estrogen excretion, increased 17-ketosteroid excretion with no change in plasma corticosterone level. MC did not cause adrenal dysfunction in operated rats with persistent estrus, which showed an increase in 17-ketosteroid excretion associated with an increase in the plasma corticosterone level. Thus, combined per-

sistent estrus and MC suppressed tumorigenesis in the mammary gland, while adrenal dysfunction accelerated tumor growth in the mammary gland.

Therefore, anovulation is an important factor in development of mammary tumors in rats exposed to exogenous and endogenous tumorigenic agents.

- 2944 A MODEL OF EXPERIMENTAL REPRODUCTION OF CANCER OF THE ESOPHAGUS. (Rus.) Litvinov, N. N. (No affiliation), V. I. Govershenko and V. N. Kurylev. *Bull Exp Biol Med* 72(8):84-87, 1971.

N,N'-dimethylethylenedinitrosamine (5 mg/kg in aqueous solution) was introduced by catheter into the esophagi of 105 white male rats daily except Sundays for four months, and five rats were autopsied at monthly intervals of 1-4 months from the beginning of the experiment; 17 rats died in 2-6 months; and the remaining 68 animals were autopsied 5 or 6 months from the beginning of the experiment. Microscopic examination showed no changes in the esophagi from the animals killed after one month. In all five animals killed after two months, there was diffuse-focal thickening of the esophageal mucosa due to an increase in epithelial cell layers and intense keratosis. In animals killed after three months, leukoplakia was present due to hyperplastic epithelium, increased cell growth, and hyperkeratosis. These hyperplastic changes were more intense in animals killed after four months. In addition, the following changes were observed: papillomatous growths in the connective tissue; epithelial cell proliferation in the submucous membrane, infiltrating the connective tissue; benign epithelial cell tumors; and active growth of epithelial cells in a tumor growing from a thin peduncle. In animals studied after five and six months the tumors were larger and were typical squamous cell carcinomas which were frequently keratinized. Primary neoplasms and metastases were not observed in other organs. Multiple carcinomas of the esophagus associated with papillomatosis were observed in all 75 animals examined after 5-6 months.

- 2945 INCREASED ACTIVITY OF POLYNUCLEOTIDE LIGASE FROM RAT HEPATOMA INDUCED BY N-2-FLUORENYL-ACETAMIDE. (E.) Tsukada, K. (Fac. Pharm. Sci., Toyama U., Japan), S. Hokari, N. Hayasaki and N. Ito. *Cancer Res* 32(5):886-888, 1972.

Nonhepatoma and hepatoma areas of liver are studied for polynucleotide ligase activity. Wistar male rats were fed for three months on a diet containing 0.025% N-2-fluorenylacacetamide (2-FAA). Rats were maintained an additional three months following 2-FAA treatment on a diet without 2-FAA. Enzyme activity was measured in purified liver nuclei and nuclear extract by the conversion of 5'-phosphomonoesters-³²P in nicked DNA into a form which remained acid insoluble after incubation in alkaline phosphatase. ATP, Mg²⁺ and mercaptoethanol were required for enzyme activity. ATP could not be replaced by NAD⁺ in either normal rat liver or hepatoma. Mn²⁺ could not replace Mg²⁺.

The enzyme was inactivated by P-chloromercuribenzoate in the absence of mercaptoethanol. The activity of ligase in the soluble fraction from rat hepatoma (0.268 ± 0.030 μ moles phosphatase-resistant 32 P/mg protein) was five times greater than that in normal rat liver (0.046 ± 0.005). Ligase activity in the nuclear extract from rat hepatoma (1.40 ± 0.20) was about three times that in normal rat liver (0.48 ± 0.05). These differences were not caused by differences in the contamination by nucleases in the enzyme preparations. In normal liver about 50% of the ligase activity was localized in the nuclear fraction and 40% in the cytoplasm, while in hepatoma about 30% of the ligase activity was nuclear and 60% was cytoplasmic.

2946 SELECTIVE INHIBITION OF RNA POLYMERASE ACTIVITY IN RAT LIVER NUCLEI BY 4-(DIMETHYLAMINO)AZOBENZENE, AND EFFECT OF NITROFURANS ON LIVER RNA METABOLISM ASSOCIATED WITH PREVENTION OF CARCINOGENESIS. (E.) Akao, M. (Inst. Food Microbiol., Chiba U., Japan), K. Kuroda and K. Miyaki. *Gann* 63(1):1-10, 1972.

To investigate the mechanism of the reduction of liver RNA by 4-(dimethylamino)azobenzene (DAB), male Donryu rats were fed diets containing 0.06% DAB; other rats were fed diets containing DAB and either 2-(2-furyl)-3-(5-nitro-2-furyl)acrylamide (N1) or 2-amino-5-(2-(5-nitro-2-furyl)-1-(2-furyl)-vinyl-1)-1,3,4-oxadiazole (N2). The latter agents are nitrofurans which inhibit liver carcinogenesis induced by DAB. Quantities of liver RNA and DNA were determined in rats fed DAB for 5, 10 and 15 days. The DAB diet decreased the RNA content/g liver and the RNA/DNA ratios of liver significantly. RNA/DNA ratios were little changed in rats fed DAB plus N1 or N2. Studies were made to determine whether accelerated RNA degradation or suppressed RNA synthesis accounted for the decrease in liver RNA in DAB-fed rats. The half-life of 14 C-RNA in rat liver cells was used to measure RNA degradation. 14 C-RNA's half-life was not shortened by DAB feeding. The analysis of liver for RNA synthesis was made by estimating two kinds of DNA-dependent RNA polymerase in isolated liver cell nuclei: Mg^{2+} -activated and Mn^{2+} -(NH_4) $_2$ SO $_4$ -activated RNA polymerase. The Mn^{2+} -(NH_4) $_2$ SO $_4$ -activated RNA polymerase was suppressed by 35% in rats fed DAB for ten days. Mg^{2+} -activated RNA polymerase was stimulated by DAB. N1 and N2, fed concurrently with DAB, increased both RNA polymerases in rat liver. The decrease of liver RNA by DAB was apparently caused by RNA polymerase suppression by DAB; nitrofurans apparently antagonized the action of DAB on liver RNA by increasing RNA polymerase activity.

2947 EFFECT OF MALE HORMONE ON CHEMICALLY INDUCED SKIN CANCER IN MICE. (Fr.) Derout, J. (Bouicaut Hosp., Paris, France), G. Thieriot-Prevost and J. de Brux. *C R Acad Sci (Paris)* 165 (3):520-523, 1971.

Of 90 male C57BL/Gif mice, 30 normal ones received a

single injection of Androtardyl (testosterone 100 μ g i.p.) in olive oil and were subjected to weekly skin painting with methylcholanthrene (MC) in mineral oil, 30 were subjected to castration + MC, and 30 intact mice received only MC. Mice treated with Androtardyl developed tumors somewhat earlier (after 12 weeks) than the others, but these tumors were highly differentiated, keratinized papillomas which only became malignant about 17 weeks after initiation of treatment. These tumors resemble the relatively benign verrucose laryngeal carcinomas found in man. Intact mice treated with MC alone developed invasive, highly differentiated epidermoid tumors after 16 weeks, while castrated mice given MC developed moderately differentiated, rapidly infiltrating tumors of the same type after 14 weeks. These findings indicate that male hormone has a significant effect on tumor differentiation but has very little effect on the time at which malignant tumors appear.

2948 OESTRADIOL RECEPTORS IN CARCINOMA AND BENIGN DISEASE OF THE BREAST: AN *IN VITRO* ASSAY. (E.) Feherty, P. (Middlesex Hosp. Med. Sch., London, England), G. Farrer-Brown and A. E. Kellie. *Brit J Cancer* 24(4):697-710, 1971.

Supernatant fractions of homogenates of breast tumor biopsies were tested by an *in vitro* assay for the presence of specific, high-affinity receptors which could bind 3 H-labeled estradiol. The method was applied to biopsies from 94 patients with malignant and benign disease of the breast. Of the 53 biopsies classified as carcinomas, 37 contained high-affinity estradiol receptors in concentrations ranging from 0.3 to 22.6×10^{-15} moles/mg tissues, two were "borderline", and 14 had no receptor. The proportion of positive results and the range of concentrations were found to be somewhat higher in postmenopausal than in premenopausal patients. Despite detailed examination, no histological feature was found which could explain the variation in receptor concentration; neither could it be accounted for by differences in the cellularity of the biopsies (expressed as total DNA content). Of the 41 benign breast biopsies examined, only three contained any high-affinity estradiol receptor, and in these the concentration was very low (0.3 to 0.6×10^{-15} moles/mg tissue). The receptor was not detected in normal breast tissue.

2949 INTRACELLULAR DISTRIBUTION OF *IN VIVO* LIVER CATALASE-DEPRESSING SUBSTANCE IN RHODAMINE SARCOMA. (E.) Kannan, Y. (Inst. Protein Res., Osaka U., Japan), K. Nishikawa, Y. Matuo and T. Horio. *Gann* 63(2):201-208, 1972.

Nuclear, mitochondrial, microsomal and supernatant fractions of rat Rhodamine sarcoma tissue were assayed in an attempt to localize the liver catalase-depressing ("toxohormone") activity previously reported. Of all fractions, the nuclear one

possessed the highest liver catalase-depressing activity when injected into mice. Depressing activity of the mitochondrial and microsomal fractions was less than that of the nuclear fraction. The supernatant fraction contained no activity. Assays performed on nucleolar and chromatin fractions of purified sarcoma nuclei showed that the catalase-depressing activity was only associated with the latter. Although catalase-depressing activity was also found in cell homogenates of dorsal muscle and liver of normal rats, the extent of depression was much lower than that of Rhodamine sarcoma tissues. Fractions prepared from tumor tissues freshly obtained had a significantly lower activity than those prepared from tumor tissues stored frozen.

- 2950 HORMONAL CARCINOGENESIS GROWTH OF HYPOPHYSEAL ISOGRAFTS AND THE INDUCTION OF MAMMARY TUMOURS IN MICE. (E.) Röpcke, G. (Netherlands Cancer Inst., Amsterdam). *Rev Roum Endocrinol* 8(3):229-232, 1971.

The effects of estrogens and progesterone were studied on hypophyseal isograft growth and mammary tumor induction in various mouse strains and hybrids. Pituitary isografts to the left kidney were performed in 6-to-8-wk-old mice. Isografts grew in intact mice to a wt of 4000 mg or more within two yr. Ovariectomy drastically reduced graft growth. Isograft growth was restored by treatment of castrate females with estrogen, but not with progesterone. Estrogen also stimulated graft growth in castrate males. Castrate male (C57BL x CBA)F₁ mice bearing isografts were fed different concentrations of estrone or estrone plus progesterone (0.0125 to 2.00 mg/l) in their drinking water. Although no dose-response relationships could be established, all types of estrogen administered (high and low doses as well as discontinuous treatment at 5-day intervals) induced substantial growth of the isografts. Mammary tumor incidences obtained with estrone treatment alone were correlated more with isograft growth than with the estrogen dose given. These results indicated that estrone was acting by stimulating production of prolactin by the pituitary isografts. Progesterone appeared to act directly on the mammary gland, in synergism with prolactin, increasing the mammary tumor incidence and decreasing the average age of tumor-bearing mice.

- 2951 NITROSAMINE STUDIES: NEOPLASMS OF LIVER AND GENITAL MESOTHELIUM IN NITROSOPYRROLIDINE-TREATED MRC RATS. (E.) Greenblatt, M. (U. Nebraska Coll. Med., Omaha) and W. Lijinsky. *J Nat Cancer Inst* 48(6):1687-1696, 1972.

Male and female MRC (Wistar-derived) rats were fed nitrosopyrrolidine (NP), a cyclic nitrosamine, in their drinking water (total dose of 1,340 mg) for 7 wk. After cessation of treatment, animals were observed for 105 wk and survivors were sacrificed and autopsied. Seventy untreated animals served as

controls. Hepatocellular carcinomas were induced in all 25 rats treated with NP. They were the only tumors found in females and were usually large, solitary, well-defined masses. According to the Broder classification, 16 of 25 (64%) were grade 1-2 and 9 of 25 (36%) were grade 3-4. There was little overall variation in histologic grade within each tumor and uninvolved liver tissue was essentially normal in 20 of 25 (80%) of the tumor-bearing rats. Vascular invasion of the hepatic venous circulation was present in 12 of 25 (48%) of the tumor-bearing rats but was not invariably associated with distant metastases (lung, lymph nodes) which were seen in only 6 of 25 (24%) animals. In addition, genital tumors occurred in 7 of 12 male rats, and four of these were papillary mesotheliomas of the tunica vaginalis testis, a histologic type rarely described in MRC rats. Two of the four animals with papillary mesotheliomas had associated interstitial cell tumors. A review of the literature with respect to the carcinogenic activity of nitroso compounds and their possible relationship to human neoplasia is presented.

- 2952 THE EFFECT OF VARIATION IN CARCINOGENIC DOSAGE ON THE INDUCTION OF TUMOURS IN THE DORSAL AND VULVAL SKIN OF FEMALE RATS. (E.) Glucksmann, A. (Strangeways Res. Lab., Cambridge, England) and C. P. Cherry. *Brit J Cancer* 24(4):735-745, 1971.

The response to 5, 10, 20 or 40 weekly paintings with 9,10-dimethyl-1,2-benzanthracene (DMBA) of the dorsal and vulval skin in intact and castrate rats is compared. Squamous and basal cell tumors appeared faster in the dorsal skin than in the vulval region with 5, 10 or 20 paintings, but at the same rate with 40 doses. The rate of induction of epithelial tumors was optimal with 20 applications dorsally, but increased with dose at the vulva. Progression of malignancy of squamous cell tumors was greater and faster in the dorsal than in the vulval region. For basal celled neoplasms of the vulva there was a peak value in malignant conversion at 20 doses, but otherwise there was no consistent difference in the pattern at the two sites. Castration reduced the incidence of basal cell tumors of the vulva in rats painted weekly for life, but did not affect the incidence of epithelial tumors of the skin. Sarcomas occurred in 29% of rats in the dorsal region, but in only 0.4% at the vulva. Sarcomatous changes in the stroma of epitheliomas were also more frequent in the dorsal skin. Local factors rather than variation in individual sensitivity accounted for the differences with region in the carcinogenic response as shown by their persistence in rats treated simultaneously at both sites.

- 2953 STUDIES ON THE BINDING AND DISTRIBUTION OF RADIOACTIVELY LABELLED 3'-METHYLCHOLANTHRENE IN SUBCELLULAR FRACTIONS OF RAT LIVER. (E.) Jones, P. A. (Dept. Biochem., U. Rhodesia,

Salisbury) and A. O. Hawtrey. *Brit J Cancer* 24(4): 45-852, 1971.

The subcellular distribution of [^{14}C] or [^3H] 3'-methylcholanthrene (3-MC) was studied in liver from male albino rats ten hr after administration of a single i.p. injection of the labeled hydrocarbon. Subcellular fractions were obtained by ultracentrifugation of the liver homogenates. Experiments showed that 3-MC which was non-covalently bound was highly prevalent and was associated with protein and not with t-RNA. Covalently bound radioactivity occurred to a small extent and was not considered significant. Washed mitochondria (25% incorporation), washed microsomes (20%) and cell sap (52%) accounted for the main binding of labeled 3-MC of its metabolites in rat liver. Highly purified cell wall membranes had no radioactivity associated with them. Purified nuclei possessed only 2% of incorporated radioactivity. Fractions with the highest labeling in terms of specific activity (dpm/mg protein) were the washed mitochondria, washed microsomes and washed ribosome-free microsomal membranes and the core proteins from these fractions. Fractionation of the cell sap into pH 5 enzyme and pH 5 supernatant indicated that the specific activity of the pH 5 enzyme was about four times higher than that of the pH 5 supernatant. Further fractionation of the pH 5 enzyme by $(\text{NH}_4)_2\text{SO}_4$ precipitation indicated that the 0-30% fraction contained the highest specific activity.

2954 N-NITROSAMINES IN SMOKE CONDENSATE FROM SEVERAL VARIETIES OF TOBACCO. (E.) Johnson, D. E. (Southwest Res. Inst. San Antonio, Texas) and J. W. Rhoades. *J Nat Cancer Inst* 48(6): 845-1847, 1972.

Smoke condensate collected by impingement from experimental cigarettes made from unblended tobaccos (Robinson, Catterton or Burley) supplied by the U.S. Department of Agriculture was analyzed by gas chromatography for N-dimethylnitrosamine (DMNA) content. DMNA content was consistently lower (0-5 ng/cigarette) in smoke from cigarette made from tobacco grown in "low"-nitrogen soil than in smoke from cigarettes made from the same tobaccos grown in "high"-nitrogen soil (27-140 ng/cigarette). Smoke condensate from a popular brand of U.S.-nonfilter cigarettes contained 8 ng DMNA/cigarette. A second peak seen in gas chromatograms of condensate was present in much smaller quantities than DMNA and was tentatively identified as N-methylethyl-nitrosamine.

2955 N-DIMETHYLNITROSAMINE IN TOBACCO SMOKE CONDENSATE. (E.) Rhoades, J. W. (Southwest Res. Inst., San Antonio, Texas) and D. E. Johnson. *Nature* 236(5345):307-308, 1972.

Gas chromatographic analysis of cigarette smoke condensates showed two peaks with retention times identical to N-dimethylnitrosamine (DMN) and N-methylethyl-nitrosamine (MEN) on two different

column packings. The presence of DMN in the major peak was confirmed by high resolution mass spectroscopy. Analysis of DMN content of U.S.D.A. experimental cigarettes made from three different tobacco varieties showed that DMN content was consistently high (27-140 μg /cigarette) in cigarettes made from tobacco grown in soil containing a high nitrogen level. DMN content of cigarettes made from the same varieties of tobacco grown in low nitrogen soil was low (0-5 μg /cigarette). DMN content of a popular non-filter cigarette was 8 μg .

2956 EFFECT OF VARIOUS ESTROGENS ON THE INDUCTION OF LIVER CANCER IN MALE RATS TREATED WITH p-DIMETHYLAMINOAZOBENZENE (DAB). (Fr.) Lacassagne, A. (Radium Inst., Paris, France), M.-F. Jayle, L. Hurst and S. de Lauzon. *C R Acad Sci [D] (Paris)* 274(6):970-972, 1972.

In male Wistar rats given 600 mg/kg p-dimethylaminoazobenzene (DAB) in their food, simultaneous addition of 20 mg/kg estradiol or 20 mg/kg 6-ketoestradiol had no effect on DAB-induced liver cancer, whereas addition of ethinyl estradiol in much lower doses (2 and 4 mg/kg) inhibited liver cancer but caused weight loss, atrophy of the testes, seminal vesicles, and prostate, and interrupted spermatogenesis 37 days after institution of treatment. Liver necrosis and cirrhosis developed in some of these rats, but none had any malignant tumor nodules. Simultaneous administration of DAB + 2-methoxyestradiol (20 mg/kg) accelerated the development of multiple liver tumors which appeared five months after institution of treatment; this compound has minimal estrogen activity and had no effect on the testes or on spermatogenesis. In rats given DAB + 3,17 β -dimethoxyestratriene (20 mg/kg) in their food, primary liver carcinomas did not appear until 291 days later and no multiple tumors were found in these animals. The three rats sacrificed 330-351 days after treatment was begun had only nonmalignant liver changes. These findings suggest that compounds with estrogen activity inhibit the formation of DAB-induced liver tumors since they are not metabolized by enzymes in the liver.

2957 THE ACTION OF TWO ALKALOIDS, FUNTUMINE AND IREHDIAMINE A ON p-DIMETHYLAMINOAZOBENZENE (DAB)-INDUCED LIVER CANCER IN THE RAT. (Fr.) Lacassagne, A. (Radium Inst., Paris, France), L. Hurst, N. Dat-Xuong, Q. Khuong-Huu and R. Goutarel. *C R Acad Sci [D] (Paris)* 274(20):2830-2832, 1972.

Adult male Wistar rats were fed a diet containing p-dimethylaminoazobenzene (DAB; 0.60 g/kg food) with or without funtumine or irehdiamine A dihydrochloride (IDA; 0.05 g/kg food). Multiple liver tumors were found after 145 days in rats given DAB alone, after 186 days in rats given DAB + funtumine, and after 134 days in rats given DAB + IDA. Neither of these aminosteroids inhibited the growth of DAB-induced liver tumors, but IDA did accelerate

the later stages of tumor development. Peritoneal metastases developed in 2/10 rats given DAB + IDA. Administration of IDA alone for 188 days caused no abnormalities in the weight or structure of the liver. It is concluded that IDA potentiates the carcinogenic effect of DAB in the rat liver.

- 2958 INDUCTION OF HAMSTER TUMORS OF THE URINARY BLADDER BY 3,2'-DIMETHYL-4-AMINOBIIPHENYL.
(E.) So, B. T. (Amer. Hlth. Fdn., New York, N.Y.) and E. L. Wynder. *J Nat Cancer Inst* 48(6):1733-1738, 1972.

3,2'-dimethyl-4-aminobiphenyl (3,2'-DMAB) was administered s.c. once a wk at a dose of 100 mg/kg body wt to male and female Syrian golden hamsters. Of 20 hamsters which lived over 158 days, 15 (12 females and 3 males) developed bladder tumors. In addition, two adenocarcinomas of the colon, one malignant lymphoma, two mammary carcinomas, four granulosa-theca cell tumors of the ovaries, and one squamous cell carcinoma of the skin were found. The mean cumulative doses and days required for induction of bladder tumors were 2400-2700 mg/kg body wt (360-405 mg/animal) and 260-310 days. No local sarcomas were induced at the site of injection.

- 2959 COMPARISON OF SOME BIOLOGICAL EFFECTS OF STERIGMATOCYSTIN AND AFLATOXIN ANALOGUES ON PRIMARY CELL CULTURES. (E.) Engelbrecht, J. C. (Natl. Inst. Nutritional Dis., Pretoria, South Africa) and B. Altenkirk. *J Nat Cancer Inst* 48(6):1647-1655, 1972.

The toxicity of 15 analogous compounds, related to either sterigmatocystin or aflatoxin B₁, was evaluated on a primary cell culture system. Confluent primary kidney epithelial cell cultures of *Cercopithecus aethiops* were exposed to the various compounds (2 mg/l) for 24 hr after which time the cells were fixed and stained. In addition, the effects of these compounds on nucleolar morphology, mitosis, and incorporation of ³H-thymidine and ³H-uridine were studied. Structurally, the 15 compounds were divided into three groups manifesting toxic patterns which indicated a correlation between toxicity and structure. Compounds with an unsaturated $\Delta^{1,2}$ -furo-benzofuran system caused marked nucleolar changes and all completely inhibited mitosis after 24 hr. These compounds differed in their toxic effect on the nucleoli, sterigmatocystin I and aflatoxin B₁ being the most toxic. Compounds with a saturated $\Delta^{1,2}$ -furo-benzofuran system were much less toxic and produced only negligible nucleolar changes. Only dihydrosterigmatocystin markedly inhibited mitosis. Open-ring-furobenzofuran compounds had no apparent effect on mitosis or nucleolar morphology. The compounds with an unsaturated $\Delta^{1,2}$ -furobenzofuran were the most potent inhibitors of ³H-thymidine and ³H-uridine uptake, followed by the other two groups in the same order in which they showed toxicity and inhibition of mitosis. The results indicate that compounds which markedly

affect nucleoli also inhibit mitosis completely and most actively prevent the incorporation of ³H-thymidine and ³H-uridine. Increased toxicity was associated with a methoxy group at position C-6. It is suggested that compounds containing an unsaturated bond in the $\Delta^{1,2}$ -position and a carbonyl group that is unsaturated in the $\Delta^{1,2}$ position are required for carcinogenicity in this group of compounds.

- 2960 HISTOGENESIS AND AUTORADIOGRAPHY OF ADENOCARCINOMA OF THE GLANDULAR STOMACH IN RATS INDUCED BY ORAL ADMINISTRATION OF N, N'-2,7-FLUORENYLENEBISACETAMIDE COMBINED WITH IRRADIATION TO THE STOMACH REGION. (E.) Nagayo, T. (Aichi Cancer Ctr. Res. Inst., Japan), M. Ito and S. Yamada. *Gann* 63(2):143-151, 1972.

X-rays (500 R/wk) were directed to the stomach region of 28 male and female young adult Buffalo strain rats for 20 wk during ingestion of a diet containing 0.025% N,N'-2,7-fluorenylenebisacetamide (2,7-FAA). Control groups received either irradiation alone or 2,7-FAA alone. Five wk after the last irradiation, surviving animals were sacrificed and their stomachs were examined histologically. Neoplasms were induced with high frequency in the glandular stomach of all experimental groups and were classified into three categories: Type A (composed of immature atypical tubules), Type B (adenocarcinoma-like growths) and Type C (adenocarcinomas). Most of the 21 rats studied showed more than one of the histologic types. When diagnosis of adenocarcinoma was limited to Type C, frequency of induced carcinoma was 28.6% (6/21). Type B neoplasms were found in 57.1% (12/21) and Type A in 81.0% (17/21) of the experimental rats. No neoplasms were observed in 24 rats of the two control groups. Severe atrophy of the glandular mucosae and intensely heterotopic adenomatous growth in the proximal ends of the duodenum were consistently found in the rats receiving both X-irradiation and 2,7-FAA. Since gradations between the three histologic types were consistently observed, it was assumed that the appearance of immature tubules in the severely atrophic mucosa was the initial change in malignant transformation. The labeling patterns of cells in normal and neoplastic gastric glandular tissues were compared one hr after i.p. injection of ³H-thymidine. Although labeled cells in normal tissue were always found regularly in the transitional zone between foveolar epithelium and glandular tissues, labeled cells were diffusely scattered among all neoplastic tissues. Abnormality of distribution and frequency of labeling were least in Type A neoplasms and greatest in Type C.

- 2961 ON THE BINDING OF BENZ(a)PYRENE TO DNA IN VIVO. (E.) Carlassare, F. (U. Padova, Italy), C. Antonello, F. Baccichetti and P. Malfer. *Z Naturforsch* 27(2):200-202, 1972.

Male and female NVL mice were given a single oral

ose of ^3H -benz(a)pyrene. The mice were sacrificed after 15 hr and the amount of label was determined by scintillation spectrometry in DNA samples extracted from skin, spleen and liver. Calculations indicated that one molecule of benz(a)pyrene was bound to every 6.8 molecules of liver DNA, every 101 molecules of skin DNA, and every 168 molecules of spleen DNA. The relatively high specific activity of liver DNA samples suggested that covalent binding of benz(a)pyrene to liver DNA took place.

962 SMOKING AND LARYNGEAL CANCER. (E.) Stell, P. M. (Dept. Otolaryngology, U. Liverpool, England). *Lancet* (7751):617-618, 1972.

The smoking habits of 190 male and female patients with laryngeal squamous-cell carcinomas seen between 1965 and 1971 were compared with those of age and sex matched controls. There were fewer non-smokers and more heavy (11 or more cigarettes/day) smokers among the carcinoma patients than among the controls ($P < 0.001$). Only 13% of the patients were non-smokers or ex-smokers (stopped within the last yr), compared with 41% of the controls. A review of the literature showed that, although tobacco consumption and the incidence of lung cancer have risen sharply over the past 70 yr, the incidence of laryngeal cancer has remained more or less constant. It is suggested that any data showing a correlation between heavy cigarette smoking and laryngeal cancer must be interpreted with caution.

963 METABOLIC CONTROLS IN PRECANCEROUS LIVER: DEFECTIVE CONTROL OF CHOLESTEROL SYNTHESIS IN RATS FED N-2-FLUORENYLACETAMIDE. (E.) Horton, J. (Waite Agric. Res. Inst., U. Adelaide, South Australia) and J. R. Sabine. *Europ J Cancer* 7:459-465, 1971.

The synthesis of cholesterol from ^{14}C -acetate in liver slices was measured from rats fed the hepatocarcinogen, N-2-fluorenylacetamide (FAA). Within 3 wk of beginning FAA feeding (a) cholesterol synthesis was increased (b) feedback control of cholesterologenesis was partially or completely lost, (c) cholesterol synthesis was extremely variable within all groups fed FAA. Feedback control was regained within 16 wk in the liver, but remained ineffective in the hyperplastic nodules present on some livers at that time. It is suggested that loss of feedback control is an essential step in tumor development.

964 INHIBITION OF CHEMICAL CARCINOGENESIS BY VIRAL VACCINES. (E.) Whitmire, C. E. (Microbiol. Assoc., Bethesda, Md.) and R. J. Huebner. *Science* 177(4043):60-61, 1972.

Studies were undertaken to determine whether type C RNA virus vaccines would inhibit induction of sarcoma by 3-methylcholanthrene (3MC) in female weanling

BALB/cCr and C57BL/6 Cum mice. Vaccines were made by inoculation of mice with inactivated Rauscher leukemia virus (RLV), radiation leukemia virus (RAD LV), or a wild type murine leukemia virus (MuLV) which was isolated from a 3MC-induced tumor in a C57BL/6J mouse. Four-wk-old mice were immunized by a single i.p. injection of vaccine. Four wk later, vaccinated mice were challenged with a single intrascapular s.c. injection of 150 μg of 3MC. RLV vaccine reduced the incidence of sarcomas from 75% to 50% in the BALB/cCr mice. RadLV vaccine and MuLV vaccine reduced the incidence of sarcoma from 86% to 33% and 37%, resp, in the C57BL/6Cum mice. The significant reduction in 3MC-induced sarcomas by type C virus supports the idea that the type C RNA viruses are involved in the etiology of chemically induced tumors.

2965 STRAIN DIFFERENCE IN CARCINOGENESIS BY URETHAN ADMINISTRATION TO SUCKLING RATS. (E.) Matsuyama, M. (Aichi Cancer Ctr. Res. Inst., Japan), H. Suzuki, M. Ito, S. Yamada and T. Nagayo. *Gann* 63(2):209-215, 1972.

Urethan was administered to suckling rats in order to disclose its neoplastic potential in various tissues. Male and female Buffalo and Long-Evans strain rats were given five weekly s.c. injections of urethan (1 mg/g body wt) beginning at seven days of age. Untreated rats of both strains served as controls. The experiment was terminated after 130 wk at which time all animals were sacrificed and tumor-bearing tissues were examined histologically. Seventy to 100% of the treated rats of both strains had one or more primary tumors at the time of death. A large strain difference was observed in the susceptibility of various organs to urethan carcinogenesis between Buffalo and Long-Evans strains. Buffalo rats had thymomas, malignant lymphomas, mammary fibroadenomas and liver tumors but no kidney tumors. Long-Evans rats primarily had kidney tumors. Both treated strains each developed three B-cell adenomas of the pancreatic islets. Although a wide range of other tumors were found, none developed at the site of injection.

2966 NITROSAMINE FORMATION *IN VIVO*: INDUCTION OF LUNG ADENOMAS IN SWISS MICE BY CONCURRENT FEEDING OF NITRITE AND METHYLUREA OR ETHYLUREA. (E.) Mirvish, S. S. (U. Nebraska Med. Ctr., Omaha), M. Greenblatt and V. R. C. Kommineni. *J Nat Cancer Inst* 48(5):1311-1315, 1972.

Non-inbred male and female Swiss mice were maintained for 28 wk on a diet containing either 5.36 g methylurea/kg food or 6.36 g ethylurea/kg food. Half of each group also received a solution of sodium nitrite (1.0 g/l drinking water). All animals were maintained an additional 12 wk without treatment and were then sacrificed and examined for lung adenomas and malignant lymphomas. Although tumor incidence was the same as controls in mice fed only methylurea or ethylurea or in mice receiving only sodium nitrite,

mice fed a combination of methylurea or ethylurea and nitrite had a highly significant ($P < 0.001$) increase in lung adenomas. More than two lung adenomas/mouse occurred in 33 of the 57 mice treated with alkylurea plus nitrite, but in only two of 73 mice treated with alkylurea alone. No sex-dependent difference was observed. Malignant lymphoma also occurred with a higher incidence ($P < 0.05$) in alkylurea-plus-nitrite group (10 of 57 mice) than in the untreated controls (10 of 144 mice). The results indicate that the lung adenomas were induced by methylnitrosourea and ethylnitrosourea, formed by *in vivo* nitrosation of the corresponding alkylureas.

- 2967 INFLUENCE OF AGE AND SEX ON HEPATIC LESIONS INDUCED BY CHEMICAL CARCINOGENS: INGESTION OF 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE BY BUFFALO STRAIN RATS. (E.) Reuber, M. D. (Dept. Path., U. Maryland Sch. Med., Baltimore), K. Stromberg and E. L. Glover. *J Nat Cancer Inst* 48(3):675-683, 1972.

Inbred Buffalo strain mice and female rats 5, 8, 12, 24 and 52 wk old were fed a synthetic diet containing 0.06% 3'-methyl-4-dimethylaminoazobenzene (3'-MeDAB) for four-wk periods, followed by one wk on a basal diet, until the carcinogen had been administered for 12 wk. Control rats given the basal diet without 3'-MeDAB. At the end of 24 wk all surviving animals were killed. All animals were autopsied. No control animals developed lesions of the liver or other organs. The younger (five and eight-wk-old) rats developed the highest incidence of cholangiocarcinomas, hepatocellular carcinomas, cirrhosis and liver cholangiofibrosis. The incidence of these lesions was the same for males and females. The younger rats also tended to have more carcinomas per liver and larger carcinomas than did 12, 24 hr 52-wk-old animals. Cholangiocarcinomas tended to metastasize most often in male rats five and eight wk old. Metastases were not observed in females older than eight wk. Metastases of poorly differentiated or undifferentiated cholangiocarcinomas were usually seen in lungs, thymic lymph nodes, omentum, and occasionally on the peritoneal surfaces. No metastases of hepatocellular carcinomas were seen in either sex. Male rats 12, 24 or 52 wk old were more susceptible than females of the same ages ($P < 0.01$) to the development of hepatic lesions.

- 2968 EFFECT OF NEURAMINIDASE ON GROWTH OF A 3-METHYLCHOLANTHRENE-INDUCED FIBROSARCOMA IN NORMAL AND IMMUNOSUPPRESSED SYNGENEIC MICE. (E.) Simons, R. L. (Dept. Surg., U. Minnesota, Minneapolis), A. Rios, P. K. Ray and G. Lundgren. *J Nat Cancer Inst* 47(5):1087-1094, 1971.

Treatment of a weakly immunogenic 3-methylcholanthrene-induced fibrosarcoma (MC-42) with *Vibrio cholerae* neuraminidase (VCN) *in vitro* interfered with growth of the tumor cells in syngeneic C3H/HeJ female mice. Palpable tumors did not appear in some recipients, and

many of the tumors which did appear spontaneously regressed. The effect could be detected at all tumor cell doses and at low concentrations of VCN. The recipients that survived were treated a second time by subsequent inoculations of large numbers of MC-42 cells, but tolerated the growth of immunologically distinct, 3-methylcholanthrene-induced fibrosarcomas (MC-43). The inhibitory effect of VCN treatment on tumor growth was attributed to host inactivation of the enzyme or to inactivation of the enzyme with sialic acid—a negative feedback inhibitor of neuraminidase. VCN-treated tumor cells grew as rapidly as control cells in immunosuppressed recipients. The results are consistent with the hypothesis that removal of the terminal sialic acid residues from the cell surface does not interfere with the intrinsic growth potential of the tumor cells, but that it increases the immunogenicity of tumor-specific transplantation antigens on the cell surface. Increased tumor immunogenicity is probably the result of changes on the cell surface which make the treated cells more susceptible to immunologic processing by the recipient.

- 2969 RELATIVE DNA CONCENTRATION IN MOUSE EPIDERMIS TREATED WITH CARCINOGENS OR CROTON OIL. (E.) Garcia, H. (U. Nebraska Coll. Med., Omaha) and S. Leiva. *Tumori* 57(3):129-132, 1971.

SLJ newborn mice were arranged in four experimental groups. Group 1 was painted on the skin of the back with one drop of 7,12 dimethylbenz(a)anthracene (DMBA) as a 1% solution in mineral oil. Group 2 was painted in the same way with a 5% solution of croton oil in mineral oil. Group 3 was inoculated subcutaneously with 0.5 mg of urethan in distilled water. Group 4 served as the control and was painted on the skin with mineral oil only. Animals were sacrificed after 24 hr and skin biopsies from the treated areas were fixed and stained by the Feulgen reaction method. Relative DNA content of epidermal cells was determined by the optical density of the nuclear stain as measured by histophotometry. Increases in the percentage of nuclei with higher DNA concentrations were observed in all experimental groups. No significant differences between DMBA, urethan and croton oil in relation to early alterations in DNA concentration of basal cells were observed. In the cases of DMBA and croton oil, these increases corresponded to periods of increased thymidine incorporation, as previously reported in the literature. With urethan, however, DNA concentration remained high after 24 hr. even though thymidine incorporation had decreased by this time. It was concluded that the modifications in DNA content of epidermal cells of mice induced by croton oil and carcinogens were probably incidental phenomena, not strictly related to the process of carcinogenesis.

- 2970 7,12-DIMETHYLBENZ(a)ANTHRACENE-INDUCED NEONATAL CARCINOGENESIS AND ANAMNESTIC IMMUNE RESPONSE IN THE SWISS MOUSE. (It.) Baroni, C. D. (Inst. Path. Anat. Hist., U. Rome, Italy), R.

Scelsi, P. C. Mingazzini and S. Uccini. *Boll Ist Sieroter Milan* 50(4):303-305, 1971.

Swiss mice were injected with 7,12-dimethylbenz(a)-anthracene (DMBA; 100 µg s.c.) in olive oil 16-18 hr after birth and were sacrificed at 30-200 days of age. Controls and DMBA-treated mice received two i.p. injections of sheep red-blood cells: one 20 days before sacrifice and the other, 48 hr before. The total number of nucleated spleen cells was counted, and the number of hemolysis plaques was counted after spleen cells had been incubated with rabbit anti-gamma-globulin serum; the latter test is a measure of 7S or IgG hemolysin. Although the total number of spleen cells remained almost constant in both control and treated mice during this experiment, the number of plaque-forming cells was consistently lower in DMBA-treated mice than in controls, even before tumors developed. These findings indicate that DMBA has an immunosuppressive effect on secondary or anamnestic immune response. It is suggested that when DMBA is injected at birth, it probably acts on the immune system via bone marrow precursors.

2971 REACTION OF ALKYLATING MUTAGENS AND CARCINOGENS WITH NUCLEIC ACIDS: N-3 OF GUANINE AS A SITE OF ALKYLATION BY N-METHYL-N-NITROSOUREA AND DIMETHYL SULPHATE. (E.) Lawley, P. D. (Chester Beatty Res. Inst., London, England), D. J. Orr and S. A. Shah. *Chem-Biol Interactions* 4(6):431-434, 1971/72.

Small amounts of N-3 alkylation of guanine residues have been detected *in vitro* in nucleic acids or poly(G) treated at neutral pH with agents of both S_N2 and S_N1 types (represented by dimethyl sulphate (DMS) or N-methyl-N-nitrosourea (MN), resp.). The yield of 3-methylguanine from treated salmon sperm DNA, identified by chromatography, spectrometry, or both, was 1.1 mmole/mole DNA-P for MN and 0.3 mmole/mole DNA-P for DMS. N-7 methylation of DNA guanine was also seen in DMS- and MN-treated bacteriophage µ2 RNA, rabbit reticulocyte rRNA and poly(G). The only tautomeric structure of 7-methylguanine nucleoside which would be likely to permit Watson-Crick base-pairing was the form with an imino group at the 2-position, and this form would tend to promote mispairing with thymine. Such a mispairing mechanism might possibly explain the relatively weak mutagenic activity of S_N2 alkylating agents.

2972 SYNTHESIS AND ONCOGENICITY OF 3-HYDROXYURIC ACID. (E.) Lee, T.-C. (Sloan-Kettering Inst., New York, N. Y.), G. Stöhrer, M. N. Teller, A. Myles and G. B. Brown. *Biochemistry* 10(24):4463-4466, 1971.

3-Hydroxyuric acid was synthesized by a method which involves cyclization in base of the imidazolone ring of uric acid. An initial oncogenesis assay

with five rats administered s.c., led to one tumor in five rats. A repeat test with 21 rats resulted in a 19% incidence at a dose level of 1.0 mg, which is to be compared with a 100% incidence at 0.5 mg doses and 30% at 0.1 mg doses, on the same dosage schedule, with 3-hydroxyxanthine. Controls with the vehicle and with uric acid, as well as with xanthine were all negative. *In vitro*, xanthine reduces a small portion of 3-hydroxyuric acid to 3-hydroxyxanthine. The results suggest that the compounds oncogenicity can be attributed to the reduction *in vivo* of a portion of it to 3-hydroxyxanthine.

2973 MORPHOLOGIC FEATURES OF MAMMARY CARCINOMAS IN WOMEN TAKING HORMONAL CONTRACEPTIVES.

(E.) Gould, V. E. (U. Washington Sch. Med., Seattle), M. Wolff and N. K. Mottet. *Amer J Clin Path* 57(2): 139-143, 1972.

Carcinomas of the breast in three women taking hormonal contraceptives had both lobular and ductal components, secretory activity, and conspicuous mucopolysaccharides in the stroma of the involved lobules and around the neoplastic ducts. The lesions were pleomorphic and diffuse and contained abundant lymphocytic infiltration. Although these observations suggest very variable target organ responsiveness to hormonal stimulation, the problem requiring investigation is not just whether a distinctive pattern of breast carcinoma is associated with hormonal contraceptive intake, but rather whether it might, in some instances, alter the evolution of the disease.

2974 CARCINOGENIC EFFECT OF N,N'-DIMETHYLNITROSOUREA ON SYRIAN HAMSTERS. (E.) Hiraki, S. (Dept. Path., Okayama U. Med. Sch., Japan). *Cann* 62(4):321-323 (and Plate LXIII), 1971.

Thirty-four Syrian hamsters, 8-10 wk old, were given s.c. administrations of N,N'-dimethylnitrosourea (DMN) at weekly intervals in the intrascapular region in a dose of 40 mg/kg body weight. Control hamsters were injected s.c. with saline solution. All the treated hamsters were found dead or killed between 17 and 31 wk, and the average lifespan was 24 wk. Twenty-three (68%) of all the treated hamsters had well-differentiated squamous cell carcinoma of the forestomach which showed no metastasis or infiltration into other organs. After 18 injections, 11 (79%) of all the treated females developed three or four s.c. tumors derived from the mammary glands. The histological pattern of the tumors showed adenocarcinoma or adenoacanthoma. Twelve (86%) of all the treated females had tumor in the uterine cervix (adenoacanthomas). Four males and two females (18%) developed tumors of the pancreas (adenocarcinoma). In addition, cholangiocarcinoma of the liver was found in eight (24%) and anaplastic sarcoma situated at the dorsal subcutis in two (6%). The instability of DMN in aqueous solutions and the induction of various tumors at a site remote from the injection

site suggest that DMH is rapidly absorbed from s.c. tissue into the systemic circulation without loss of its carcinogenic activity and its subsequent derivative may induce these malignant tumors.

- 2975 INHIBITION OF MAMMARY TUMORIGENESIS BY ERGOT ALKALOIDS AND PROMOTION OF MAMMARY TUMORIGENESIS BY PITUITARY ISOGRAFTS IN ADRENO-OVARECTOMIZED MICE. (E.) Yanai, R. (Nat). Cancer Ctr. Res. Inst., Tokyo, Japan) and H. Nagasawa. *J Nat Cancer Inst* 48(3):715-719, 1972.

The effect of ergocornine or 2-bromo- α -ergocryptine (CB-154) in intact C3H/He virgin mice and the effect of pituitary isografts in adreno-ovariectomized mice on spontaneous tumor incidence were investigated to clarify the importance of prolactin on mammary tumorigenesis. Each alkaloid was mixed with cholesterol, 1:4, and 50 mg was pelleted and implanted s.c.. Control mice received cholesterol implants. At the end of eight months, mammary tumor incidence was 23.5 and 16.7% in mice implanted with ergocornine and CB-154, resp., whereas the incidence in control mice was 73.7%. It was concluded that mammary tumor incidence was significantly inhibited by these ergot alkaloids through their suppression of pituitary prolactin secretion. Mammary tumor incidence was 51.3% at the end of eight months after three pituitaries each were grafted in adreno-ovariectomized mice, while no tumors appeared in the adreno-ovariectomized controls. This indicated that prolactin secreted continuously by the grafted pituitaries promoted the development of spontaneous mammary tumors in the apparent absence of adrenal and ovarian hormones. These results demonstrated that prolactin is a primary hormonal factor in spontaneous mammary tumorigenesis in mice.

- 2976 ACUTE LEUKEMIA DUE TO CHRONIC EXPOSURE TO BENZENE. (E.) Aksoy, M. (Istanbul Med. Sch., Turkey), K. Dincol, S. Erdem and G. Dincol. *Amer J Med* 52(2):160-165, 1972.

Four cases of acute leukemia in shoemakers chronically exposed to benzene-containing adhesives are presented. In each case the patient's employment record indicated heavy exposure over long periods of time to benzene vapors. In two of the patients aplastic anemia had been previously diagnosed, whereas in the other two, leukemia developed without a prior episode of anemia. Hematological data and course of treatment are presented for each patient. A rising incidence of leukemia among shoemakers in Istanbul is related directly to benzene compounds commonly used in adhesives employed in the manufacture of shoes.

- 2977 IMMUNE SUPPRESSION INDUCED BY 4-NITROQUINOLINE 1-OXIDE AND ITS DERIVATIVES. (E.) Nakashima, S. (Drug Res. Inst., Toyama U., Japan) and S. Ono. *Germ* 63(1):111-117, 1972.

The immunosuppressive response elicited in mice by 4-nitroquinoline 1-oxide (4-NQO) and 4-hydroxyaminoquinoline (4-HAQO) was studied. Forty-eight female ddY mice weighing 20-22 g were antigenically stimulated by i.p. injections of 0.25 mg of bacterial α -amylase. Sera of these animals were then analyzed to establish antibody titer baselines. Starting on the day of immunization, six groups of eight mice each were given injections of 4-HAQO or 4-NQO in different doses and at different intervals. Two other groups were given injections of the noncarcinogenic 4-aminoquinoline 1-oxide (4-AQO). A control group of saline-treated mice was established. Changes in the antibody titers of all animals were followed during the entire course of treatment. The results indicate that the suppressive activity of 4-NQO is dose-dependent. Since the carcinogenic 4-NQO and 4-HAQO were immunosuppressive and noncarcinogenic 4-AQO was not, the suppressive action of the first two agents may bear some relation to their carcinogenicity.

- 2978 IN VIVO CONVERSION OF PHENMETRAZINE INTO ITS N-NITROSO DERIVATIVE. (E.) Greenblatt, M. (U. Nebraska Med. Ctr., Omaha), V. Komineni, E. Conrad, L. Wallcave and W. Lijinsky. *Nature New Biol* 236(62):25-26, 1972.

The nitrosation of phenmetrazine (3-methyl-2-phenylmorpholine) and phendimetrazine (3,4-dimethyl-2-phenylmorpholine), two drugs commonly taken for appetite control, was studied. Rabbits received intragastric injections of aqueous solutions of phenmetrazine (177 mg) or phendimetrazine containing sodium nitrite, and the N-nitroso derivative, nitrosophenmetrazine (NPM), was identified by gas chromatography. Whereas phenmetrazine was converted to NPM (13 to 18% of theoretical after five hr), no NPM was found in gastric juice from rabbits injected with phenmetrazine or nitrite alone. Gastric concentrations of NPM and nitrite were highest one hr after injection (0.64 mg NPM and 0.12 mg nitrite per ml) and declined rapidly thereafter. The decline in NPM concentration was probably due in part to absorption from the stomach. Conversion of phenmetrazine to NPM increased with increasing nitrite concentration. Insignificant amounts of NPM were produced when nitrate was substituted for nitrite. Similar experiments with rats showed as efficient nitrosation of phenmetrazine. Although it is not known whether NPM is carcinogenic, related nitroso derivatives are carcinogenic in rats, and therefore ingestion of phenmetrazine when food containing nitrite is also present in the stomach may constitute a hazard.

- 2979 EVIDENCE FOR DNA REPAIR SYNTHESIS AND TURNOVER IN RAT LIVER FOLLOWING INGESTION OF 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE. (E.) Goodman, J. I. (McArdle Lab. Cancer Res., U. Wisconsin, Madison) and V. R. Potter. *Cancer Res* 32(4):766-775, 1972.

Hepatic DNA of immature (50 g, 25-day-old) male Sprague-Dawley rats was prelabeled by i.p. injection of ^{14}C -thymidine. When the animals reached 200 g (53 days old), they were placed on a diet containing 0.05% (w/w) of the hepatic carcinogen, 3'-methyl-4-dimethyl-aminoazobenzene (3'-MeDAB). Groups of animals were then sacrificed at weekly intervals over a period of five weeks. Two hr prior to sacrifice, each animal received a single i.p. injection of ^3H -thymidine for the labeling of newly synthesized DNA. Radioactivity was determined in total liver homogenates (hepatocyte plus "stromal" cells), in DNA from purified hepatocyte homogenates, and in purified hepatocyte nuclei and "stromal" nuclei. Over the course of the experiment, there was a marked and progressive loss (up to 80%) of DNA ($t_{1/2} = 13$ days) from the livers of 3'-MeDAB-treated animals, as determined by the loss of ^{14}C -labeled DNA. This was accompanied by an increase in the amount of the ^3H -labeled DNA. Total hepatic cell DNA remained constant, indicating that 3'-MeDAB initially caused a profound increase in turnover of hepatic cell DNA. The effect of 3'-MeDAB was specific for hepatic cell DNA, since no loss of prelabeled renal cell DNA was observed. So that a higher percentage of prelabeled hepatocyte DNA could be obtained, rats were labeled with ^3H -thymidine after partial hepatectomy. Four weeks later, the animals were placed on the 3'-MeDAB diet; loss of prelabeled DNA was again studied, and the results agreed with those from the ^{14}C -prelabeled rats. The degree of necrosis seen in histological sections was insufficient to account for the observed loss of DNA. Studies of DNA sedimentation in alkaline sucrose gradients indicated that repair of hepatic DNA was an early consequence of 3'-MeDAB infection and accounted for some of the increased DNA turnover. Since gene transcription might have been inhibited or altered during DNA repair and since unrepaired DNA segments could result in misreading, it was possible that 3'-MeDAB-induced repair was one of the mechanisms underlying the change in gene expression observed in precancerous livers.

980 CHANGES IN RIBONUCLEIC ACID DEGRADING ENZYMES IN EHRlich ASCITES CELLS DURING GROWTH AND AFTER ACTINOMYCIN D TREATMENT. (E.) Rowth on Tigerstrom, R. G. (U. Alberta Cancer Res. Unit, Edmonton, Canada). *Can J Biochem* 50(3):244-252, 1972.

Ehrlich ascites cells were treated with actinomycin (act D) (5 $\mu\text{g}/\text{ml}$, 15 min) and injected i.p. into a/ICR Swiss mice. Control animals received injections of saline-treated ascites cells. After even days spectrophotometry of the act D-treated cells showed increases in alkaline RNase II, acid RNase I and phosphodiesterase II activities of 7.2-, 10- and 2.5-fold, resp., as compared with controls. RNase inhibitor activity was significantly lower than in controls. RNase I, phosphodiesterase I and acid phosphatase activities were unchanged. Smaller increases in the same enzyme activities, but no change in RNase inhibitor activity, were observed

when untreated cells were collected after four days instead of after seven days of growth. Net synthesis of protein and RNA, determined by the rate of incorporation of ^{14}C -leucine and ^{14}C -guanine into acid-insoluble material, was slightly faster when control cells were collected after four instead of seven days. Protein synthesis in act D-treated cells was the same as in controls at seven days. Although initial rates of RNA synthesis were the same in control and act D-treated seven-day cells, treated cells showed a rapidly decelerating rate after 30 min, whereas incorporation into controls was linear for two hr. One possible reason for this was the higher RNase and phosphodiesterase activities in act D-treated cells. However, little or no difference between treated and control cells was seen in the degradation of nuclear RNA after 30 min. RNase levels in act D-treated cells were similar at seven and nine days after transplantation and RNase inhibitor levels were increased from a low level at seven days to high levels at nine days. However, RNA and protein synthesis was similar at seven and nine days. Therefore it was concluded that RNase inhibitor had little influence on the rate of protein synthesis, net RNA synthesis and possibly on the rate of nuclear RNA degradation. It was also concluded that different levels of RNase activities, as measured by *in vitro* assays, do not affect the rate of protein synthesis.

2981 REPLICATION OF LOW-LEVEL CARCINOGENIC ACTIVITY BIOASSAYS. (E.) Van Duuren, B. L. (New York U. Med. Ctr., N.Y.), C. Katz, M. B. Shimkin, D. Swern and R. Weider. *Cancer Res* 32(4):880-881, 1972.

Carcinogenic activity of five compounds (stearic acid, methyl stearate, and γ -stearolactone, which were not expected to be carcinogenic, and p-nitroperbenzoic acid and glycidyl stearate which were expected to be carcinogenic), was determined independently in two laboratories using the same batches of chemicals and vehicle. ICR/Ha Swiss Millerton female mice or CFW (Swiss Webster) female mice were given s.c. injections of chemical once weekly for 26 wk (1.3 to 130 mg, total dose) and sarcoma induction was determined. The results between the two laboratories in terms of s.c. sarcoma induction were very similar. Stearic acid failed to induce any sarcomas at the injection sites; the other four substances induced sarcomas in less than 10% of the animals. Data on tumor induction in various organs did not contribute further evidence of carcinogenic activity of the compounds. Activity of the two compounds, methyl stearate and γ -stearolactone, which were not expected to be carcinogenic was not due to "solid-state" carcinogenesis, since they were lipid-soluble.

2982 LACTATE DEHYDROGENASE ISOZYME IN MOUSE LUNG CANCER PRODUCED BY 4-NITROQUINOLINE 1-OXIDE. (E.) Yamane, Y. (Fac. Pharmaceutical Sci., Chiba U., Japan), K. Sakai and Y. Amemiya. *Gann* 63(2):153-159, 1972.

Female dd-yf strain mice received intrascapular s.c. injections of a lecithin suspension of 4-nitroquinoline 1-oxide (4-NQO) weekly for six weeks (total dose: 1.50 mg/mouse). At different times after the end of the injection period, lung tissue was removed and homogenates were tested for total LDH activity by spectrophotometric measurement of the oxidation of NADH. LDH isozymes were separated by agar gel electrophoresis. All animals developed lung tumors within 3.5 months. Total LDH activity did not differ between control and experimental groups up to 3.5 months even though small tumors were present. After five months, however, total LDH activity had increased in the carcinogen-treated group to a value 1.7 times that of control. This increase was presumably due to an increase in the amount of tumor tissue relative to normal lung tissue. LDH activity in tumorous portions of the lung was 2.5 to 3.5 times that of normal control lung tissue and up to 50% higher than that of normal embryonic mouse lung. After six months, tumor-bearing mouse lung showed a 40% decrease in the activity of LDH fractions I and II and a 20% increase in the activity of fractions IV and V compared with control lung. In tumor tissue, fraction I was totally absent, fraction II was decreased by 70%, and fractions IV and V were increased by 25% and 10%, resp. This pattern was identical to that of embryonic lung tissue. These results indicated that an increase in M-type LDH activity had occurred in 4-NQO-induced lung cancer, which was similar to the pattern observed in embryonic lung tissue.

- 2983 CHEMICAL BINDING OF CARCINOGENIC 4-NITROQUINOLINE 1-OXIDE DERIVATIVES WITH DNA *IN VIVO* AND *IN VITRO*. (E.) Kawazoe, Y. (Natl. Cancer Ctr. Res. Inst., Tokyo, Japan), G.-F. Huang, M. Araki and C. Koga. *Gann* 63(2):161-166, 1972.

Thirteen ^3H -labeled derivatives of 4-nitroquinoline 1-oxide (4-NQO) were studied for their ability to bind DNA. Ehrlich ascites were incubated *in vitro* for two hr with each chemical (10^{-4} M), the cellular DNA was then purified, and the radioactivity was determined in a scintillation counter. In other experiments, purified calf thymus DNA was incubated for 48 hr with labeled chemical (5×10^{-4} M) and DNA-bound radioactivity was determined. In both systems, 4-NQO and the two derivatives, 4-hydroxyaminoquinoline 1-oxide (4-HAQO) and diacetyl-4-hydroxyaminoquinoline 1-oxide (Ac₂-4-HAQO), showed the most potent binding ability, in that order. Since these three chemicals are the most carcinogenic of the derivatives and since the least carcinogenic derivatives bound to DNA with much less affinity, it was concluded that carcinogenic ability was associated with the DNA-binding ability of these compounds.

- 2984 EPOXIDES OF CARCINOGENIC POLYCYCLIC HYDROCARBONS ARE FRAMESHIFT MUTAGENS. (E.) Ames, B. N. (Dept. Biochem., U. California, Berkeley), P. Sims and P. L. Grover. *Science* 176(4030):47-49, 1972.

A set of tester strains (TA 1538, TA 1537, and TA 1534) developed in *Salmonella typhimurium* have been designed for detecting frameshift mutagens of varying specificity. The 2-region epoxides of benz[a]anthracene and 7-methylbenz[a]anthracene were found to be the only compounds tested to cause mutations in these strains; parent hydrocarbons, K-region diols and phenols and some other epoxides were inactive as mutagens in these tests. Some of the compounds were active against another tester strain, TA 1535, which detects base-substitution mutagens. Benz[a]anthracene 1,6-oxide and 7-methylbenz[a]anthracene 3,4-oxide gave positive results in a forward mutation test which detects both base substitutions and frameshift mutations. A new tester strain, TA 1537, was constructed and found to be excellent for detecting frameshift mutagenesis effected by dibenz[a,h]anthracene 1,6-oxide. Indirect evidence showing that the epoxides were reacting with bacterial DNA, as well as intercalating, was obtained by comparing their mutagenic effect on strains with and without excision repair. It is postulated that polycyclic hydrocarbons may be carcinogenic because of the mutagenicity of epoxide intermediates formed during metabolism and that the mechanism of action may involve intercalation followed by covalent reaction.

- 2985 *IN VITRO* MALIGNANT TRANSFORMATION OF CELLS DERIVED FROM PULMONARY AND WHOLE EMBRYONIC TISSUES OF STRAIN A MICE BY 4-NITROQUINOLINE 1-OXIDE. (E.) Toyoshima, K. (Nara Med. U., Japan), H. Tsuji and Y. Tsubura. *J Nara Med Ass* 22(2,3):162-174, 1971.

Cells were derived from either pulmonary or whole tissues from embryos of strain A mice. These cells consisted of either polyhedral epithelial cells surrounded by spindle-shaped fibroblasts, or of fibroblast cells alone. Once tissue cultures established, they were exposed to 4-nitroquinoline 1-oxide at different concentrations and for various lengths of time. Exposure to the chemical at concentrations of 3.9×10^{-8} M had a cytotoxic effect to which the epithelial cells were more susceptible than the fibroblast cells. At lower concentrations of 2.6×10^{-7} M, 4-nitroquinoline 1-oxide caused malignant transformations of both cell types, as evidenced by a decrease in doubling time, a loss of contact inhibition, an increase in saturation density, and a positive shift to tetraploidy in chromosomal number. Transformation was confirmed by inoculation of the chemically treated cells into strain A mice; both transformed strains produced tumors, histologically identified as fibrosarcomas, in the recipients.

- 2986 CARCINOGENIC COMPOUNDS ON EDIBLE MEAT IN NEW ZEALAND. (E.) Dacre, J. C. (Med. Res. Council New Zealand, Dunedin). *N Z Med J* 73(465):74-77, 1971.

A survey was made in New Zealand of the marking-dyes

applied to meats that are destined for human consumption. Samples of the colors were obtained from the dye manufacturer and from the meat-packing plants; in addition, the colors were extracted from meats purchased in supermarkets. Following thin layer chromatographic techniques and absorption spectroscopy, the dyes were classified as to toxicity. Namely, tartrazine and sunset yellow FCF were acceptable for use in foods; benzyl violet 4B had a potential for inducing harmful effects; there was insufficient data to form a conclusion concerning violet 5BN and methyl violet; and magenta and auramine were found to be harmful. Interestingly, since the initiation of the use of these dyes, bladder cancer has increased in New Zealand, particularly in the male population. The use of such food marking-dyes may play a role in this increase.

- 2987 URINARY CYTOLOGY IN WORKERS EXPOSED TO CARCINOGENIC AROMATIC AMINES: A SIX-YEAR STUDY. (E.) Forni, A. (U. Milan, Sch. Med., Italy), G. Ghetti and G. Armeli. *Acta Cytol* 16(2):142-145, 1972.

A follow-up cytologic study of urinary sediment by the Papanicolaou method was carried out in workers of the dyestuff industry with past or present exposure to carcinogenic aromatic amines. Between September 1964 and December 1970, 858 workers received one or more cytologic examinations for a total of 8,249; 304 workers are presently lost to follow-up. During this time 16 workers developed bladder tumors (ten papillomas and six carcinomas), and one developed multiple papillary carcinoma of the left ureter. Fourteen of these tumors were diagnosed by cytology; one case of papilloma had persistent negative cytology, also on reexamination; two subjects with papilloma were not under cytologic control prior to diagnosis. Moreover 13 diagnoses of recurrence were made in nine workers and confirmed, while six recurrences were suspected at cytology, but so far were not confirmed. The time elapsed between cytologic and cystoscopic or histologic diagnosis of bladder tumors was from less than 1 to 67 months for the new cases, and from less than 1 to 32 months for the recurrences. Some subjects with intermittent suspicious cytology had cystoscopic findings negative for tumor, with inflammatory or congestive changes; of these workers, some are lost to follow-up, while the remainder are still followed by periodical cytologic examination.

- 2988 SOME PRELIMINARY OBSERVATIONS ON THE BINDING OF URETHAN TO DNA OF SEVERAL TISSUES OF MICE AND RATS. (E.) Bhide, S. V. (Cancer Res. Inst., Tata Memorial Ctr., Bombay, India), E. Premkumar, M. A. Siddiqui and P. M. Bhargava. *Indian J Cancer* 8(3):172-175, 1971.

Three- to four wk-old male Swiss mice and three- to four-month-old male inbred albino rats were given

i.p. injections of isotopically labeled urethan at different specific activities. Animals were sacrificed at intervals up to 48 hr and DNA was purified from lung, liver and kidney homogenates. Although urethan was bound to DNA from all three tissues, maximal radioactivity was associated with lung DNA. Maximal binding of urethan to lung and liver DNA occurred earlier (12 hr) than maximal binding to kidney DNA (24 hr). Specific activity of urethan-bound DNA was higher in the mouse than in the rat. The extent of binding was dependent on the urethan dose, with significant increases in the range of 0.5-1.0 mg/g body weight, concentrations which had previously been shown to cause tumor induction. Stability of binding under various conditions indicated that urethan or a metabolite was covalently bound to DNA.

- 2989 CYTOTOXIC EFFECTS OF D-GLUCOSAMINE ON THE ULTRASTRUCTURES OF NORMAL AND NEOPLASTIC TISSUES *IN VIVO*. (E.) Molnar, Z. (Dept. Path. U. Chicago, Ill.) and J. G. Bekesi. *Cancer Res* 32(4):756-765, 1972.

The effects of continuous D-glucosamine infusion (350 mg/kg/hr) on the fine structure of Walker carcinoma and normal liver and kidney of adult male Sprague-Dawley rats were studied *in vivo*. Infusion for 18 hr caused a slight dilation of the cisternae of the endoplasmic reticulum (ER) and Golgi sacs of tumor and liver parenchymal cells. The epithelial cells of renal tubules contained lamellar structures within numerous autophagic vacuoles. Infusion for 40 hr produced conspicuous degenerative changes in the nuclei and nucleoli of tumor cells. The nuclear matrix showed a much-decreased electron-density and contained clumped interchromatin granules. Nucleoli were rounded up and the strands of the nucleolonema had coalesced. Conspicuous small aggregates of high-contrast material (probably chromatin) had formed, predominantly in the electron-lucent areas of the nucleolus. Cytoplasmic changes in tumor cells were less pronounced than the nuclear ones. Liver parenchymal cells showed almost complete fragmentation of the long profiles of the rough ER into small vesicles. Autophagic vacuoles were frequently seen. Only single rows of cisternae remained surrounding the mitochondria. The cytoplasm of the lining epithelium of the renal proximal tubules was highly vacuolated. Necrosis was never observed in renal or hepatic tissue. However, tumor tissue of rats sacrificed five days after a 40-hr infusion of D-glucosamine was completely necrotic. Associated with this was an almost complete recovery of renal and hepatic cell ultrastructure.

- 2990 KINETIC, IMMUNOCHEMICAL, AND PHYSICAL STUDIES ON PURIFIED RAT LIVER ADENOSINE 5' PHOSPHATE DEAMINASE AFTER INDUCTION WITH 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE OR THIOACETAMIDE. (E.) Smith, L. D. (Samuel Roberts Nobel Fdn., Inc., Ard-

more, Okla.) and D. E. Fizer. *Cancer Res* 31(19):1341-1347, 1971.

After induction with hepatocarcinogens and partial purification, kinetic, immunochromatographic, and physical properties of rat liver AMP deaminase were studied. The hepatic enzyme was induced by intraperitoneal injections of thioacetamide or 3'-methyl-4-di-methylaminoazobenzene. Enzymes were purified by lithium sulfate precipitation, heat treatment, diethylaminoethyl cellulose chromatography, and gel filtration. The activity of both the induced enzyme and the normal enzyme was modulated by ATP, GTP, and alkali metal ions. Induction did not alter GTP inhibition of ATP activation. Data were obtained suggesting that citrate ion altered substrate affinity and inhibited ATP-GTP modulation of enzyme activity. Studies with antibody to rat liver AMP deaminase developed in rabbits indicated that the induced enzyme had essentially identical titration equivalence with the noninduced enzyme in both the crude and partially purified states. Lability of the induced enzyme cohort in the 105,000 X g supernatant fraction to heating at 55° was lost when it was partially purified.

- 2991 THE EFFECTS OF TWO ISOMERIC BENZOFLAVONES ON ARYL HYDROCARBON HYDROXYLASE AND THE TOXICITY AND CARCINOGENICITY OF POLYCYCLIC HYDROCARBONS. (E.) Diamond, L. (Wistar Inst. Anatomy Biol., Philadelphia, Pa.), R. McFall, J. Miller and H. V. Gelboin. *Cancer Res* 32(4):731-736, 1972.

The effects of two isomeric benzoflavones (BF), 5,6-BF and 7,8-BF, were studied on aryl hydrocarbon hydroxylase (AHH) activity in hamster embryo (HE) cell cultures, on 7,12-dimethylbenz(a)anthracene (DMBA)-induced adrenal necrosis and lung tumorigenesis in female Sprague-Dawley rats and A/HeJ mice *in vivo*, and on the metabolism and cytotoxicity of carcinogenic hydrocarbons in HE cells. At concentrations ten to 20 times higher than that of the hydrocarbons, 7,8-BF almost completely inhibited the metabolism of isotopically labeled BF and DMBA to water-soluble derivatives in HE cultures. A 5,6-BF concentration 100 times that of the hydrocarbons was required to produce the same degree of metabolism. 5,6-BF doubled AHH activity in HE cells, as measured by fluoromicrophotometry. 7,8-BF inhibited basal AHH activity, as well as benz(a)anthracene-induced AHH. 7,8-BF at a concentration equal to (0.1 µg/ml), or greater than, that of the hydrocarbon protected HE cells against cytotoxicity induced by oral administration of DMBA, BP and 3-methylcholanthrene; 5,6-BF gave slight protection at high concentrations (2 µg/ml). When administered by i.p. injection 48 hr before the hydrocarbon, 7,8-BF was one-tenth as effective as 5,6-BF in protecting rats against DMBA-induced adrenal necrosis and was also a less effective inducer of hepatic AHH. Mice fed a diet containing 5,6-BF or 7,8-BF for two weeks showed induction of AHH activity in liver, lung and small intestine, but not kidney. Oral administration of either 5,6-BF or 7,8-BF prior to administration of DMBA

protected mice against pulmonary adenoma formation, with 5,6-BF being the more potent inhibitor.

- 2992 ADENINE PHOSPHORIBOSYL TRANSFERASE ACTIVITY OF MOUSE ASCITES TUMOR AND DERIVED TUMORIGENIC AND NONTUMORIGENIC TISSUE MATERIALS. (E.) Blair, D. W. E. (Dept. Cancer Biol., U. Louisville, Louisville, Kentucky), L. J. Bricker, M. Deane, W. D. Hunter and L. C. Morgan. *Cancer Res* 32(3):763-770, 1972.

Adenine phosphoribosyl transferase was tested as a possible "marker" enzyme for tumorigenicity of cultured mouse ascites tumor cells. Enzyme-specific activities were determined by a radioisotopic method for cell-free extracts of four tumors: Ehrlich and Ehrlich-lettinger carcinomas, 60MHz lymphoma and T43 adenocarcinoma, and for their derived tumorigenic and nontumorigenic monolayer cultures. Enzyme activity was not correlated with the tumorigenicity of the cells. Whereas the activities were similar and relatively high (1.2 to 2 units/mg protein/hr/mg protein) for the four types of tumor cells obtained directly from mice, those for both tumorigenic and nontumorigenic cultured cells were 33-75% lower. The lower enzyme activities of cultured cells occurred by the fifth passage after culture initiation; they were not attributable to differences in pH optima or optimal concentrations of Mg^{+2} , adenine, or 5-phosphoribosyl-α-1-pyrophosphate. The decreased enzyme activities were not due to the presence of an inhibitor, as extracts from cultured cells did not inhibit the activities of extracts from freshly harvested ascites tumor cells. Little or no loss of activity resulted from storage of extracts at -20 C for 33 days. It is concluded that the lowered enzyme activity of cultured cells was apparently an adaptation to growth *in vitro*.

- 2993 INFLUENCE OF INSULIN DEPRIVATION ON GROWTH OF THE 7,12-DIMETHYLBENZ(a)ANTHRACENE-INDUCED MAMMARY CARCINOMA IN RATS SUBJECTED TO ALLOXAN DIABETES AND FOOD RESTRICTION. (E.) Heuson, J.-C. (Bordet Inst., Free U. Brussels, Belgium) and N. Legros. *Cancer Res* 32(2):226-232, 1972.

Mammary tumors were induced in random-bred, female Sprague-Dawley rats by DMBA feeding. In experiment 1, 20 rats were randomized into two groups of ten, three wk after DMBA feeding. One group served as control; alloxan diabetes was induced in the other. In experiment 2, 90 rats were randomized into two groups of 36 and 54 resp., four wk after DMBA feeding. The first group served as control; alloxan diabetes was induced in the other. Each group was observed for 12 wk. None of the surviving diabetic rats developed mammary tumors, whereas a majority of the controls developed one or several tumors. In experiment 3, 37 tumor-bearing rats were subjected to alloxan diabetes 21 wk after DMBA administration. Fifteen became diabetic and 12 survived at the end of the six wk observation period. There was an average weight loss of 56 g (19% of the ini-

ial weight of 299 g). In these rats, 51 out of 56 tumors initially present (90%) decreased rapidly in size; five continued to grow. Tumor regression in the diabetic rats did not seem to occur as a result of a direct effect of alloxan on tumor tissue. In experiment 4, administration of estradiol benzoate failed to prevent the tumor regression produced by alloxan diabetes. In experiment 5, it was found that food restriction resulted in a rapid tumor regression which was partially counteracted by estradiol benzoate. Tumors regressing as a result of alloxan diabetes, those progressing (about 10%) in spite of diabetes, and those that progressed under the stimulating effect of estradiol benzoate in rats subjected to food restriction were investigated with respect to their insulin dependence in organ culture. It was observed that the tumors regressing in alloxan-diabetic rats were, by and large, markedly insulin dependent *in vitro*, whereas those growing despite diabetes were little- or noninsulin dependent. Eventually, most tumors that are stimulated to grow by estradiol benzoate in food-restricted rats proved very insulin dependent *in vitro*. These observations suggest that the tumors that are insulin dependent in organ culture similarly have a stringent requirement for insulin to grow *in vivo* and that they regress after induction of alloxan diabetes as a consequence of insulin deprivation.

- 2994 SOME PROPERTIES OF POLYADENYLIC ACID AND DNA AFTER TREATMENT WITH THE CARCINOGEN N-ACETOXY-2-ACETYLAMINOFLUORENE. (E.) Michelson, L. M. (Inst. Biol. Phys.-Chim., Paris, France), A. Kapuler and F. Pochon. *Biochim Biophys Acta* 52(4):441-448, 1972.

Chemical, photochemical and physical properties of the homopolymer, poly(A-AAF), were studied. Poly(A-AAF) was formed in a reaction between poly(A) and N-acetoxy-2-acetylaminofluorene (AAAF) at 38°C in the dark, with more than 95% of the adenosine residues being modified. Poly(A-AAF) formed stoichiometric complexes with poly(U) and poly(I), but formation of a double helical "acid form" characteristic of poly(A) could not be observed by UV absorption spectroscopy down to pH 2 in 0.05 to 0.5 M NaCl. Optical rotary dispersion spectra of poly(A-AAF) and its complexes with poly(U) and poly(I) showed no striking differences from those of poly(A) and its complexes, suggesting the same structural characteristics were present in both cases. Irradiation of poly(A-AAF) at 310 nm generated a second polymer, poly(A-AAF)(hv), which was fluorescent at room temperature. Long-wavelength (320 nm) irradiation of DNA-AAF also produced a modified DNA which was strongly fluorescent at room temperature in aqueous buffer. The UV absorption-temperature profiles of DNA-AAF indicated a considerable increase in cross-linking after irradiation. Thermal denaturation and enzymatic degradation of DNA-AAF caused a red shift in the emission spectra, compared with native DNA, suggesting that the fluorescent residues were not free and exterior to the DNA double-strand, as with poly(A-AAF), but

were included to a large extent in the secondary structure. These results suggest that cross-linking of DNA strands (presumably increased by the action of free radicals), and possibly the light sensitivity of AAAF, might play a role in the biological action of the hydrocarbon.

- 2995 THE EFFECT OF TRANSPLENTAL ADMINISTRATION OF DDT ON ORGAN CULTURES OF FOETAL MOUSE LUNG TISSUE. (E.) Shabad, L. M. (Acad. Med. Sci. USSR, Moscow), T. S. Kolesnichenko and T. V. Nikonova. *Int J Cancer* 9(2):365-373, 1972.

The possible carcinogenic effect of the pesticide, DDT, was evaluated by testing the effect of transplacental administration of DDT on organ cultures of fetal mouse lung tissue. Organ cultures of fetal lung tissue from strain A mice 6-8 wk old exposed to DDT through the transplacental route showed intensive growth as compared to controls, a total of 1,076 DDT-exposed explants and 712 controls being examined. A dose of 50 ppm (parts per million) DDT induced a diffuse hyperplasia and focal proliferations, i.e. pre-adenomatous lesions, in the first generation. A progressively higher incidence of these lesions was observed at a dose level of 10 ppm, rising from 8.9% in the F₁ generation to 39.9% in the F₃ generation; however the incidence dropped in the F₄ and F₅ generations (30.1% and 20.1% resp.). Since no adenomas were observed in the present study the changes occurring in organ cultures of fetal lungs following intra-uterine exposure to DDT can only suggest a possible weak blastomogenic effect of DDT.

- 2996 THYMIC LYMPHOMA AND MYELOID LEUKEMIA IN THE RAT INDUCED WITH ETHYLNITROSOUREA. (E.) Hadjiolov, D. (Oncological Res. Inst., Sofia, Bulgaria). *Z Krebsforsch* 77:98-100, 1972.

A high incidence of thymic lymphoma and myeloid leukemia induced in rats with relatively small doses of ethylnitrosourea (ENU) is reported. Ten male Wistar rats were given monthly i.p. injections of 30 mg ENU and 20 rats received doses of 50 mg ENU; ten control rats received only saline. At the end of eight months all rats manifesting splenomegaly and orbital hemorrhaging were sacrificed and at ten months the experiment was terminated. Histologic findings on lymphatic tissues, kidney and tumors showed that among the first ten rats, three developed thymic lymphomas and three developed hyperplastic thymic lesions; among the other 20 experimental rats, nine developed thymic lymphomas, five, myeloid leukemia, and three, other neoplasms. It is not known why in some cases the myeloid tissue appears more susceptible to the carcinogenic action whereas in others the lymphoid tissue is susceptible.

- 2997 EFFECTS OF FEEDING THE CARCINOGEN DIMETHYLNITROSAMINE ON ITS METABOLISM AND METHYLATION OF DNA IN THE MOUSE. (E.) Den Engelse, L.

(Netherlands Cancer Inst., Amsterdam) and P. Lemelot. *Chem-Biol Interactions* 4(6):321-327, 1971/72.

The reversibility of dimethylnitrosamine (DMNA)-induced formation of 7-methylguanine (7-MeG) in lung, liver and kidney DNA was studied in C3H male mice. Animals received 10 ppm DMNA in their drinking water for six weeks. At the end of this period, DMNA-containing water was replaced by normal water. At various times after the start of the experiment, animals received a single i.p. injection of ^{14}C -DMNA, and 48 hr later the 7-MeG content of the DNA was determined. In addition, liver microsomal DMNA-N-demethylating activity was determined by measuring formaldehyde production *in vitro*, and blood DMNA concentration was assayed by gas chromatography. Pretreatment with DMNA strongly decreased methylation of liver DNA and stimulated methylation of both lung and kidney DNA. These effects were reversible, since normal or near normal methylation patterns were obtained when four to 11 weeks had elapsed between DMNA pretreatment and injection of labeled DMNA. A progressive, reversible inhibition of liver N-demethylase activity was also observed, which paralleled the changes seen in the methylation of liver DNA. DMNA took longer to appear in, and disappeared more slowly from, the blood of mice pretreated with DMNA than it did in the control mice, which had not been pretreated.

- 2998 DRUG-INDUCED CANCER. (E.) Fraumeni, J. F., Jr. (Nat'l. Cancer Inst., Bethesda, Md.) and R. W. Miller. *J Nat Cancer Inst* 48(5):1267-1270, 1972.

The carcinogenic capacity of drugs has been largely recognized as the result of animal experimentation and occupational studies. Current data on the oncogenic properties of various compounds have focused on: 1) radioisotopes; 2) immunodepressive drugs; 3) coal tar and creosote preparations; and 4) alkylating agents. Since the evidence for drug induced cancer is limited, recommendation for future investigations in this area should include surveillance of trends by cell type, age, sex and locale. In addition, the importance of the clinician is recognized in the reporting of clusters of cancers that are rare in the general population, particularly when the series has unusual demographic, clinical, occupational, familial or histopathologic characteristics. The establishment of new lines of communication among clinicians, experimentalists and epidemiologists are deemed necessary to provide impetus for studies into drug-induced cancer.

- 2999 INDUCTION OF LUNG TUMORS AND MALIGNANT LYMPHOMAS IN MICE BY METRONIDAZOLE. (E.) Rustia, M. (U. Nebraska Coll. Med., Omaha) and P. Shubik. *J Nat Cancer Inst* 48(3):721-729, 1972.

Metronidazole [1-(2-hydroxyethyl)-2-methyl-5-nitro-

imidazole], an anti-protozoal agent, was tested for carcinogenicity in a lifetime study in random-bred male and female Swiss mice. The drug was administered orally at levels of 0.5, 0.8, 0.15 or 0.06% of the powdered diet. None of the doses was toxic. The incidence of lung tumors, which were primarily adenomas, was significantly elevated, compared to controls, in animals receiving the three highest concentrations of metronidazole. The incidence of lung tumors in males (1/2) receiving a 0.5% metronidazole diet was significantly higher than that of the females (4%) of that group. No sex difference was seen in any of the other groups. Only females developed a significantly increased incidence of malignant lymphomas (primarily histiocytic and lymphocytic) at the two higher dose levels (0.5 and 0.1%) which was over twice that observed in the control animals. The latent periods observed for both lung tumors and lymphomas were probably not related to the frequencies of the neoplasms.

- 3000 POSSIBLE CARCINOGENICITY OF TAR-CONTAINING OINTMENTS. (Rus.) Shabad, L. M. (Inst.

Exp. Clin. Oncol., Moscow, USSR), A. B. Linnik, V. P. Tumanov and L. S. Rubetskoi. *Russkii Dokl* 16(6):6-9, 1971.

The possible carcinogenic effects of various tars and ointments prepared from these tars were studied in five groups of hybrid mice (C57 X CBA). The preparations were applied 2-3 times a week for 10-12 months, and the animals were observed for 1 1/2 years. Animals given coal tar containing 5190 $\mu\text{g/g}$ benzo(a)pyrene (BP) (18/19), those given Swiss "Ciba" coal tar containing 5020 $\mu\text{g/g}$ BP (20/21), and those given Locacorten tar ointment containing 225 $\mu\text{g/g}$ BP (16/17) died from tumors, while those given birch ointment 0.044 $\mu\text{g/g}$ BP and Vishnevskii ointment 0.0013 $\mu\text{g/g}$ BP survived with no tumor development. Birch tar was applied to the skin of Chinchilla rabbits and Vishnevskii ointment to the skin of six more rabbits twice a week for two years. None of these animals showed tumor growth. Thus, coal tar containing a large amount of BP (5190 $\mu\text{g/g}$) caused skin cancer, while Vishnevskii ointment with a low BP content (0.0013 $\mu\text{g/g}$) did not induce tumors.

- 3001 SUBCUTANEOUS INJECTIONS OF VACCINE ADJUVANT DEAE-DEXTRAN INDUCE LOCAL SARCOMAS IN MICE. (E.) Rice, J. M. (Nat'l. Cancer Inst., Bethesda, Md.) and R. M. Madison. *Nature New Biol* 236:28, 1972.

Female Swiss-Webster mice were given a single i.p. injection of the carcinogen 1-ethyl-1-nitrosourea (ENU) followed by weekly or twice weekly s.c. injections of DEAE-dextran in neutral, buffered saline for 10 to 20 wk. A total of 18 sarcomas were observed at the site of injection in 127 mice which were alive at the time when the first tumor was observed (25 wk after the first injection). Sarcomas developed whether or not mice also received poly I-poly C in the injec-

ions. No sarcomas developed in 42 mice (control) treated with ENU alone. Sarcomas also developed during the first yr of life in four of 48 mice which received DEAE-dextran injections, but no ENU. The incidences of other tumor types including mammary carcinoma, thymic lymphoma, and pulmonary adenoma were not significantly affected by repeated s.c. injections of DEAE-dextran in either ENU-treated or normal mice. It is concluded that DEAE-dextran was a non-reactive chemical carcinogen, with local but not systemic oncogenicity for rodent tissues.

002 CARCINOGENICITY OF HALO-ETHERS: II. STRUCTURE-ACTIVITY RELATIONSHIPS OF ANALOGS OF BIS(CHLOROMETHYL)ETHER. (E.) Van Duuren, B. L. Inst. Envir. Med., New York, N.Y.), C. Katz, B. M. Goldschmidt, K. Frenkel and A. Sivak. *J Nat Cancer Inst* 48(5):1431-1439, 1972.

Six chloro compounds related to the carcinogen bis(chloromethyl)ether were tested for carcinogenic activity by weekly s.c. injection for life in ICR/Ha mice and/or as initiating agents in 2-stage carcinogenesis on mouse skin. Two compounds, bis(α -chloromethyl)ether and 2,3-dichlorotetrahydrofuran, showed tumor-initiating activity. Of 20 mice, seven bore a total of nine papillomas with bis(α -chloroethyl)ether, and five of 20 mice bore papillomas and one bore a carcinoma with 2,3 dichlorotetrahydrofuran. All six compounds induced s.c. sarcomas in mice, but only two of the six, chloromethyl methyl ether (CMME) and bis(α -chloroethyl)ether, caused significant numbers of sarcomas at the injection site. None of the compounds induced significant incidences of tumors at sites distant from the injection site. Studies on the rate of hydrolysis of these six compounds and other related compounds tested earlier showed a good correlation between chemical reactivity and carcinogenicity. CMME and bis(chloromethyl)ether did not affect the melting point and buoyant density of salmon sperm DNA. The unlabeled compounds also did not yield simple alkylated products on reaction with purines. DNA under conditions in which other alkylating carcinogens, such as β -propiolactone and diepoxybutane, reacted. It is suggested that reactions with nucleic acids were not necessarily the critical step in chemical carcinogenesis by the chloro compounds tested.

003 SERIAL TRANSPLANTATION OF URETHAN-TREATED MAMMARY NODULE OUTGROWTH LINE D1. (E.) Medina, D. (Dept. Zool. Cancer Res. Genetics Lab., U. California, Berkeley). *J Nat Cancer Inst* 48(5):1371-1375, 1972.

Urethan-treated mammary nodule outgrowths were serially transplanted in various groups of mice for two or more generations. The urethan-treated outgrowths differed from methylcholanthrene (MCA)-treated outgrowths in two ways: 1) D1 nodule outgrowths exposed to urethan produced a high incidence of tumors (83%) if left *in situ*, continuing to yield tumors (32%) when retransplanted into untreated

mice. However, the tumor incidence decreases with successive transplant generations. 2) Urethan treatment did not alter the sensitivity of the nodule cells to hormone-mediated tumorigenesis. The oncogenic agents, urethan and mammary tumor virus (MTV), and urethan and MCA, were applied sequentially to D1 outgrowths. The results indicated that the effects of urethan and MTV, and urethan and MCA, were additive in the induction of mammary tumors. Thus, prior exposure of the outgrowths to urethan did not alter their responsiveness to MTV or MCA. These experiments provide no evidence that urethan interacts with MTV to promote mammary tumorigenesis in these nodule outgrowths.

3004 SERIAL TRANSPLANTATION OF METHYLCHOLANTHRENE-TREATED MAMMARY NODULE OUTGROWTH LINE D1. (E.) Medina, D. (Dept. Zool. Cancer Res. Genetics Lab., U. California, Berkeley). *J Nat Cancer Inst* 48(5):1363-1370, 1972.

Carcinogen-treated BALB/cCrgl mammary nodule outgrowths were serially transplanted into various groups of mice for two or more generations to determine the specific conditions for expression of the carcinogen-induced alterations. D1 nodule outgrowths exposed to 3-methylcholanthrene (MCA) produced a high incidence of tumors if left in the treated host, but failed to yield a significant number of tumors if transplanted as small pieces into untreated hosts. However, MCA-treated D1 outgrowths transplanted as whole glands onto the abdomens of untreated BALB/c mice and D1 outgrowths transplanted as small pieces into BALB/c mice with pituitary isografts produced a high incidence of mammary tumors. The serial transplantation of MCA-treated outgrowths for four generations into a series of MCA-treated hosts showed no accumulative effect of MCA on the tumor-producing capabilities of D1 outgrowths. The results are interpreted to mean that MCA treatment of nodule outgrowth line D1 leads to two separate and independent alterations. MCA increases the tumor-producing capabilities of nodule cells maintained in the hormonal milieu of a virgin mouse and also increases the susceptibility of nodule cells to the hormone-mediated tumorigenesis produced by pituitary isografts.

3005 STRAND SCISSION AND REJOINING OF DNA IN CULTURED MAMMALIAN CELLS INDUCED BY 4-NITROQUINOLINE 1-OXIDE. (E.) Andoh, T. (Inst. Med. Sci., U. Tokyo, Japan) and T. Ide. *Cancer Res* 32:1230-1235, 1972.

The effect of the carcinogen, 4-nitroquinoline 1-oxide (4NQO) on stationary cultured mouse fibroblasts, strain L-P3, a substrain of L-929, was studied. Cells were cultured in a protein- and lipid-free synthetic medium, DM-120. Strand breakage and repair of DNA caused by 4-NQO was examined. 4-NQO caused single- and double-strand breaks of DNA prelabeled with ^3H -

thymidine as shown by alkaline and neutral sucrose gradient centrifugation, resp. Breakage increased with increasing concentrations of carcinogen. At a concentration of $10^{-3}M$ 4-NQO, the DNA in the cells consisted either of a heterogeneous population of single-stranded molecules with sedimentation coefficients of 40 to 120S, or of an apparently homogeneous population of double-stranded 130S molecules, presumably containing single-strand breaks. Both the single- and double-strand breaks were repaired upon incubation of treated cells at 37 C in carcinogen-free medium. A 24 hr incubation was necessary for complete repair of double-strand breaks. Repair of single-strand breaks was complete by three hr. Repair of double-strand breaks was accompanied by the ability of treated cells to once again grow at a rate comparable to that of untreated controls.

- 3006 PROGESTIN SECRETION IN 3-METHYLCHOLANTHRENE-TREATED RATS. (E.) Moon, R. C. (U. Tennessee Med. Units, Memphis) and S. Young. *Int J Cancer* 9(2):402-408, 1972.

The mechanism of deciduomata maintenance by 3-methylcholanthrene (MCA) was investigated in normally cycling Sprague-Dawley rats. Animals received daily injections of ovine prolactin (LTH) from days 1-4 following estrus (pre-trauma period). On days 5 to 8 (post-trauma period), each rat received either daily injections of LTH, sesame oil intragastrically, or 10 mg 3-methylcholanthrene (MCA) in 1 ml sesame oil intragastrically. Other rats were either adrenalectomized, ovariectomized or hypophysectomized at the time of uterine traumatization on day 4. Results showed that rats which were not treated with LTH but in which the uterus was traumatized did not develop deciduomata, whereas 80% of rats treated with 5 IU LTH during the post-trauma period were positive. Rats receiving 10 IU LTH during the pre-trauma period but untreated during the post-trauma period did not develop deciduomata. However, 27% of rats were positive when fed oil during the post-trauma period. In the second experiment, 1 ml oil prior to and during the pre-trauma period resulted in all negative responses when oil was fed during the post-trauma period. All rats receiving LTH during the pre-trauma period followed by MCA during the post-trauma period were positive. None of the ovariectomized or hypophysectomized rats exhibited deciduomata when treated with MCA during the post-trauma period. However, 75% of the adrenalectomized rats showed positive reactions. These data indicate that MCA effects release of progesterin in quantities sufficient to maintain deciduomata and that both the pituitary gland and ovary are essential for this response.

- 3007 THE EFFECT OF GROWTH HORMONE, INSULIN AND ALLOXAN-INDUCED DIABETES ON CARCINOGENESIS IN THE GENITAL TRACT OF INTACT AND CASTRATE FEMALE RATS. (E.) Cherry, C. P. (Strangeways Res. Lab., Cambridge, England) and A. Glucksmann. *Brit J Cancer* 24(4):746-758, 1971.

Intact and castrate female Lister strain rats were given weekly intravaginal applications of a 1% solution of 9,10-dimethyl-1,2-benzanthracene (DMBA). Prior to the start of, and during the period of DMBA application, some intact and castrate rats received i.m. injections of protamine zinc insulin (1.2 U/day for 5 days/wk). Other intact and castrate rats were treated with a single i.p. injection of a 6% solution of Alloxan (150 mg/kg body wt) to induce diabetes prior to the DMBA applications. Still other intact and castrate rats received i.m. injections of bovine growth hormone (1 mg/rat, 5 days/wk) prior to and during DMBA application. All rats were weighed every two wk throughout the experiment. Sick or tumor-bearing animals were killed and autopsied. Castrate animals of all treatment groups were consistently heavier than intact animals under the same conditions. They also had more sarcomatous and epithelial cervico-vaginal neoplasms than the intact animals. Promotion of carcinogenesis and gain in body wt were independent phenomena caused by castration in the medicated rats. Growth hormone was the most effective in enhancing body wt in all animals, but was the least active tumor promoter. It reduced the incidence of sarcomas in intact rats, but increased that of epithelial neoplasms, and promoted both types in castrates. The highest incidence of cervico-vaginal epithelial and sarcomatous tumors occurred in spayed diabetics. Squamous cell epitheliomas of the vulva were not affected by castration or additional medication; however, basal cell carcinomas tended to be more frequent in intact rats than in castrates, and particularly numerous in unoperated diabetic rats who did not respond to insulin. Vulval sarcomas were usually rare but were increased in numbers in insulin-treated intact rats. Granular myoblastomas of the cervico-vaginal tract occurred in unoperated rats only, especially in diabetics and in growth hormone- or insulin-treated rats.

- 3008 DIETARY AFLATOXINS AND HUMAN LIVER CANCER: V. DURATION OF PRIMARY LIVER CANCER AND PREVALENCE OF HEPATOMEGALY IN THAILAND. (E.) Shank, R. C. (Dept. Nutr., Massachusetts Inst. Tech., Cambridge), P. Siddhichai, B. Subhamani, N. Bhamarapravati, J. E. Gordon and G. N. Wogan. *Fd Cosmet Toxicol* 10(3):181-191, 1972.

A study designed to determine the duration of primary liver cancer, based on hospital records of 271 patients from major hospitals in Bangkok and Chiang Mai, Thailand, from 1963 to 1969, is presented. Duration was defined as the interval between time of medical recognition of the cancer (day of report) and date of death; duration was measured to allow calculation of incidence from prevalence. To examine the relationship between aflatoxin intake and liver cancer it was necessary to measure frequency of liver cancer for rural and urban areas. Surveys were not practical in urban areas, partly due to population mobility. Quantitative information on liver cancer and hepatomegaly frequency was provided by a prevalence survey; two Thai provinces, Singburi and Songkhala, with a difference in liver cancer incidence, were selected for the rural field study.

The first province is an area of high aflatoxin intake, the second an area of low aflatoxin intake. Hospital records for the cities of Bangkok and Chiang Mai, which adjoin these two rural areas, indicated that 52% of the patients were less than 40 years old at time of death, with 25% under 40 yr. Primary liver cancer duration, as shown by autopsy biopsy was 1.5 months for 19 male patients aged 35-59 yr and 1.2 months for 41 males aged 50-59. Hepatomegaly rates in Singburi for males were twice those of females; the reverse relationship in Songkhala. It is thought that the results of the rural prevalence study are without statistical significance; however, it is suggested that liver cancer frequency in rural areas is similar to that in cities.

09 EFFECT OF THE CARCINOGEN N-NITROSOMETHYLUREA ON THE tRNA METHYLASE ACTIVITY OF CELLS CULTURED *IN VITRO*. (E.) Wilkinson, R. (Mancerson Labs, Manchester, England) and D. J. Linger. *Int J Cancer* 8:401-409, 1971.

tRNA methylase enzyme activity in a permanent line of these hamster ovary fibroblasts maintained *in vitro* was investigated in an attempt to detect early biochemical changes after treatment with N-nitrosomethylurea (NMU). Tumors were induced in 12 to six-wk-old female hamsters by cheek-pouch injections of 10^6 cells. Cloned populations from single cells surviving 80 μ g/ml NMU showed morphological conversion. Enzyme activity of cell-free extracts was determined by measuring 14 C methyl group incorporation from labeled S-adenosyl-L-methionine into methyl-deficient *E. coli* tRNA. Enzymes from T7 cells could introduce three times as many methyl groups into *E. coli* tRNA as those from N12 untreated cells at a protein concentration of 0.3 mg. No major qualitative differences were observed in tRNA bases methylated after NMU treatment. Elevation of methylase activity remained stable during six months of continuous cell culture. It is suggested that a permanent heritable alteration may have taken place after carcinogen exposure. However, it is as yet undetermined whether NMU exposure resulted in malignant conversion of the treated cells.

0 SPECIFIC VULNERABILITY OF THE LARGEST TELEOCENTRIC CHROMOSOME OF RAT BONE MARROW CELLS TO 7,12-DIMETHYLBENZ(a)ANTHRACENE. (E.) Sugiyama, (Ben May Lab. Cancer Res., U. Chicago, Ill.). *J Cancer Inst* 47(6):1267-1275, 1971.

Unbred, normal, male Long-Evans rats were injected i.v. with 50 mg/kg body wt 7,12-dimethylbenz(a)anthracene (DMBA) and killed at various times thereafter. Femoral bone marrow cells were prepared for chromosomal examination. A higher-than-expected incidence of chromosome aberrations was seen in the largest telocentric chromosome (C-1); aberration incidence in C-1 was 3.7, 2.5 and 2.0 times expected values in metaphases examined six, 12 and 24 hr after exposure, resp. Other chromosomes showed aberrations,

but only C-1 was vulnerable to aberrations six hr after DMBA. The C-1 chromosome appeared to be especially vulnerable to breaks in later interphase (late S or G2) or prophase. Two regions, 29 and 53% of the total length from the centromere of the C-1 chromosome, were especially susceptible to DMBA. The percentage of isochromatid lesions in six-hr C-1 specimens was 24.5% in the 29% region and 18% in the 53% region. The incidence of sister-chromatid exchanges was increased in DMBA-treated cells; chromatid exchanges after DMBA were preferentially induced in the two target sites of the C-1 chromosome, the 29% and 53% regions. The C-1 chromosome, and especially these two regions, replicated DNA late. The data were thought to suggest that two vulnerable regions of the C-1 chromosome were heterochromatic in nature.

3011 THE ROLE OF AVIATION IN POLLUTING THE HUMAN ENVIRONMENT WITH CARCINOGENIC HYDROCARBONS (3,4-BENZOPYRENE STUDY). (Ger.) Shabad, L. M. (Inst. Exp. Clin. Onkol. USSR, Moscow) and G. A. Smirnov. *Z Ges Hyg* 17(12):888-891, 1971.

Measurements of the amount of 3,4-benzo(a)pyrene (BP) in soot and exhaust gases from jet and turboprop aircraft engines, made by the Chesina modification of the Muel and Lacroix Method, disclosed that soot samples contained from 250 μ g-30 mg BP/kg soot, and that these engines emitted from 2-4 mg BP during one minute of flight. Because these emissions may contain other hydrocarbons, which act as promoters or inhibitors of BP, tests were performed on first-generation hybrid C57 x CBA mice. The effect of a 0.1% solution of chemically pure BP in benzene was compared with benzene extracts of soot from turboprop and piston engines, each of which contained 0.1% BP, and with pure benzene as a control. The solutions were applied to the skin of these mice, with each mouse receiving 50 applications. The test and control groups each included between 20 and 34 mice. Both benzene extracts of soot produced tumors in all of the mice tested, and pure BP induced tumors in 28/29 (96.5%) mice; no tumors developed in the controls. Of the tumors induced, 28/29 (96.5%) were malignant in the group treated with a benzene extract of soot from turboprop engines, 29/29 (100%) were malignant in the group treated with a benzene extract of soot from piston engines, and 26/28 (93%) were malignant in the group treated with a 0.1% solution of chemically pure BP. Most of the tumors were squamous-cell carcinomas, but there was one sarcoma and four carcinosarcomas. The BP content of soil from [5-7 cm below the surface of] the landing strip of the Moscow airport was 2-3 times greater than soil 10-12 cm from the surface, and the BP content of areas adjacent to taxiways was greater than areas near the landing strip. Grass growing next to runways contained 5.4-21.3 μ g BP/kg, and grass roots contained 3.1-7.0 μ g/kg. Snow on the landing strip contained 0.28-2.22 μ g/m² BP, depending upon the distance from the taxiway. These BP values were significantly larger than those obtained in control samples, showing that aviation causes environmental pollution.

- 3012 THE EFFECT OF TOBACCO SMOKE CONDENSATE ON RNA SYNTHESIS IN MOUSE SKIN. (Fr.) Alexandrov, K. (Inst. Sci. Res. Cancer, Villejuif, France) and C. Vendrely. *Chem-Biol Interactions* 4(3):155-161, 1971-1972.

3,4-Benzo(a)pyrene (BP) (20 µg in a 0.02% acetone solution), 0.1 ml of the initial condensate from tobacco smoke, 0.1 ml of a hexane extract of the initial condensate, or 0.1 ml of the residual fraction remaining after hexane extraction, was applied to the skin of male mice of the I.C. strain. As an RNA precursor, 10 µCi/g of ³H-orotic acid with a specific activity of 16 Ci/mMol was injected i.p. one hr before the mice were killed; radioactivity was measured with a Packard Tri-Carb spectrometer. The application of BP decreased the incorporation of orotic acid into skin RNA by 25-30% two hr after treatment. The initial condensate also inhibited RNA synthesis, but the effect occurred four hr after treatment, probably because this fraction is viscous and penetrates into the skin more slowly. The hexane fraction had the same effect as BP without a time lag, while the residual fraction doubled RNA synthesis during the 24 hr after application. The inhibition of RNA synthesis induced by carcinogens is interpreted as one step in the malignant transformation of tissues, particularly in the tumor initiation stage.

- 3013 REGRESSION AND RECURRENCE OF MAMMARY TUMOR PRODUCED WITH 7,12-DIMETHYLBENZ(a)ANTHRA-CENE (DMBA) IN RATS. (E.) Imaizumi, T. (Jikei U. Sch. Med., Japan) and I. Ohira. *Jikei Med J* 18:1-5, 1971.

Female Sprague-Dawley rats (six wk old, 150 g) were treated as follows: Group I received a single feeding of 1 ml olive oil by gastric intubation (ten rats). Group II received a single oral feeding of 10 mg of 7,12-dimethylbenz(a)anthracene (DMBA) dissolved in 1 ml olive oil (ten rats). Group III received 10 mg DMBA by gastric intubation. On the 41st day after the carcinogen administration these females were allowed to mate at will (five rats for DMBA and parturition, resp.). Group IV received 1 ml olive oil and was allowed to mate as Group III (five rats). Pregnant animals in both groups III and IV were allowed to nurse the entire litters for 28 days. Induced tumors were detected by palpation. All animals were observed for approximately 12 months, and at necropsy all tumors were prepared for microscopy. Animals which received only olive oil at six wk of age (Group I and IV) did not develop mammary tumors. Administration of a single dose of 10 mg DMBA resulted in development of mammary tumors in 14 of 15 animals (Group II and III). In three cases of Group III and one case of Group II, regression of mammary tumors were observed. In further observations, mammary tumors recurred on sites different from the initial sites.

- 3014 NITROSOUREA-INDUCED BRAIN TUMORS IN THE RAT: COMMENTS ON THE PATHOGENESIS OF MIXED AND POLYMORPHIC GLIOMAS. (It.) Schiffer, D. (Nerv.

Mental Dis. Clin. U. Torino, Turin, Italy), A. Paoletti, E. Grossi-Paoletti and P. Paoletti. *Cancer* 37(1):333-341, 1971.

- 3015 THE ROLE OF SOME PHYSICAL PROPERTIES COMMON TO VARIOUS INDUSTRIAL TYPES OF CARBON BLACK UPON SEPARATION FROM BENZ(a)PYRENE: A CARCINOGENOUS HYDROCARBON. (Rus.) Shatskiy, L. M. (Inst. Exp. Clin. Oncol., USSR Acad. Med. Sci., Moscow), L. N. Pylev and R. L. Nasyrov. *Sig To Prof* 2(1):9-12, 1972.

- 3016 POSSIBLE RELATIONS BETWEEN ASBESTOS AND PLEURAL-PULMONARY MALIGNANCY IN LIGURIA. (It.) Zanardi, S. (Genoa U., Italy) and L. Fontana. *Med Lavoro* 62(6-7):336-343, 1971.

- 3017 MALIGNANT HEMANGIOENDOTHELIOMA OF THE LIVER AND CHRONIC ARSENICISM. (Sp.) Rennke, H. (Salvador Hosp. Santiago, Chile), G. A. Prat, R. B. Etcheverry, R. U. Katz and S. Denoso. *Rev Med Chile* 99(9):664-668, 1971.

- 3018 CYTOTOXIC ACTION OF AFLATOXIN B₁ ON LYMPHOCYTES IN PHYTOHAEMAGGLUTININ CULTURE. (Pol.) Aleksandrowicz, J. (Acad. Med. Cracow, Poland), I. Urasinski, J. Lisiewicz and B. Malkiewicz. *Przegl Lek* 28(3):689-692, 1971.

- 3019 EAR LOBE TUMOUR INDUCED IN OVARECTOMIZED RATS BY DIMETHYLBENZANTHRA-CENE: DERMATO-FIBROSARCOMA PROTUBERANS. (Fr.) Jasmin, G. (Fac. Med., U. Montreal, Quebec, Canada) and J. L. Riopelle. *Monch Arch Abt B Zellpath* 10:30-39, 1972.

- 3020 QUANTITATIVE STUDIES OF TOBACCO SMOKE CONDENSATE - INDUCED CARCINOGENIC EFFECTS IN RATS. (Ger.) Schmähl, D. (German Cancer Res. Ctr. Heidelberg, Germany). *Z Krebsforsch* 76(4):320-324, 1971.

- 3021 THE EFFICACY OF PREVENTIVE MEASURES AGAINST CARCINOGENIC HAZARDS IN THE PRODUCTION OF COAL BRIQUETTES. (Rus.) Kireeva, I. S. (A. N. Marzeyev Sci. Res. Inst. Gen. Commun. Hyg. Kiev, USSR) and N. Ya. Yanysheva. *Gig Sanit* 37(2):10-14, 1972.

- 3022 THE HEPATIC ACTIVITIES OF 1-CARBON ENZYMES DURING THE CHRONIC ADMINISTRATION OF DI-ETHYLNITROSAMINE, 2-ACETYLAMINOFLUORENE, AND N,N-DI-METHYL-4-AMINOAZOBENZENE TO RATS. (E.) Poirier, M. C. (Montreal Inst. Cancer, Quebec, Canada), L. A. Poirier and R. Lepage. *Cancer Res* 32(6):1104-1107, 1972.

023 HUMAN GROWTH HORMONE AND LUNG CARCINOMA.
(E.) Glass, D. N. (Kennedy Inst. Rheumatology, Hammersmith, England), A. S. Russell and R. Davies. *Lancet* (7752):683-684, 1972.

024 CANCER OF THE SCROTUM PRODUCED BY MINERAL OILS IN THE NETHERLANDS. (Dut.) Pruyn, F. A. M. (Philips Telecommun. Industry, Hilversum, Netherlands) and K. Reijnierse. *T Soc Geneesk* 0(5):182-187, 1972.

3025 PHOTOCHEMICAL COUPLING OF BENZO[a]PYRENE WITH 1-METHYLCYTOSINE; PHOTOENHANCEMENT OF CARCINOGENICITY. (E.) Cavalieri, E. (Lawrence Rad. Lab., U. California, Berkeley) and M. Calvin. *Photochem Photobiol* 14(5):641-653, 1971.

See also:

- * (Rev): 2919, 2921, 2922
- * (Viral): 3033, 3069, 3080, 3121, 3143
- * (Immun): 3170, 3195, 3199, 3227
- * (Path): 3226
- * (Epid-Biom): 3266, 3277, 3281

- 3026 RISK FACTORS OF SKIN CANCER. (Ger.) Luger, A. (Vienna, Austria). *Deut. Erforsch. Bekämp. Krebkrankh.* 26(5):372-373, 1971.

The causes of skin cancer, the most important of which is sunlight, are discussed. Although UV radiation in sunlight damages cell chromosomes, the damage can be repaired, but the extent of repair is limited. Skin pigmentation acts as a protective mechanism. The critical exposure time for skin cancer ranged from 40,000-180,000 hr, depending upon the ability of the individual to produce pigment. The author's analysis of 1267 cases of skin cancer and another 9541 cases reported in the literature demonstrates that 86.6% of all squamous-cell carcinomas are located on the face or neck in sites ordinarily exposed to light (nose, ear, lower lip, lower eyelid, back of the hands). The incidence of skin cancer reaches a maximum at age 71.3 yr. Skin cancer is found more in persons engaged in outdoor occupations than in factory workers. Prolonged exposure to small doses of ionizing radiation can also induce skin cancer: x-ray technicians, assistants, and physicians have a high risk for this form of cancer. Other risk factors for skin cancer include chronic inflammations of the genitalia which cause prickle-cell carcinomas; ingestion of arsenic-containing drugs, which induce multiple basal-cell carcinomas; scarring from burns, lupus vulgaris, or lupus erythematosus; and smoking which causes lip cancer because of the photosensitizing effect of tobacco tar.

- 3027 OTHER TUMORS. (E.) Steer, A. (Atomic Bomb Casualty Commission, Hiroshima, Japan). *Human Path* 2(4):541-546, 1971.

Life span study cases from the Atomic Bomb Casualty Commission (ABCC) and from the Hiroshima and Nagasaki tumor registry files were reviewed in order to determine whether or not A-bomb irradiation was associated with cancers of various organs. Although a relationship between exposure to A-bomb irradiation and the incidence of breast cancer in Japanese women has not been established, evidence suggests a possible association. The occurrence of gynecologic cancer among members of the Life Span Study Sample has been studied on several occasions with questionable evidence of an association of ovarian, uterine, or cervical cancer with radiation exposure at the time of the A-bombs. A review of related pathology material at ABCC showed no increase in gallbladder carcinoma in the heavily irradiated group as compared to a nonexposed group. Malignant salivary gland tumors showed a significant increase ($P < 0.001$) in the heavily irradiated group. Although benign salivary gland tumors were also more frequent in the irradiated group, the increase was not significant ($P > 0.05$). A study of leukemogenesis and carcinogenesis in offspring of women exposed to A-bomb irradiation while pregnant showed no significant excess in mortality when compared to controls not exposed to irradiation. Although children exposed to A-bomb irradiation showed no excess of neoplasms in general, an excessive increase in leukemia

($P < 0.0001$) and possibly an increase in breast cancer were observed. Children exposed to a 165 dose in excess of 100 rads have also shown an excessive number of thyroid malignancies with a latent period of about 15 yr. Preliminary studies of multiple primary malignant tumors have indicated that the carcinogenic effect of A-bomb irradiation was not additive in the sense of producing multiple malignant neoplasms.

- 3028 EXPERIMENTAL LUNG CANCERS PRODUCED IN THE RAT BY RADON INHALATION. (Fr.) Gamaud, J. (Atomic Energy Commission, Bazel, France), R. Perraud and J. Lafuma. *Int. Assoc. Radiat. Biol.* 27(23):2388-2389, 1971.

Rats were exposed to atmospheres containing a mean concentration of 130 mg/m^3 uranium mineral dust 15 times for a total of 50 hr, a mean concentration of 6×10^{-7} curies/liter of radon 125 times for a total of 620 hr, or to both radon and dust. All 34 surviving rats exposed to radon, either alone or associated with dust, developed various types of bronchopulmonary carcinomas (alveolar cell carcinomas, adenocarcinomas, rather well-differentiated squamous cell carcinomas). Some tumors were made up of several different histological types; small cell carcinomas were not found. After 21 months no cancer had developed in any of the controls or in rats exposed to mineral dust. These findings show that large doses of radon can induce lung cancer in animals exposed to it; it is not necessary to first expose the animals to dust. Exposure to the dust appeared to retard the appearance of tumors by about one month.

- 3029 RADIATION CARCINOGENESIS AT LOW DOSES. (E.) Rossi, H. H. (Coll. Physicians Surg. Columbia U., New York, N.Y.) and A. M. Kellner. *Science* 175(4018):200-202, 1972.

Radiations of high linear energy transfer (neutrons) are experimentally applied to Sprague-Dawley rats serving to clarify some of the issues involved in determining existence of a "threshold dose". Previous studies of x-rays have shown a linear dependence of incidence of mammary rat neoplasms on dose while results for neutrons have been less consistent with linearity. Even if the dose-effect relation for x-rays were linear in the high dose range previously studied, linear extrapolation to lower doses is unjustified. The neutron dose-effect curve and microdosimetric determinations imply that the development of malignancies are determined by radiation effects on a number of interacting cells.

- 3030 THE INFLUENCE OF IRRADIATION *IN VIVO* ON OXYGEN CONSUMPTION AND RESPIRATORY CONTROL OF ISOLATED RAT-LIVER CELLS. (E.) Watras, J. (Inst. Oncology, Gliwice, Poland) and M. Widel. *Neoplasma* 19(3):175-179, 1972.

3031 SWEAT GLAND CARCINOMA ARISING IN IRRADIATED SKIN. (E.) El-Domeiri, A. A. (Sloan-Kettering Mem. Cancer Ctr., New York, N.Y.), A. G. Luvo and E. J. Beattie, Jr. *Amer J Roentgen* 114(5): 606-609, 1972.

3032 RADIATION CANCERS AND A-BOMB SURVIVORS. (E.) Stewart, A. M. (Dept. Soc. Med., Oxford U., England). *Lancet* (7750):588-589, 1972.

See also:

- * (Rev); 2904, 2919
- * (Chem); 2924, 2960, 3025
- * (Viral); 3092
- * (Immun); 3212, 3227

- 3033 HERPES SIMPLEX VIRUS LATENCY IN CULTURED HUMAN CELLS FOLLOWING TREATMENT WITH CYTOSINE ARABINOSIDE. (E.) O'Neill, F. J. (Milton S. Hershey Med. Ctr. Pennsylvania St. U., Hershey), R. J. Goldberg and F. Rapp. *J Gen Virol* 14:189-197, 1972.

Human embryonic lung (HEL) cells infected with herpes simplex virus type 2 (HSV-2), strain 316-D, were treated with cytosine arabinoside (ara-C) in an effort to obtain non-productively infected HEL cultures. Exposure of cultures to 10 or 20 µg/ml ara-C starting 24 hr prior to HSV-2 infection totally inhibited virus synthesis by four days after inoculation. The inhibition continued through nine days post-infection. Microscopic examination of inhibited cultures revealed normal cell morphology. Removal of ara-C after up to 22 days of treatment resulted in recovery of infectious virus after a delay of 6 to 11 days. The reappearance of infectious virus coincided with the appearance of virus CPE. The period between the disappearance and reappearance of infectious virus was defined as the "latent period" (days 4 to 13 after infection). The ability of latent period cultures to support the replication of HSV-2 or vesicular stomatitis virus indicated that ara-C was not preventing virus expression by a toxic effect. Infectious center assays showed that as many as 1 in 800 latent period cells were capable of ultimately synthesizing infectious virus.

- 3034 SEROLOGIC EVIDENCE FOR A SIMIAN-VIRUS-40-LIKE INFECTION OF MAN. (E.) Shah, K. V. (Johns Hopkins Sch. Hyg. Public Hlth., Baltimore, Md.), F. R. McCrumb, Jr., R. W. Daniel and H. L. Ozer. *J Nat Cancer Inst* 48(2):557-561, 1972.

Sera from four groups of donors were tested for the presence of SV40-reacting antibodies. Neutralizing antibodies were found in about 20% of the sera of Maryland children born between 1955 and 1957. This group had a high risk of having received SV40 contaminated Salk poliomyelitis vaccine. SV40-neutralizing antibodies were also found in nine (3.2%) sera of a low-risk group of Maryland children born between 1964 and 1968. SV40-reacting antibodies were detected in four of 200 sera collected from adults in 1951 and 1954 before monkey kidney vaccines came into general use. The validity of the results from neutralization tests was confirmed by indirect immunofluorescence and radioisotope precipitation tests. These results strongly suggest that man may become infected with an SV40-like virus without being exposed to monkeys or monkey products.

- 3035 SPECIFIC IMMUNOFLUORESCENCE TEST FOR DETECTION OF HERPESVIRUS ANTIGEN IN CELLS OF THE LUCKE RENAL ADENOCARCINOMA. (E.) Paul, S. M. (Chapman H. Hyans III Lab. Tumor Cell Biol., Tulane U., New Orleans, Louisiana), M. Mizell, B. Craige, J. Blazek and M. Skinner. *Proc Soc Exp Biol Med* 139(3):944-948, 1972.

A fluorescent antibody technique has been developed

which detects viral antigen(s) in the winter state (virus-containing) of the Lucké renal adenocarcinoma of *Rana pipiens*. Antiserum prepared against purified herpesvirus fractions of the Lucké tumor was used to detect the virus-containing nature of various tumor samples. A strong positive reaction was elicited against two different virus fractions similar to those used for preparation of the antiserum. Winter tumor frozen sections gave bright fluorescence in the nucleus and cytoplasm when stained with immune rabbit serum in the indirect immunofluorescence (IF) test. Normal kidney and summer (nonviral) tumor sections consistently gave negative IF results. The IF test was thus specific for the virus-containing state of the Lucké tumor and has been used successfully in detecting the virus-containing components of various tumor samples.

- 3036 CONTINUOUS LONG-TERM REPLICATION OF FELINE LEUKEMIA VIRUS (FeLV) IN AN ESTABLISHED CANINE CELL CULTURE (MDCK). (E.) Essex, M. (U. California, Davis), T. G. Kawakami and K. Kurata. *Proc Soc Exp Biol Med* 139(1):295-299, 1972.

The growth properties and immunological parameters of cultures of uninfected and FeLV-infected Madin-Darby canine kidney cells (MDCK) were studied. The growth curves of uninfected and infected MDCK cells were similar. Cultures lagged for one day after inoculation and then grew logarithmically. Examination by light microscopy revealed no cytopathic effect or loss of contact inhibition in FeLV-infected MDCK cells. Pellet preparations obtained by ultracentrifugation of infected MDCK culture fluid from passages 8, 12, 22, 33 and 57 gave a strongly positive complement fixation test using antiserum to purified FeLV. Culture fluids from infected cells at passages 5, 22, 33 and 57 were similarly positive using the gel precipitation technique. Examination of infected cells at passages 8, 33 and 57 by electron microscopy showed budding and mature C-type particles typical of FeLV. C-type particles were also observed in the 1.13 to 1.17 g/cm³ density fraction from FeLV-infected MDCK culture fluids. These results demonstrate that an established cell line of canine origin could support the replication of FeLV in a steady-state noncytotoxic manner.

- 3037 STUDIES ON THE HYPERPLASTIC FOCUS FORMATION BY VARIOLA VIRUS IN HUMAN CELL CULTURES: III. VIRUS GROWTH AND FOCUS FORMATION IN HeLa CELLS CULTURED AT SUPRAOPTIMAL TEMPERATURES. (E.) Kitamura, T. (Natl. Inst. Hlth., Tokyo, Japan). *Japan J Med Sci Biol* 24(3):153-162, 1971.

Variola virus growth and hyperplastic focus formation in HeLa cells cultured at temperatures higher than 37°C were studied. Virus growth was inhibited by 98% at 37.5°C, whereas the efficiency of focus formation was not changed. At 38.0°C the growth of virus was almost completely inhibited, while the number of

oci formed was reduced only to 30 to 50% of those formed at 37 C. At temperatures higher than 38.5 C both virus growth and focus formation were completely inhibited. The interaction between variola virus and HeLa cells leading to focus formation was analysed by exposing the infected cultures to 40 C for a limited period of time at various intervals after infection. Virus adsorption and penetration into HeLa cells were rather accelerated at 40 C. Shifting the incubation temperature of the infected cultures from 37 C to 40 C at any time after infection resulted in interruption of the virus growth. It was also indicated that 30 to 36 hr at 37 C were necessary for visible foci to develop even after the shift up, suggesting that micro-foci formed during this period and that subsequent cell aggregation took place at 40 C. Shift down experiments from 40 C to 37 C indicated that initial incubation at 40 C for longer than 36 hr impaired greatly the efficiency of focus formation after shift down, probably due to the thermal degradation of penetrated virus.

038 IDENTIFICATION OF VIRUS-INDUCED PROTEINS IN CELLS PRODUCTIVELY INFECTED WITH SIMIAN VIRUS 40. (E.) Fischer, H. (German Cancer Res. Ctr., Heidelberg) and G. Sauer. *J Virol* 9(1):1-9, 1972.

The number and molecular wt of the structural polypeptides of highly purified SV40, strain Rh911, were determined by polyacrylamide gel electrophoresis. Six different polypeptides were found, two of which (VP1 and VP2) comprised the bulk of the viral capsid proteins. The pattern of protein synthesis in productively infected CV-1 cells was studied by sodium dodecyl sulfate polyacrylamide gel electrophoresis. Identification of virus-induced proteins in the infected CV-1 cells was achieved in double-labeling experiments by electrophoresis with purified labeled SV40 capsid proteins. Four of these proteins (VP1-VP4) were classified as virion components as synthesis occurred after the onset of viral DNA replication (18 hr post-infection) and since the synthesis of these proteins was inhibited by arabinofuranosylcytosine (ara-C). Appearance of two other virus-induced proteins was not prevented by ara-C; one of them did not comigrate in electrophoresis with purified virion polypeptides, and both could be detected before the onset of viral DNA synthesis. These latter two proteins were classified on the basis of these criteria as nonvirion capsid proteins (NCVP1 and NCVP2).

039 DETECTION AND ASSAY OF AVIAN TUMOR VIRUS GROUP-SPECIFIC ANTIGEN AND ANTIBODY BY THE PAIRED RADIOIODINE-LABELED ANTIBODY TECHNIQUE. (E.) Leber, J. (Dept. Vet. Path., Ohio St. U., Columbus) and D. S. Yohn. *J Virol* 9(2):244-250, 1972.

The paired radioiodine-labeled antibody technique (PRILAT) was employed to measure avian leukosis group-specific (gs) antigens and antibody in Rous sarcoma virus (RSV)-induced tumor and transformed cell lines from hamsters, chickens, turkeys and pigeons. The technique was specific and reproducible, and

proved to be more sensitive than the microcomplement-fixation test for avian leukosis (COFAL) as evidenced by the ability to detect gs antibody in COFAL-negative sera from hamsters bearing RSV-induced tumors. The PRILAT method was used to detect the relative gs content of the various tumor and RSV-transformed cells. These results were confirmed by immunofluorescence and complement fixation tests. Sera from chickens bearing RSV-induced wing web tumors were not positive for gs antibodies; however, sera from pigeons, chickens and turkeys immunized with avian leukosis virus reacted in direct PRILAT inhibition and/or indirect PRILAT tests.

3040 HYBRIDIZATION OF ROUS SARCOMA VIRUS DEOXYRIBONUCLEIC ACID POLYMERASE PRODUCT AND RIBONUCLEIC ACIDS FROM CHICKEN AND RAT CELLS INFECTED WITH ROUS SARCOMA VIRUS. (E.) Coffin, J. M. (McArdle Lab., U. Wisconsin, Madison) and H. M. Temin. *J Virol* 9(5):766-775, 1972.

Rous sarcoma virus (RSV)-specific RNA prelabeled with ³²P in virus-producing chick embryo fibroblasts and non-virus-producing rat embryo fibroblasts infected with RSV was studied by hybridization with the endogenous DNA product of the RSV virion DNA polymerase system. By hybridizing the total DNA product with excess virion RNA, the product DNA was separated into hybridized ("minus") and nonhybridized ("plus") DNA. The "minus" DNA was complementary to at least 20% of the RNA from RSV which remained of high molecular wt. after denaturation. A maximum of approximately 65% hybridization was observed between "minus" DNA and RSV RNA or RSV-infected chick cell RNA. A maximum of about 60% hybridization was measured between "minus" DNA and RSV-infected rat cell RNA. RSV-infected chicken cells contained RSV-specific RNA equivalent to about 6,000 virions per cell. RSV-infected rat cells contained RSV-specific RNA equivalent to approximately 400 virions per cell. Neither cell type contained detectable RNA complementary to virion RNA. The RSV-specific RNA in RSV-infected rat cells did not appear to be qualitatively different from that in RSV-infected chick cells.

3041 VIRUS-INDUCED INTERFERENCE IN HETEROLOGOUSLY INFECTED HeLa CELLS. (E.) Doyle, M. (Dept. Biol., U. California, San Diego, La Jolla) and J. J. Holland. *J Virol* 9(1):22-28, 1972.

The replication of virus and synthesis of viral proteins and nucleic acid were studied in HeLa cells doubly infected with polio-virus type 1 and vesicular stomatitis virus (VSV). Addition of poliovirus to cultures preinfected with VSV, at any time before completion of VSV macromolecular synthesis (up to eight hr post-infection), led to marked inhibition of VSV replication as determined by plaque assay. Replication of poliovirus was apparently unaffected by the presence of VSV. Replication of

poliovirus was not necessary for interference with VSV replication. Superinfection by poliovirus of cells preinfected with VSV shut off incorporation of ^3H -amino acids into VSV-specific proteins within two hr. However, poliovirus had little, if any, direct effect on incorporation of ^3H -uridine into VSV RNA. A decrease in VSV RNA synthesis late in infection in the presence of poliovirus was probably a secondary effect of the earlier inhibition of VSV protein synthesis. Similar experiments using coxsackievirus B₁ showed that it also was able to inhibit VSV replication and protein synthesis in doubly infected cells without affecting VSV RNA synthesis. It is concluded that poliovirus interfered with VSV virion production only at the translational level of viral messenger RNA.

- 3042 ANTIBODIES TO EB VIRUS CAPSID ANTIGEN AND TO SOLUBLE ANTIGEN OF LYMPHOBLASTOID CELLS IN INFECTIOUS MONONUCLEOSIS PATIENTS. (E.) Vonka, V. (Inst. Sera Vaccines, Prague, Czechoslovakia), I. Vlckova, H. Zavadova, K. Kouba, J. Lazovska and J. Duben. *Int J Cancer* 9(3):529-535, 1972.

Sera from infectious mononucleosis (IM) patients aged 2 to 35 yr and from normal subjects aged 11 to 35 yr were examined for the presence of antibody to Epstein-Barr (EB) virus capsid antigen (VCA) by the indirect immunofluorescence test, and for antibody reactive with the soluble (S) antigen of lymphoblastoid cell lines by the complement-fixation test. Sera from all IM patients taken either in the acute stage of the disease or up to nine yr after its onset contained VCA antibody. The sera taken in the acute stage of IM were free of S antibody; out of 97 sera examined only one was weakly reactive. Only one of the seven sera taken 4 to 5 months after the onset of the disease contained S antibody; however, S antibody appeared in the majority of the subjects after the seventh month following onset. These data indicate that the S antibody appears much later in the course of EB virus infection than the VCA antibody. The majority of sera from subjects with no history of the disease possessed VCA antibody; most of these also possessed S antibody. The incidence of S antibody in these people was the same as that in patients who had suffered from IM nine yr previously.

- 3043 ABSENCE OF LEUKOSIS VIRUS MARKERS IN HAMSTER CELLS TRANSFORMED BY HERPES SIMPLEX VIRUS TYPE 2. (E.) Rapp, F. (Milton S. Hershey Med. Ctr., Pennsylvania St. U., Hershey), R. Conner, R. Glaser and R. Duff. *J Virol* 9(6):1059-1063, 1972.

Hamster embryo fibroblasts transformed by UV-inactivated herpes simplex virus type 2 (HSV-2) were tested by various means for the presence or absence of RNA tumor virus information. Medium from HSV-2 transformed cells prelabeled with ^3H -uridine contained no labeled C-type particles which characteristically band in sucrose gradients at 1.16 gm/cm³. Complement fixation and indirect immunofluorescence tests failed to detect

species-specific gs-1 and interspecies gs-3 antigens in all five HSV-2 transformed cell lines whether or not they were exposed to bromodeoxyuridine or iodo-deoxyuridine. Direct electron microscopic observation also failed to show C-type particles, although incomplete herpes-like particles were seen within nuclei and budding from nuclear membranes of a small number of cells. These results are inconsistent with the oncogene theory of cellular transformation and suggest that C-type particles or their genome do not play an obvious role in the maintenance of HSV-2 transformed hamster cells.

- 3044 EARLY STAGES OF ROUS VIRUS ACTION ON SENSITIVE AND RESISTANT CELLS. (E.) Dyadkova, A. M. (N. N. Petrov Res. Inst. Oncology, Leningrad, USSR), O. K. Kuznetsov and G. A. Sovostjyanov. *Neoplasma* 19(3):157-162, 1972.

The course of Rous sarcoma virus (RSV) infection of RSV-sensitive chick embryo cells and of RSV-resistant human embryo cells was studied by electron microscopy and indirect immunofluorescence. Both sensitive and resistant cells incorporated virus particles (by pinocytosis and phagocytosis) to the same extent. By two to three hr post-infection, the number of recognizable virus particles had decreased significantly in sensitive cells. Such a decrease, however, was not apparent in resistant cells. Some virus particles were extruded from resistant cells into the intercellular spaces. The indirect immunofluorescence method revealed that the incidence of viral antigen was greatly reduced in sensitive cultures (5-7% of the cells) after one hr and that viral antigen was undetectable after six hr. Viral antigen was present in 26-63% of the resistant cells after one hr and it did not completely disappear until 72 hr post-infection. It was thus assumed that virus particles in resistant cells remained undamaged for longer periods than those in sensitive cells which rapidly undergo uncoating.

- 3045 THE FORMATION OF VARIANTS WITH A REVERSION OF PROPERTIES OF TRANSFORMED CELLS: VI. STABILITY OF THE REVERTED STATE. (E.) Rabinowitz, Z. (Weizmann Inst. Sci., Rehovoth, Israel) and L. Sachs. *Int J Cancer* 9(2):334-343, 1972.

The stability of the reverted state was analyzed in revertants from polyoma-virus-transformed hamster cells in which reversion was not associated with a loss of the viral genome. The frequency of reversion was studied in 12 cloned revertants after different periods of *in vitro* cultivation. The regaining of two transformed properties, the ability to form colonies at 41 C and in soft agar, were used as markers for reversion. No temperature re-revertants and 2 to 184 agar re-revertants per 5 x 10⁴ cells were detected 45 days after isolation of the clones. At 90 days after isolation, there were 14 to 784 temperature re-revertants and 242 to 1160 agar re-

revertants per 5×10^4 cells. Thus, the stability of the reverted state was decreased by *in vitro* cultivation. A study of the isolated re-revertants indicated that once a transformed property has been regained during re-reversion, the immediate progeny of the re-revertants may contain a high frequency of segregants which had lost this regained property. The re-reverted state was more stable in re-revertants isolated from revertants 100 days after cultivation than in re-revertants from revertants cultured for 55 days. Re-reversion for one transformed property was not necessarily associated with re-reversion for the other transformed property. The different degrees of stability of the reverted state could possibly be explained by differences in the presence of chromosomes responsible for either expression or suppression of the transformed properties.

046 A NON-FUNCTIONAL ARGININE BIOSYNTHETIC PATHWAY IN POLYOMA INFECTED-MOUSE EMBRYO CELLS. (E.) Winters, A. L. (Div. Biol., Kansas State U., Manhattan), R. A. Consigli and Q. R. Rogers. *Biochem Biophys Res Commun* 47(5):1044-1050, 1972.

The arginine biosynthetic pathway was studied in polyoma virus-infected primary mouse embryo cells which showed a strict arginine requirement for viral replication. During viral replication, equimolar concentrations of citrulline substituted for arginine, but equimolar or ten times equimolar concentrations of ornithine did not replace arginine. Amino acid analysis of purified viral preparations prelabeled with either ^{14}C -ornithine or ^{14}C -citrulline showed that citrulline was metabolized to arginine but that ornithine was converted primarily to proline and glutamic acid with no label appearing in arginine. Assay of ornithine carbamoyltransferase (OCT) activity in cell-free lysates showed that this enzyme was not lacking in infected cells. Therefore, the inability of ornithine to serve as an arginine precursor in infected cells appeared to be due to the fact that it was used by ornithine- δ -transaminase to synthesize proline and glutamate rather than by OCT to synthesize citrulline. It is concluded that the arginine biosynthetic pathway is non-functional in polyoma-infected mouse cells.

047 RNA-DEPENDENT DNA POLYMERASE ACTIVITY OF RNA TUMOR VIRUSES: I. DIRECTING INFLUENCE OF DNA IN THE REACTION. (E.) Hurwitz, J. (Albert Einstein Coll. Med., Bronx, N.Y.) and J. P. Leis. *Virology* 9(1):116-129, 1972.

The template requirements and DNA products of the DNA polymerases isolated from Rauscher leukemia and avian myeloblastosis viruses have been examined. All DNA preparations or synthetic polydeoxynucleotides which were active as primers possessed a duplex structure containing single-stranded regions with a 3'-hydroxyl terminus. Native DNA and fully single-stranded DNA

were inactive; moreover, their activity was not enhanced by sonic oscillation or treatment with micrococcal or *Neurospora* nuclease, or by low levels of DNase I. Poor DNA templates were activated by treatment with *E. coli* exonuclease III, large amounts of DNase I, or an endonuclease isolated from Rauscher viral preparations. In reactions primed with deoxyadenylate-deoxythymidylate copolymer, the product formed was covalently attached to primer strands, indicating that no new strands were initiated. DNA polymerase products formed with exonuclease III- or DNase I-treated DNA were duplex structures. Short single-stranded regions were completely repaired, whereas long single-stranded regions were only partly repaired. DNA preparations containing extensive single-stranded regions were poorly utilized as templates.

3048 SYNTHESIS AND ASSEMBLY OF SIMIAN VIRUS 40: I. DIFFERENTIAL SYNTHESIS OF INTACT VIRIONS AND EMPTY SHELLS. (E.) Ozer, H. L. (Nat'l. Cancer Inst., Bethesda, Md.). *J Virology* 9(1):41-51, 1972.

The synthesis and assembly of SV40 in Vero cells was studied. A rapid procedure enabling the purification and separation of radioactively labeled virions and empty shells was developed. ^3H -amino acid-labeled, infected cells were harvested late in infection before gross cytopathic changes occurred. Virus was extracted by sonic treatment and the low-speed supernatant was sedimented through sucrose into a CsCl "cushion". Two radioactive peaks in the CsCl cushion were identified by electron microscopy as intact virions (>90% purity) and empty shells (80-85% purity). Labeled intact virions analyzed by polyacrylamide gel electrophoresis contained four major proteins of 45,000 (I), 23,000 (II), 15,000 (IIIA) and 13,000 (IIIB) daltons. Electrophoretic analysis of empty shells indicated that they contained a relatively decreased amount of peaks IIIA and IIIB. Cells were labeled with ^3H -lysine for periods of 15 minutes to two hours beginning 72 hours post-infection and viral particles were purified and analyzed by electrophoresis. As much as 5-10% of the total acid-precipitable radioactivity was incorporated into viral particles in a two hour label. For all labeling periods, more than 60% of the radioactivity incorporated into viral proteins was associated with the major capsid protein. Predominant labeling of empty shells occurred in short (1-3 hr) pulses while prolonged labeling periods (16-24 hr) routinely resulted in more radioactivity in intact virions. Treatment of cells with cytosine arabinoside late in infection caused a 50% inhibition in the rate of synthesis and/or assembly of intact virions with little change in the rate of appearance of empty shells. It is believed that empty shells are likely heterogeneous in biological origin as well as structure. Evidence from this investigation supports either of two possibilities: (i) that empty shells are synthesized independently of intact virions and (ii) that empty shells result from breakdown of previously synthesized, intact virions. A third possibility - that empty shells are precursors of intact virions - is discussed in a subsequent paper.

- 3049 AN ESTABLISHED RIII MOUSE MAMMARY TUMOR CELL LINE; KINETICS OF MAMMARY TUMOR VIRUS (MTV) PRODUCTION. (E.) Lasfargues, E. Y. (Inst. Med. Res., Camden, N.J.), B. Kramarsky, N. H. Sarkar, J. C. Lasfargues and D. H. Moore. *Proc Soc Exp Biol Med* 139(1):242-247, 1972.

A cell line was established from a soft spontaneous mammary tumor which occurred in an RIII mouse. The cell line, RIII-MT, was epithelial. Thin sections of the cultures prepared at 2-3 month intervals during the three yr of cultivation have consistently shown the presence of intracytoplasmic A-type particles and also B-type particles budding from the cell membrane. C-type particles associated with the leukemia-sarcoma system have not been found. Mammary tumor virus (MTV) antigen was detected in the third lactation milk of 34 out of 42 C57BL female mice inoculated with culture fluids. Several of these animals developed mammary tumors; none developed leukemia. Inoculation of 4×10^6 RIII-MT cells into newborn RIII mice resulted in infiltrating carcinomas at the site of injection. The MTV produced at the cell surface of RIII-MT cells was not spontaneously released. Harvest of the virions was obtained by cell dispersion with trypsin followed by storage for seven days at 4 C. After refrigeration, the virus retained its full infectivity.

- 3050 PROTEINS SPECIFIED BY HERPES SIMPLEX VIRUS: V. PURIFICATION AND STRUCTURAL PROTEINS OF THE HERPESVIRION. (E.) Spear, P. G. (Dept. Microbiol., U. Chicago, Illinois) and B. Roizman. *J Virol* 9(1):143-159, 1972.

Herpes simplex virus was purified from infected human epidermal carcinoma no. 2 (HEp-2) cells. Cells were disrupted and the cytoplasm was separated from the nuclei. The cytoplasmic extract was subjected to rate zonal centrifugation on dextran 10 gradients to separate virions from soluble proteins. The virions were further purified by centrifugation through discontinuous sucrose gradients. Virion proteins were purified 120 to 200-fold with respect to cellular proteins. Residual contaminants were identified as host cell and viral constituents of membrane vesicles. Evidence suggested that the contaminating host proteins were not structural components of the virion. Analysis of purified virion preparations by polyacrylamide gel electrophoresis revealed 24 protein and glycoprotein bands. The glycoproteins, identified by their ability to incorporate ^{14}C -glucosamine, were selectively lost during the isolation procedure. Electrophoretic comparison of these ^{14}C -labeled glycoproteins with glycoproteins from uninfected cells and purified virions suggested that they were present both in contaminating membrane fragments and in the virion. The average molecular wt of the viral proteins as determined by polyacrylamide gel electrophoresis ranged from 25,000 to 275,000 daltons. The sum of the molecular wt of viral proteins was 2,580,000 daltons. This corresponded to 47% of the genetic information of the virus. Treatment of purified virions with the non-ionic detergent NP-40 removed some of the nonglycosy-

lated and many of the glycosylated proteins. Although NP-40 destroyed the normal morphology of the virion envelope, it did leave behind traces of the envelope visible in the electron microscope as well as some glycoproteins thought to be components of the envelope.

- 3051 IMMUNOELECTROPHORETIC ANALYSIS OF AVIAN RIBONUCLEIC ACID TUMOR VIRUS GROUP-SPECIFIC ANTIGENS. (E.) Bonar, R. A. (Duke U. Med. Ctr., Durham, North Carolina), R. Ishizaki and J. W. Beard. *J Virol* 9(1):90-95, 1972.

Fifteen pigeons inoculated with the Schmidt-Ruppin strain of Rous sarcoma virus (SR-RSV) developed tumors. In all 13 surviving birds, the tumors began to regress about six wk after inoculation. Sera from these pigeons, taken eight wk after inoculation, had complement-fixing group-specific antibody titers of 1:2 to 1:256. Immunoelectrophoresis of disrupted BAI strain A (myeloblastosis) avian tumor virus with pigeon serum showed at least five precipitation arcs. The pattern of precipitation lines was dependent in part on the means used for virus disruption, and ethyl ether and nonionic detergents appeared to be both effective and relatively mild reagents. Immunoelectrophoretic comparison of pigeon serum with serum from a tumor-bearing hamster and that from virus-inoculated rabbits yielded very similar, although not identical, results.

- 3052 GENETICALLY STABLE REASSORTMENT OF MARKERS DURING MIXED INFECTION WITH AVIAN TUMOR VIRUSES. (E.) Vogt, P. K. (U. Washington Sch. Med., Seattle). *Virology* 46(3):947-952, 1971.

The cloning experiments described indicate that mixed infections with certain pairs of Rous sarcoma virus (RSV) and avian leukosis viruses (RAV) give rise to stable combination forms which carry the host range marker of the leukosis virus and the transformation marker of RSV. These agents may be regarded either as avian leukosis viruses which have acquired the ability to transform, or as RSV which has exchanged its host range marker for that of a leukosis virus. The reciprocal combination form would be an avian leukosis virus with the host range of RSV. The evidence presented against phenotypic mixing is not conclusive, even though the absence of excess RAV from recombinant clones was repeatedly confirmed.

- 3053 HYBRIDIZATION OF BURKITT LYMPHOBLASTOID CELLS. (E.) Glaser, R. (Milton S. Hershey Med. Ctr., Pennsylvania St. U., Hershey) and F. J. O'Neill. *Science* 176(4040):1245-1247, 1972.

Burkitt lymphoblastoid cell lines EB₃ (containing Epstein-Barr virus (EBV) antigens in 1-4% of the cells) and P3J-HR1 (containing EBV antigens in <10% of the

cells) were fused to mouse LM(TK⁻) CLID cells and human sternal marrow D98/AH-2 cells, resp., with the use of inactivated Sendai virus. Clones from both hybrids (EB₂/CLID and D98/HRL) were able to grow in selective medium (Eagle's or F-12 supplemented with fetal calf serum, hypoxanthine, aminopterin and thymidine) although both the parental mouse and human marrow lines could not. Analysis of metaphases for each hybrid line showed a modal number of 52 to 53 for EB₂/CLID cells and 100 to 108 for D98/HRL cells; these values confirm that the lines are hybrids. Although indirect immunofluorescence studies were unable to detect EBV antigens in either hybrid line, initial observations revealed that 5'-iododeoxyuridine could induce the synthesis of EBV antigens. No virus particles were found in the cells by electron microscopy.

054 THE OCCURRENCE OF SV40-NEUTRALIZING ANTIBODIES IN SERA OF PATIENTS WITH GENITOURINARY CARCINOMA. (E.) Shah, K. V. (Johns Hopkins U., Sch. Hyg. Public Hlth., Baltimore, Md.), L. D. Palma and J. P. Murphy. *J Surg Oncol* 3(4):443-450, 1971.

Neutralizing antibodies to SV40 were detected in sera from seven of 182 patients studied at the Roswell Park Memorial Institute. Four of 91 (4.4%) bladder tumor patients, two of 24 (8.3%) patients with prostatic carcinoma, and one of four patients with testicular tumors had antibodies. Neutralizing antibodies were demonstrable in repeated bleedings over a 5 to 1 month period. Antibodies against SV40 T-antigen were not detected in any of the sera. None of the antibody-positive patients gave a history of immunization with polio-virus vaccines (a source of major human exposure to SV40 in the U.S. due to contamination). These findings suggest that the seven antibody-positive donors were infected with a virus cross-reacting with SV40 or that infection with SV40 may have occurred in some unknown manner.

055 MUTATION CAUSING TEMPERATURE-SENSITIVE EXPRESSION OF CELL TRANSFORMATION BY A TUMOR VIRUS. (E.) Renger, H. C. (New York U. Sch. Med., N.Y.) and C. Basilio. *Proc Nat Acad Sci* 69(1):109-114, 1972.

Several SV-40 transformed mouse 3T3 cell lines were isolated and characterized according to temperature sensitivity and *in vitro* growth characteristics. All transformant characteristics were expressed at 22°C but not at 39°C. Transformed lines grew at 22°C but not at 39°C as multilayers, reached higher saturation densities, had higher cloning efficiencies and grew faster in gamma-globulin-free medium than did transformants at 39°C. T-antigen synthesis occurred in all transformed lines at either temperature. Confluent transformed cells continued to incorporate ³H-thymidine at 32°C but not at 39°C. Inhibition of DNA synthesis at the higher temperature could be reversed by transferring the cultures to the lower temperature. No significant change in chromo-

some number was noted in the temperature-sensitive transformants. Viruses rescued from all infected lines did not differ in growth characteristics or in transforming ability. It thus appeared that the mutants described were host-cell rather than virus mutants.

3056 VIRUS-LIKE PARTICLES IN HUMAN BREAST CANCER AND CHRONIC CYSTIC MASTITIS. (Ger.)

Thomssen, R. (Inst. Hyg., Gottingen U., Germany), G. Bandlow and P. Stankovic. *Deut Med Wochenschr* 97(7):219-221, 1972.

Electron microscope examination of nine human breast carcinomas and of biopsy material from two cases of chronic cystic mastopathy revealed the presence of pleomorphic virus-like particles in four of the nine breast tumors and in both cases of cystic mastopathy. These particles (average size 110 mμ) with knobby spikes of membrane had a strong structural resemblance to type B particles found in mammary carcinomas of mice, milk from tumor-bearing mice, and some human milk. Inoculation of the material into embryonated chick eggs and monkey kidney tissue cultures gave negative results.

3057 STRUCTURAL STUDIES ON THE ADENOVIRUS

HEXON. (E.) Franklin, R. M. (Public Hlth. Res. Inst. City New York, N.Y.), S. C. Harrison, U. Pettersson, L. Philipson, C. I. Branden and P.-E. Werner. *Cold Spring Harbor Symp Quant Biol* 36:503-510, 1971.

Physical and chemical properties of the adenovirus type 2 (Ad-2) hexon, the major morphological unit of the virus particle, were studied. The molecular wt of the hexon was estimated by sedimentation and diffusion, sedimentation equilibrium, and by crystallographic parameters to be between 313,000 and 396,000. Analysis of tryptic peptides indicated that the hexon was composed of six identical polypeptides of molecular wt 50,000 to 65,000 daltons. X-ray analysis of crystallized Ad-2 hexon suggested that there were four hexons per unit cell and that each hexon was composed of three asymmetric units. Therefore, the hexon probably had threefold symmetry, and the hexon cylinder axis was concluded to be located along the cube body diagonals. Three-dimensional data collected by photographic methods at 10 Å resolution showed no evidence for a non-crystallographic dyad parallel to the threefold axis. Ultrastructural studies on groups of nine hexons suggested that the hexon must be a polar oligomer and emphasized that the perpendicular dyad of the hexon must be interpreted with caution. Therefore, it could not be concluded that the hexon possessed strict D₃ symmetry.

3058 REVERSION OF MURINE SARCOMA VIRUS TRANSFORMED MOUSE CELLS: VARIANTS WITHOUT A RESCUABLE SARCOMA VIRUS. (E.) Fischinger, P. J. (Natl. Cancer

Inst., Bethesda, Md.), S. Nomura, P. T. Peebles, D. K. Haapala and R. H. Bassin. *Science* 176(4038):1033-1035, 1972.

Extended cultivation of single colonies of murine sarcoma virus (MSV)-transformed mouse 3T3 cells ($S^{+}L^{-}$), which were negative for murine leukemia virus (MuLV) and which yielded sarcoma virus after superinfection with MuLV, resulted in the formation of spontaneous flat revertants from which MSV could no longer be rescued. The revertants were able to support MuLV growth and showed an enhanced sensitivity to MSV superinfection. Like normal cells, the flat revertants did not release RNA-dependent DNA polymerase activity into the supernatant fluid, nor did they have any detectable C-type particles. Because revertants could be obtained with high frequency from progeny of single transformed cells, each cell that contained the MSV genome seemed to have the capacity to suppress or eliminate an RNA tumor virus native to its species of origin.

- 3059 RIBONUCLEOTIDE REDUCTASE ACTIVITY OF SYNCHRONIZED KB CELLS INFECTED WITH HERPES SIMPLEX VIRUS. (E.) Cohen, G. H. (Ctr. Oral Hlth. Res., U. Pennsylvania, Philadelphia). *J Virol* 9(3):408-418, 1972.

The rate of DNA synthesis, and activity of ribonucleotide reductase were determined in uninfected and herpes simplex virus (HSV)-infected KB cells synchronized by the double thymidine (TdR) block method. Whereas uninfected cells incorporated ^{14}C -hypoxanthine into DNA only after removal of the TdR block, DNA synthesis in infected KB cells continued whether or not excess TdR was present. CsCl buoyant density centrifugation indicated that excess TdR had no effect on viral DNA synthesis, which accounted for approximately 50% of the incorporation of precursor into acid insoluble material whether or not TdR was present. These results suggest that a normal round of viral DNA synthesis took place under conditions sufficient to inhibit cellular DNA synthesis in uninfected cells. Since relatively more cellular DNA was synthesized in infected TdR-blocked cells, the event which relieved the TdR block was not specific for viral DNA synthesis. Excess TdR also did not inhibit virus replication in infected cells. Assay of TdR blocked uninfected and infected KB cells for ribonucleotide reductase activity showed that enzyme activity was stimulated two-fold by three hr after HSV infection. Reductase activity in extracts from infected cells was less sensitive to inhibition by exogenous TTP than enzyme activity in uninfected cells and functioned at 60% capacity even in the presence of 2 mM TTP. These results support the idea that a viral induced ribonucleotide reductase is present in HSV infected KB cells and that this enzyme is relatively insensitive to inhibition by exogenous TTP.

- 3060 ISOLATION OF SIMIAN VIRUS 40 RECOMBINANTS FROM CELLS INFECTED WITH OLIGOMERIC FORMS OF SIMIAN VIRUS 40 DEOXYRIBONUCLEIC ACID. (E.)

Dubbs, D. R. (Baylor Coll. Med., Houston, Tex.), S. Kit, R. Jaenisch and A. J. Levine. *J Virol* 9(4):717-719, 1972.

Secondary cultures of African green monkey kidney cells (CV-1) were simultaneously infected with two plaque morphology mutants SV40, mKS-U4 (produces fuzzy plaques) and 3T3-4-88J3 (produces clear plaques). The newly synthesized SV40 DNA was isolated, and monomers (A-I), dimers (A-II) and a higher oligomer fraction (trimers-hexamers) (A-III) were purified on alkaline sucrose gradients. These fractions were then assayed for infectivity and plaque morphology. Both small clear- and fuzzy-plaque mutants were obtained from 17-40% of the individual plaques produced by the A-I and A-II fractions, as well as with SV40 DNA monomers or dimers mixed *in vitro*. It is concluded that the cells were probably infected with more than one DNA molecule. Because of the high incidence of mixed plaques after infection with the A-I fraction or from mixed monomers or dimers, a definitive conclusion concerning the origin of SV40 dimers and oligomers was not possible. An unexpected finding was the production of large clear plaques by infection of CV-1 cells with the A-III oligomer fraction. Results suggest that this plaque-type is a stable recombinant and not simply a revertant of the fuzzy- or small-clear-plaque-type virus.

- 3061 HERPESVIRUSES IN TUMORS OF POSTSPAWNING *RANA PIPIENS*. (E.) McKinnell, R. G. (Dept. Zoology, U. Minnesota, Minneapolis) and V. L. Ellis. *Cancer Res* 32:1154-1159, 1972.

Renal adenocarcinomas from six tumor-bearing frogs collected in rural Minnesota during the spring were examined for herpesvirus by electron microscopy. All six renal tumors of *R. pipiens* contained mature herpesvirus 42 days after spawning. Sloughed, lytic tumor cells seen in the lumina of tumor tubules contained viruses in various stages of maturation. Tumor cells showed no virus particles, and this suggested that the tumors were in transition from a stage of active virus production (winter or algid type) to a stage of no virus production (summer or calid type). The enhanced susceptibility of eggs and early embryos to tumor induction by virus suggest that active herpesvirus production at this stage of the life cycle may play an etiological role.

- 3062 PRODUCTION OF INFECTIVE EPSTEIN-BARR VIRUS IN A BURKITT LYMPHOMA CELL LINE, P3HR-1. (E.) Nagoya, T. (Kumamoto U. Med. Sch., Japan) and Y. Hinuma. *Gann* 63(1):87-93, 1972.

Production of infective Epstein-Barr virus (EB) virus in the culture medium of a Burkitt lymphoma cell line, P3HR-1, was examined. Infectivity of the EB virus produced in the P3HR-1 cultures was determined by measuring synthesis of a new non-virion antigen (N-antigen) in a clonal line (C-6) of human hemato-

oietic cells. The percentage of N-antigen-forming cells, detected by an indirect immunofluorescence method, was proportional to the inoculated dose of virus. The quantity of infective EB virus produced by 3HR-1 cells was greater at 33 C than at 37 C. The mounts produced were also higher in low density than in high density cultures. The yield of infective virus from P3HR-1 cultures was proportional to the number of virion antigen-bearing cells in the culture. Infectivity of EB virus was most stable with storage at -80 C. Infectivity was relatively stable at 4 C and was poor at -20, 33 and 37 C. Infectivity decayed most rapidly at 37 C with a half-life of about three days.

063 ANALYSIS OF SIMIAN VIRUS 40-INDUCED TRANSFORMATION OF HAMSTER KIDNEY TISSUE *IN VITRO*: III. INDUCTION OF INFECTIOUS SIMIAN VIRUS 40 FROM VIROGENIC TRANSFORMED HAMSTER CELLS BY AMINO ACID DEPRIVATION OR CYCLOHEXIMIDE TREATMENT. (E.) Kaplan, J. C. (Harvard Med. Sch., Boston, Mass.), J. M. Wilbert and P. H. Black. *J Virol* 9(3):448-453, 1972.

Clones of virogenic SV-40-transformed hamster kidney cells (T8-AP1) were grown for varying lengths of time in medium deficient in the essential amino acids, leucine, arginine or methionine. Infectious virus, determined by plaque assay, was induced after deprivation periods of from 24 to 32 hr. The highest yields of infectious virus were obtained from cultures derived for three to four days. Infectious virus could also be induced by treatment of cell monolayers with cycloheximide. Maximum virus yields were obtained with exposure for 16 and 24 hr periods at 10 µg/ml. Under these conditions, protein synthesis and DNA synthesis were inhibited from 77 to 85% and 70 to 92%, respectively, as determined by the rate of incorporation of radiolabeled precursors. It is suggested that inhibition of protein synthesis by either amino acid deprivation or by cycloheximide is responsible for the induction of infectious SV40 from virogenic cells. It is postulated that the inhibition of protein synthesis produced virus induction by causing a temporary inhibition of DNA synthesis.

064 CO-INFECTION OF MOUSE SPLEEN CELLS WITH MURINE SARCOMA VIRUS AND GUAROA VIRUS. (E.) Woods, W. A. (Natl. Cancer Inst., Bethesda, Md.), W. Turner and M. A. Chirigos. *Appl Microbiol* 3(2):372-376, 1972.

Enhancement of tumor induction by oncornaviruses through a dual viral infection has been described by several investigators. The mechanism of this enhancement was investigated. Spleen cell cultures, derived from BALB/c mice inoculated with murine sarcoma virus-Moloney strain (MSV-M) 7-21 days prior to culture, were inoculated with the Bunyawera group virus, Guaroa virus (GV). The progeny viruses were titrated in both Vero and secondary mouse embryo cells. In mouse embryo cells, low dilutions of the

tissue culture fluid from GV-infected MSV-M spleen cultures produced progressive lytic cytopathic effects. Higher dilutions produced typical MSV-M foci. In contrast, parental GV inefficiently and erratically produced lysis in mouse embryo cells, and parental MSV-M produced only typical foci of transformed cells. The focus-forming titer was higher in dually infected cultures than in control MSV-M-infected cultures. The lytic effect was neutralized only by a mixture of GV and MSV-M antisera; the foci were neutralized only by anti-MSV-M. Progeny of dually infected cultures initially produced only the large parental GV plaque type on Vero cells; however, after seven days, co-infected cultures also contained virus producing minute plaques. Both plaque types were neutralized only by anti-GV serum. It is concluded that GV was at least phenotypically modified by passage in spleen cells co-infected with MSV-M. Further, MSV-M production was stimulated by co-infection with GV.

3065 STUDIES ON MURINE SARCOMA VIRUS: III. SYNTHESIS OF THE VIRAL ANTIGENS IN CELLS OF VARIOUS SPECIES. (E.) Chuat, J. C. (Saint-Louis Hosp, Paris, France), C. Bernard, F. Lasquellec, P. Tchen and M. Boiron. *Proc Soc Exp Biol Med* 139(3):1071-1077, 1972.

The synthesis of murine tumor virus group-specific (GS) and virus envelope (V) antigens following infection of mouse, rat, hamster, chicken, and human cells with mouse sarcoma virus, Moloney strain, was studied by immunofluorescence. The two antigens were detected in mouse embryo cells as early as 12-15 hr post-infection (PI) reaching maximal levels at 24-48 hr. An early cytopathic effect (CPE) involving the whole monolayer was consistently present after 24 hr, although only a fraction of the cells were actively synthesizing viral antigens at this time. Identical results, except for cellular alterations, were obtained after infection of rat embryo cells. Chicken and hamster cells remained totally negative with respect to GS and V antigens. Infection of human diploid cell lines resulted in the appearance of murine GS and V antigens and CPE ten days PI. The proportion of antigen-containing cells were observed to decrease in consecutive subcultures.

3066 INDUCTION OF MALIGNANT MELANOMAS ASSOCIATED WITH FIBROSARCOMAS IN GNOTOBIOTIC CATS INOCULATED WITH GARDNER-FELINE FIBROSARCOMA VIRUS. (E.) McCullough, B. (Dept. Vet. Path., Ohio St. U., Columbus), J. Schaller, J. A. Shaddock and D. S. Yohn. *J Nat Cancer Inst* 48(6):1893-1896, 1972.

Gnotobiotic kittens were injected i.m. or s.c. as neonates with concentrated preparations of the Gardner strain of feline fibrosarcoma virus (G-FeSV) propagated in tissue culture. Palpable tumors developed at the site of injection within 21-45 days (s.c.) or 90 days (i.m.). All tumors became pigmented within six wk after their initial appearance. Tumors

invaded the intercostal muscles, diaphragm, pericardium, and mediastinum or metastasized to skin and regional lymph nodes of some animals. Histologically, the primary neoplasms were composed of melanocytic and fibroblastic elements. Neoplastic cells were concentrated within the dermis but extended into the epidermis and subcutis. The metastatic skin nodules appeared similar to the primary tumors, whereas the noncutaneous metastases appeared similar to the fibroblastic areas. All five tumor homogenates tested contained detectable titers of gs-3 antigen.

- 3067 RELATIONSHIP BETWEEN ORGANIZATION OF MAMMARY TUMORS AND THE ABILITY OF TUMOR CELLS TO REPLICATE MAMMARY TUMOR VIRUS AND TO RECOGNIZE GROWTH-INHIBITORY CONTACT SIGNALS *IN VITRO*. (E.) McGrath, C. M. (Dept. Zoology, U. California, Berkeley), S. Nandi and L. Young. *J Virol* 9(2):367-376, 1972.

The relationship between mouse mammary tumor organization, organization of cultured mammary tumor cells, and replication of mammary tumor virus (MTV) was studied. MTV replication, shown by electron microscopic techniques, was confined primarily to cells organized as acini in intact mouse mammary glands. Primary mammary tumors maintained a high degree of acinar organization and cells therein continued to replicate MTV. Nonacinar mammary cells, derived by serial transplantation of acinar cells, no longer actively replicated MTV. This suggests that phenotypic differences exist among mammary epithelial cells in their ability to support virus replication, that a fundamental relationship exists between the organization of epithelium for secretion and active virus replication, and that this relationship is not altered as a primary consequence of neoplastic transformation. Mammary epithelial cells from pregnant, nontumor-bearing MTV-infected BALB/cfc3H mice, or from acinar mammary tumors from a number of mouse strains grown in culture under the influence of insulin or cortisol exhibited the ability to organize into discrete three-dimensional structures called "domes". MTV replication, determined by radioassay and indirect immunofluorescence, took place primarily in cells within these domes. Cells cultured from nonacinar tumors did not tend to organize into domes nor did they replicate MTV in primary culture. These results suggest that the cell organizational requirement for MTV replication observed *in vivo* is conserved in primary culture. Dome formation was not a result of virus replication, as uninfected BALB/c cells formed domes without MTV replication. Contact-dependent growth-regulatory signals (estimated from the saturation density of the culture) in non-MTV infected mammary epithelium cultures were not altered by virus active replication nor as a direct consequence of neoplastic transformation. Cells derived from nontumor BALB/cfc3H glands and from spontaneous tumors exhibited cell growth kinetics, saturation densities and DNA synthesis rates nearly identical to those of noninfected normal mammary epithelium in primary culture. Cultured nonalveolar tumor cells grew to higher-than-normal cell densities indicating altered growth regulatory signals.

- 3068 TRANSLATION OF AVIAN MYELOBLASTOSIS VIRUS RNA IN A CELL-FREE LYSATE OF *ESCHERICHIA COLI*. (E.) Siegert, W. (Max-Planck-Inst. Biochem., Munich, W. Germany), R. N. H. Konings, H. Bauer and P. H. Hofschneider. *Proc Nat Acad Sci USA* 69(4):888-891, 1972.

The messenger functions of purified avian myeloblastosis virus (AMV) RNA were examined in a cell-free system using an extract of *E. coli*. AMV-RNA stimulated ^{14}C -labeled amino acid incorporation into acid insoluble material to an extent ranging up to 20% of the incorporation obtained under the direction of homologous phage M12 messenger RNA. Polyacrylamide gel electrophoresis and double immunodiffusion in agar gel, combined with autoradiography, showed that one AMV-RNA directed protein was antigenically identical to the group-specific antigen 4, and that three other proteins corresponded in molecular wt to group-specific antigens 1-3.

- 3069 RAT C-TYPE VIRUS (BV-1): EFFECT OF AMNIOTIC FLUID, FETAL SERUM, AND HORMONES IN CELL CULTURE. (E.) Bergs, V. V. (U. Miami Sch. Med., Florida). *Proc Soc Exp Biol Med* 140(1):102-105, 1972.

The possible effects of bovine amniotic fluid (BAF), fetal calf serum (FCS), estrogen, and progesterone on the growth and cytopathic effect (CPE) of BV-1, a C-type virus isolated from a DMBA-induced rat mammary carcinoma, was studied in Wistar-Furth rat embryo cell cultures. BAF (30%) and FCS (10%) protected rat cell cultures from BV-1-induced CPE. Whereas the entire cell sheet of infected control cultures showed CPE by day 7-10, only 50% of the cells in cultures treated with BAF or FCS were affected. At the same time, higher titers of infectious BV-1 were produced as early as two days post-infection in cultures maintained on medium supplemented with BAF or FCS as compared to cultures on medium supplemented with newborn calf serum. A similar stimulatory effect on the growth of BV-1 in these cultures was exerted by 95% natural estrogen. The effect was dose-dependent with concentrations between 1.0 and 2.5 $\mu\text{g/ml}$ being the most effective. Progesterone had no stimulatory effect on the replication of BV-1 and appeared to be suppressive at higher dose levels.

- 3070 A TRANSPLANTABLE LEUKEMIA FROM MICE INOCULATED WITH RAUSCHER LEUKEMIA VIRUS. (E.) Fredrickson, T. N. (Dept. Animal Dis., U. Connecticut, Storrs), J. LoBue, P. A. Alexander, Jr., E. F. Schultz and A. S. Gordon. *J Nat Cancer Inst* 48(6):1597-1605, 1972.

Rauscher leukemia virus (RLV) was given in serial log dilutions from undiluted to 10^{-8} , either i.p. or i.m., to male and female newborn and weanling BALB/c mice. Extremely high dilutions (10^{-1} or undiluted virus), given i.p., caused early mortality and splenic destruction. Relatively high dilutions (10^{-2} and 10^{-3} i.m. and 10^{-3} i.p.) of RLV induced chronic leukemia in

reated mice, which were characterized by wasting, anemia, large numbers of erythroid and/or myeloid precursors in the peripheral blood, splenomegaly and hepatomegaly. There was no lymphoproliferative involvement of the lymph nodes, thymus, or splenic white pulp. Thus induction of myelogenous leukemia appears to be part of the oncogenic spectrum of RLV. Successful isogenic transplantation of leukemic cells in four series by i.v. inoculation of recipients illustrated the truly neoplastic nature of the chronic disease. Plasma derived from mice bearing the transplantable leukemia induced a chronic disease in BALB/c mice involving erythroid precursors.

71 FBJ VIRUS-INDUCED TUMOURS IN MICE: A HISTOPATHOLOGICAL STUDY OF FBJ VIRUS TUMOURS AND THEIR RELEVANCE TO MURINE AND HUMAN OSTEOSARCOMA ARISING IN BONE. (E.) Price, C. H. G. (U. Bristol, England), M. Moore and D. B. Jones. *Brit J Cancer* 26(1):15-27, 1972.

born inbred CBAT6T6 mice were either injected i.m. with an FBJ virus-containing Moloney procedure concentrate from a CFI mouse osteosarcoma, or were injected i.p. with a cell-free extract prepared from transplant of the osteosarcoma (FBJ7). Nine of the mice injected i.m. and five of seven mice injected i.p. developed tumors. Tumors in i.m.-injected mice appeared between 27 and 48 days after inoculation and were located at or near the injection site. Tumors in i.p.-injected mice had relatively longer latent periods and were found in the regions of the lumbar spine, ribs, and sternum, and occasionally consisted of more than one discrete nodule. All tumors grew progressively on s.c. implantation in syngeneic hosts with slow invasion of surrounding soft tissue and muscle, but no metastases were seen. Twelve primary and first generation transplants were examined microscopically. Except for two periosteal fibro-spindle-cell sarcomata and two other tumors, all lesions were similar showing a loosely textured pattern of scattered pleomorphic cells. A few tumors contained areas where hyaline matrix suggested ill-formed primitive cartilage or chondrosteoid, but the related cells retained their undifferentiated appearance. In several tumors tiny islets of well-formed mature large cartilage were found. Some foci were undergoing ossification. However, no tumors showed convincing evidence that the cells were able to produce osteoid directly, and all matrix other than collagen appeared to be due to metaplasia or maturation. Thus, in definition, no tumor was acceptable as a conventional osteosarcoma. The FBJ fibrosarcomata differed on several criteria from spontaneous and Sr90-induced murine osteosarcomas and from human osteosarcomas.

72 SEPARATION OF TWO TYPES OF ADENO-ASSOCIATED VIRUS PARTICLES CONTAINING COMPLEMENTARY DEOXYNUCLEOTIDE CHAINS. (E.) Berns, K. I. (Johns Hopkins U. Sch. Med., Baltimore, Md.) and S. Adler. *Virology* 9(2):394-396, 1972.

Adeno-associated virus (AAV2H) DNA from virus grown in KB cells coinfecting with adenovirus type 2 as helper was radiolabeled with ^{32}P and density labeled with BUDR. Purified ^{32}P -BUDR-substituted AAV was fractionated by CsCl equilibrium centrifugation. Two classes of AAV particles differing in density by 6 mg/cm³ were isolated. Buoyant density centrifugation of purified DNA from the light and heavy bands showed that 80% of the particles in the heavy virus preparation contained the heavy single DNA strand and 75 to 90% of the DNA from the light particle preparation was of the light single-strand type.

3073 COMPARISON OF SOME REACTIONS CATALYZED BY DEOXYRIBONUCLEIC ACID POLYMERASE FROM AVIAN MYELOBLASTOSIS VIRUS, *ESCHERICHIA COLI*, AND *MICROCOCOCCUS LUTEUS*. (E.) Wells, R. D. (Coll. Agric. Life Sci., U. Wisconsin, Madison), R. M. Flügel, J. E. Larson, P. F. Schendel and R. W. Sweet. *Biochemistry* 11(4):621-629, 1972.

A comparative study was performed on the template specificities of the highly purified DNA polymerases from *Escherichia coli* and *Micrococcus luteus* and of a partially purified DNA polymerase from virions of avian myeloblastosis virus (AMV). The three DNA polymerases show approximately the same capacity to utilize twenty different high molecular weight templates. Thus, when tested with polymer templates (primers), the two bacterial DNA polymerases are at least as effective "reverse transcriptases" as the tumor virus associated DNA polymerase. However, (rA)_n·oligo(dT) is a markedly better template than (dA)_n·oligo(dT) for the AMV DNA polymerase, as reported previously. For the *M. luteus* DNA polymerase, the two templates are approximately equally effective. The AMV DNA polymerase provides faithful DNA synthesis when either DNAs or RNAs serve as templates (primers). DNA synthesis is dependent on the presence of a suitable primer strand and the newly synthesized DNA strand is covalently attached to the primer strand through a phosphodiester linkage. Thus, when a polyribonucleotide serves as a primer, the new DNA strand is joined to an RNA molecule. The AMV DNA polymerase apparently cannot initiate the synthesis of a new DNA strand. This behavior is identical with that observed for the two bacterial DNA polymerases.

3074 HYBRIDIZATION CHARACTERISTICS OF COMPLEMENTARY RNAs GENERATED ON MURINE MYELOMA DNA TEMPLATES. (E.) Gottlieb, A. A. (Inst. Microbiol., Rutgers U., New Brunswick, N.J.) and D. N. Tenney. *J Nat Cancer Inst* 48(5):1457-1462, 1972.

Complementary RNAs (c-RNAs) to DNA templates were produced by addition of *E. coli* sigma-containing RNA polymerase to native MAK-purified DNA templates from murine myelomas MOPC-21 and Adj-PC-5. c-RNAs were then annealed to each tumor DNA template at a temperature 16.5 C below the melting temperature of the tumor

DNAs. Under these conditions, specific hybrids were formed which had a high cytosine-guanine and a low adenine-thymine content and which had a sharp melting point. The percentage of each myeloma DNA annealed with c-RNA from the Adj-PC-5 or MOPC-21 tumors at saturation was essentially similar. c-RNA from either tumor could discriminate between tumor DNA, mouse liver DNA, and calf-thymus DNA. Although a number of the mouse liver DNA sequences were probably represented in both tumor DNAs, neither of the tumor DNAs exhibited preferential binding to mouse liver c-RNA. These observations were also supported by results of experiments in which unlabeled c-RNAs derived from each DNA were used in reciprocal competition experiments with prelabeled c-RNAs generated on these templates.

- 3075 COMPONENT OF STRAIN MC29 AVIAN LEUKOSIS VIRUS WITH THE PROPERTY OF DEFECTIVENESS. (E.) Ishizaki, R. (Duke U. Med Ctr., Durham, North Carolina), A. J. Langlois, J. Chabot and J. W. Beard. *J Virol* 8(6):821-827, 1971.

Three clones of morphologically altered cells (L-MC29) of singular properties were isolated from MC29 (subgroup A) leukosis virus-infected chick embryo cells. Supernatant fluids from cultures of the cloned cells produced no transforming or interfering activity on chick embryo cells susceptible to known avian leukosis-sarcoma viruses. No virus associated with the cells was demonstrable by fluorescent-antibody staining or by electron microscopy. All L-MC29 clone cells were activated, however, by four strains of Rous-associated viruses (RAV) representative of A, B, C, and D subgroup avian leukosis viruses and by two strains of MC29 virus. Virus L-MC29 cells activated by superinfection with RAV-1 and RAV-2 were characterized by helper-dependent and helper-independent properties. These findings suggest that the strain MC29 leukosis virus, or a component thereof, possessed properties of defectiveness similar to those of the Bryan high-titer Rous sarcoma virus.

- 3076 CLONAL ASPECTS OF THE C-TYPE VIRUS RELEASING CELLS OF A CULTURED HUMAN RHABDOMYOSARCOMA LINE (RD 114) *IN VITRO*. (E.) Nelson-Rees, W. A. (U. California, Sch. Public Hlth., Oakland), R. M. McAllister and M. B. Gardner. *Nature New Biol* 236 (66):147-149, 1972.

Chromosome studies were conducted on the RD114 rhabdomyosarcoma line which was formed by the direct outgrowth of cells from a solitary tumor taken from the cerebellum of a kitten which had been inoculated *in utero* with cultured human rhabdomyosarcoma cells (RD line no. 2). This tumor and the RD114 cell line derived from it contained C-type particles. Metaphase cells from the RD114 cell line contained a small ring marker chromosome which was present in 78% of passage 21 cells, in 72% of passage three, and in 10% of the parental RD no. 2 cells used in the original inoculum. It was felt that some of the chromosome fragments observed

in early passage of RD no. 2 cells were actually the ring marker chromosome. It was also felt that this chromosome may have arisen as a result of X-irradiation of the patient prior to the biopsy used to initiate the RD no. 2 line, as the RD no. 1 line, initiated prior to radiation treatment, did not contain it. The blood-brain barrier, the "immunologically privileged" position of the brain and the corresponding fact that brain metastases are rare suggested that the formation of the kitten brain tumor was initiated by a single cell or a small number of chromosomally similar cells.

- 3077 FURTHER CHARACTERIZATION OF LIVER CATALASE-DEPRESSING FACTOR FROM SPLEENS OF FRIEND VIRUS-INFECTED GERM-FREE AND CONVENTIONAL MICE. (E.) Price, F. W. (Dept. Biol., St. U. Coll., Buffalo, N.Y.) and E. A. Mirand. *J Surg Oncol* 3(1):17-23, 1971.

The activity of a liver catalase-depressing factor (LCDF) extracted from spleen was studied in Friend virus-infected male Ha/ICR Swiss mice. The spleen extracts were assayed *in vitro* for LCDF using a liver homogenate from healthy mice as a source of enzyme. Mice were splenectomized on the seventh day postinfection and the subsequent effect on liver catalase activity was determined. Whereas the liver catalase activity of splenectomized infected mice returned to near-normal values about two wk after removal of the spleens, the mean liver catalase activity of the nonsplenectomized FV-infected groups was consistently lower than that of the corresponding healthy group. These results were considered as further evidence indicating that the lowered liver catalase activity in infected mice was due to a spleen-elaborated humoral factor (LCDF). I.p. injection of 10 mg LCDF into germ-free and conventional mice significantly depressed ($P < 0.001$) liver catalase activity below that of control mice after 48 hr. I.p. injection of 20 mg LCDF significantly decreased ($P < 0.001$) the mean thymus wt of healthy mice compared with normal controls. LCDF preparations extracted from conventional and germ-free Ha/ICR Swiss mice exerted no inhibitory effect on the catalase activity of a mouse liver homogenate. In these respects, LCDF was sharply differentiated from miscellaneous anti-catalases and was shown to be a true toxohormone.

- 3078 CULTIVATION OF THE SOFT PERITONEAL TISSUES INOCULATED WITH HUMAN ADENOVIRUS TYPE 12 *IN VIVO*. (E.) Motoi, M. (Okayama U. Med. Sch., Japan). *J Karyopathol* 13(3):131-138, 1971.

Adenovirus type 12, prototype strain "Huie", was inoculated i.p. into Syrian golden hamsters at birth. Twenty-four hr after virus inoculation, the peritoneal tissues were excised and cultured *in vitro*. By six to seven wk growth, two of four cultures showed the presence of morphologically transformed foci consisting of rapidly proliferating

small epithelioid cells which tended to pile up. Transformed cells contained a round nucleus with one or three nucleoli and scanty cytoplasm. Giant cell formation was seen frequently. Six hamsters were inoculated i.p. with 5×10^6 transformed cells and all animals subsequently developed multiple abdominal tumors and bloody ascites. Histologically, the tumors resembled the primary virus-induced tumor. Inoculation of transformed cells to virus sensitive fetal human kidney cells failed to demonstrate the presence of infectious virus. The supernatant fraction from tumor homogenates which had developed from transformed cells gave positive complement fixation reactions with serum of Ad-12-tumor bearing hamsters.

- 79 COMPARATIVE STUDY OF THE EFFECT OF EQUINE HERPES 3 VIRUS AND HERPES SIMPLEX VIRUS ON CHROMOSOMES OF RABBIT KIDNEY CELLS. (E.) Samso, (Dept. Med., U. Cambridge, England) and A. Karpas. *J. Bakt (Orig)* 218:417-433, 1971.

Primary rabbit kidney (RK) cell monolayers were infected separately with equine herpes 3 virus (EH3V) and with herpes simplex virus (HSV). At regular time intervals, viral infected and uninfected cells were arrested at metaphase with colchicine and prepared for karyotype analysis. Chromosomal lesions could be detected as early as four hr post infection, and it was noted that the same type of lesions were induced by both EH3V and HSV infected RK cells. The lesions consisted of chromosomal gaps, rearrangements, breaks, and lysis. A higher percentage of HSV-infected cells exhibited lesions which were more severe when compared to EH3V-infected cells. During the incubation period, there was an increase in the percentage of affected mitoses in both EH3V- and HSV-infected cells, but the increase was greater in HSV-infected cells. It is concluded that since the generation time of HSV was shorter than that of EH3V, the degree of chromosomal aberrations induced in RK cells is associated with a shorter virus generation time.

- 80 TRANSFORMATION OF FISCHER RAT EMBRYO CELLS BY THE COMBINED ACTION OF MURINE LEUKEMIA VIRUS AND (-)-TRANS- Δ^9 -TETRAHYDROCANNABINOL. (E.) P. J. (Microbiol. Assoc., Inc., Bethesda, Md.), W. A. Suk, G. J. Spahn and A. E. Freeman. *J. Soc Exp Biol Med* 140(2):454-456, 1972.

High passage Fischer rat embryo cells (F1706) were inoculated with Rauscher leukemia virus (RLV). After three subcultures, the infected cells were treated with $1.0 \mu\text{g/ml}$ of either (-)-trans- Δ^8 -tetrahydrocannabinol ($\Delta^8\text{THC}$), trans-cannabidiol (CBD), $\Delta^9\text{THC}$ or cannabiniol (CBN). Cells were fed chemical every day for six days and were then passaged serially in the absence of chemical. Cultures were checked at intervals for the presence of transformed cells. None of the cannabinoids studied caused any visible cell transformation after six subdivisions and were therefore considered not to be transforming

agents. Control cultures treated with 3-methylcholanthrene showed transformation after three subdivisions. Cultures treated with both concentrations of $\Delta^9\text{THC}$, however, showed macroscopic transformed foci after the 13th subculture. Cultures treated with virus alone or with $\Delta^8\text{THC}$, CBN or CBD showed no transformed foci after 20 subcultures. Inoculation of newborn Fischer rats with cells from cultures started from the 3-MC and $\Delta^9\text{THC}$ transformed foci resulted in the appearance of sarcomas at the site of injection after five days in all treated rats. No tumors developed in rats 90 days after inoculation with cells from control RLV-infected cultures.

- 3081 DETECTION OF AVIAN MYELOBLASTOSIS VIRUS IN CHICK FIBROBLAST CULTURES WHICH HAD BEEN TREATED WITH DNA FROM VIRUS-PRODUCING LEUKEMIC CELLS. (Fr.) Lacour, F. (Gustave-Roussy Inst. Villejuif, France), A. Fourcade, E. Merlin and Th. Huynh. *C R Acad Sci [D] (Paris)* 274(15):2253-2255, 1972.

A culture of chick fibroblasts was inoculated with a DNA extract from leukemic cells producing an avian myeloblastosis virus (AMV) and with DEAE dextran; the supernatant liquid injected to chicks induced typical myeloblastic leukemia. In two out of three cultures ultramicroscopic examination after two wk revealed the presence of mature virus particles in extracellular spaces or burgeoning forms in the cellular membrane only in cultures inoculated simultaneously with a DNA extract from myeloblastic cells and with DEAE dextran. The virus particles were of the C type and were identical with those belonging to the avian leukemic-sarcoma group. The cells showed no sign of malignant transformation. Chicks inoculated with supernatant liquid from the above culture developed myeloblastic leukemia identical with that produced by AMV. Leukemic cells produced a virus with ATPase activity characteristic of AMV. In contrast, no virus production occurred in cultures inoculated with the DNA extract from leukemic cells or with DEAE dextran alone. These results appear to support Temin's hypothesis which postulates that at least part of the oncogenic information is contained in DNA of transformed cells.

- 3082 ELECTRON MICROSCOPICAL STUDY OF ROWSON-PARR VIRUS INFECTION IN BALB/c MICE. (E.) Michaels, L. (Inst. Laryngology Otology, London, England), K. E. K. Rowson and E. S. Bird. *Int J Cancer* 9(1):162-171, 1972.

The significant electron microscopic changes during the course of Rowson-Parr virus (RPV) infection in young adult female BALB/c mice are described. RPV has previously been shown to induce splenomegaly and, later, lymphatic leukemia in infected mice. Splenomegaly occurred in these experiments from 13 to 28 days after RPV infection. During this period, there was active folding of cell membranes of reticulum cells of the spleen in germinal centers and red pulp. In some spleens at this stage virus-like structures

similar to mature C-type oncogenic RNA virus were observed extracellularly only, but in close association with folded cytoplasmic membranes. Budding of virus particles from the cytoplasmic membrane of reticulum cells or any other splenic cells could not be seen at this stage. Cell membrane folding was interpreted as the localization of virus antigen prior to specific antibody production. Beginning on the 25th day, spleens showed numerous plasma cells in the red pulp. These changes persist to a lesser degree in the spleen throughout the period when it is of normal size. The cells constituting the lymphoma resembled those of other murine virus induced lymphomas and had numerous C-type particles budding from their membranes. Electron microscopy of negatively stained centrifuged plasma showed the presence of scattered virus particles of typical murine oncogenic type during the first four days. Beginning on the fifth day, the virus particles became agglutinated into groups suggesting the presence of an immune response. Perivascular mononuclear cell infiltrates composed of plasma cells and reticulum cells with folded membranes, enclosing virus particles, were seen in the kidneys after the 30th wk. RPV infection thus caused a prolonged immunological response to the virus with subsequent tumor development at the site of the response. This was consistent with the idea that intense and prolonged antigenic stimulation is possibly a cause of neoplasia.

- 3083 DIFFERENCES IN THERMAL STABILITY OF DEOXYTHYMIDINE KINASE ACTIVITY IN EXTRACTS FROM CELL INFECTED WITH HERPES SIMPLEX VIRUS TYPE 1 OR TYPE 2. (E.) Ogino, T. (Milton S. Hershey Med. Ctr. Pennsylvania St. U., Hershey) and F. Rapp. *Virology* 46(3):953-955, 1971.

Deoxythymidine (TdR) kinase activities of cells were determined by the rate of phosphorylation of ³H-TdR (38C, 15 min) in cell-free extracts prepared by sonication of confluent cultures of primary rabbit kidney (RK), primary hamster embryo, and human embryonic lung cells infected (one hr, 37° C) with either herpes simplex virus (HSV) type 1 or HSV type 2. TdR kinase activity in type 2-infected RK cells began to increase at 11 hr after infection and reached a maximum activity (60 μmoles nucleotide/15 min) of over 50 times that of uninfected RK cells after 50 hr. In type 1-infected cells, the initial increase in TdR kinase activity occurred seven to eight hr after that observed in type 2-infected cells. Thermal stability of TdR kinase was determined in cell extracts 30 hr after infection with type 1 or type 2 HSV. Extracts were heated at 40° C for ten, 20 or 30 min before assaying for TdR kinase. TdR kinase activity of type 2 infected cells was more heat-labile than that of type 1 infected cells. Only 3% of TdR kinase activity remained in HSV-2 infected cells after ten min of heating, compared to 48% in HSV-1 infected cells. Uninfected TdR kinase activity was the most stable of the three activities tested (95% of TdR kinase activity remaining after ten min). Similar results were obtained for human

embryonic lung, hamster embryo and HDC-17 hamster (HSV-2 transformed) cells.

- 3084 RECENT PROGRESS ACHIEVED IN THE STUDY OF MAREK'S DISEASE OR AVIAN NEUKOLYMPHOMATOSIS. (It.) Zanella, A. (Inst. Inf. Dis. U. Milano, Italy). *Boll Ist Sieroter Milan* 50(4):306-317, 1971.

Inoculation of 1-day-old specific pathogen-free chicks [route not specified] with leukocytes or filtered or unfiltered skin homogenates from chickens with acute Marek's disease (MD) caused death, characteristic lesions of MD, and the production of precipitating antibodies for MD; inoculation of chicks with plasma from the same animals had no effect. When MD virus (LCBS 216/68 strain) was grown in chicken kidney cell monolayers and the cells were passaged, the characteristic cytopathic effect gradually increased in intensity until the 18th passage, after which its intensity decreased. The gel-precipitation reaction showed a gradual decrease in the production of antigen fraction A, starting with the 25th passage; this antigen disappeared completely by the 38th-40th passage, but another antigen fraction was still present in the cell extract. Inoculation of MD virus i.p. and i.m. into 1-day-old chicks showed a progressive decrease in virus pathogenicity which was completely attenuated by the 40th passage. Marek's disease virus was isolated from the blood of these chickens 60 days after inoculation, but not from control animals placed in contact with the inoculated chickens. Vaccination of chicks with this attenuated virus caused a significant decrease in mortality from MD in animals inoculated with a virulent strain 6.5 months after vaccination.

- 3085 ELECTRON MICROSCOPE STUDY OF LABELED LECTIN FIXATION BY RAIFORT'S PEROXIDASE ON HUMAN EMBRYO CELLS, TRANSFORMED *IN VITRO* BY A BRYAN STRAIN OF ROUS SARCOMA VIRUS. (Fr.) Francois, D. (Coll. France, Exp. Med. Lab., Paris, France), V. Van Tuyen, H. Febvre and F. Haguenau. *C R Acad Sci [D] (Paris)* 274(13):1981-1984, 1972.

The bonding of agglutinins, wheat germ lipase extract (WGA) and concanavaline A (Con A) to the surface of human fibroblasts transformed *in vitro* by Rous sarcoma virus (RSV) (strain EH₄R₂) was studied with the electron microscope by using Raifort's peroxidase which can be visualized by oxidation of diaminobenzidine in the presence of hydrogen peroxide. Human fibroblasts transformed by RSV gave a positive reaction at the level of the peripheral membrane with both WGA and Con A. With WGA this was manifested by a dense and continuous precipitate and with Con A, by a discontinuous, less dense precipitate. Without agglutinin no trace of a precipitate was discernible at the surface of the cells. While normal cells treated with Con A gave a positive reaction similar to the peripheral reaction with transformed cells, cells treated with WGA gave no reaction at all. These

sults suggest that there is a close correlation between cellular agglutinability, the ability to x WGA₁ and malignant transformation by an RNA virus. WGA is thus particularly suited for the study of changes in membrane structure caused by ligant transformation.

- 86 DNA OF ROUS SARCOMA VIRUS: ITS NATURE AND SIGNIFICANCE. (E.) Levinson, W. E. Dept. Microbiol., U. California, San Francisco), E. Varmus, A.-C. Garapin and J. M. Bishop. *Science* 175(4017):76-78, 1972.

periments were conducted to determine the source and significance of double-stranded DNA associated with virus of the Schmidt-Ruppin strain of Rous sarcoma virus (RSV). DNA-RNA hybridization followed by 2SO₄ equilibrium centrifugation indicated that the DNA was not a viral RNA transcription product. Successful annealing of virion DNA to avian host cell DNA suggested that viral DNA was probably a product of the host cell DNA. It was concluded that viral DNA is not necessary for biological activity of RSV since extensive substitution of bromodeoxyurine for virus-associated DNA thymidine did not photosensitize the biological activity of the virus.

- 87 EQUINE ABORTION (HERPES) VIRUS-SPECIFIC RNA. (E.) Huang, H. L. (U. Mississippi Sch. of Med., Jackson), J. M. Szabocsik, C. C. Randall and A. Gentry. *Virology* 45(2):381-389, 1971.

The pattern of virus-specific RNA synthesis in mouse cell cultures infected with equine abortion virus (EAV) was studied. Hybridization experiments using purified EAV DNA and ³H-labeled cytoplasmic RNA purified from infected cells showed that virus-specific RNA was largely confined to the polysome fractions. ³H-RNA from control cells failed to bind the viral DNA. Virus specific RNA from polysomal fractions was demonstrated clearly at 2-4 hr post-infection when cellular DNA synthesis was beginning to be shut down; it continued through 12-14 hr post-infection. To test the possibility that virus-specific RNA made after the onset of synthesis of cellular DNA (4-6 hr post-infection) was different from that made early, hybridization competition experiments were conducted. Viral DNA was first hybridized to unlabeled RNA extracted at 4, 8 and 12 hr post-infection, and then was hybridized to ³H-RNA extracted during the intervals 2-4, 6-8 and 10-12 hr after infection. The results indicated that approximately one-third to one-half of the RNA made between 10 and 12 hr post-infection was of a species made early (2-4 hr) after infection. These results were similar to those reported for RNA synthesis patterns in vaccinia virus-infected cells and for T2 bacteriophage.

- 88 ENDONUCLEASE ACTIVITY ASSOCIATED WITH PURIFIED SIMIAN VIRUS 40 VIRIONS. (E.)

Kaplan, J. C. (Harvard Med. Sch., Boston, Mass.), S. M. Wilbert and P. H. Black. *J Virol* 9(5):800-803, 1972.

SV40 virions purified by CsCl density gradient centrifugation were assayed for endonuclease activity by measuring the rate of conversion of ³H-labeled form I (double-stranded, circular) SV40 DNA into a nicked form. The conversion product sedimented as a sharp peak in linear alkaline sucrose gradients indicating that random breakage of form I DNA did not occur. No acid-soluble nucleotides were released during the reaction, showing the absence of exonuclease activity. The reaction was dependent on Mg⁺⁺ ions and was totally inhibited by 0.02 M EDTA or by preheating the purified virus at 80 C for 10 min. Maximum activity occurred between pH 6.7 and pH 7.1. Enzyme activity was proportional to the amount of SV40 protein and was apparently not due to contamination by host cell protein. It was not determined whether the endonuclease produced single- or double-stranded breaks in native SV40 DNA, since both forms had similar sedimentation velocities under these experimental conditions.

- 3089 THE ALTERED PATTERNS OF TRANSFER RNA IN SV40-INFECTED AND TRANSFORMED CELLS. (E.) Sekiya, T. (Inst. Microbial Chem., Tokyo, Japan) and K.-I. Oda. *Virology* 47(1):168-180, 1972.

Transfer RNAs (tRNA) were extracted from cultured African green monkey kidney (AGMK) cells, SV40-transformed AGMK cells (clone T22) and SV40-infected AGMK cells (70 hr post-infection), and their elution profiles from DEAE-Sephadex columns were compared. Among 19 aminoacyl-tRNAs tested, those for aspartic acid (asp-tRNA), asparagine (asn-tRNA) and histidine (his-tRNA) revealed differences between the normal and the transformed or infected cells. All three eluted in two peaks (I and II), but the relative amount of the peak II which was eluted at a higher salt concentration than peak I, was much greater in transformed or infected than in normal cells. In SV40-infected C14 cells (an established cell line of AGMK), an increase in the amounts of the second peak of asp-tRNA and his-tRNA was observed after extensive replication of SV40 DNA. Infection with UV-irradiated SV40 did not cause any significant change in asp-tRNA and his-tRNA. tRNAs from 3T3 and SV40-transformed 3T3 cells (SV3T3) were similarly compared; tRNAs from SV3T3 for leucine, isoleucine, phenylalanine, and threonine contained a new peak which was lacking in the corresponding tRNAs from 3T3 cells. None of the newly appearing species of tRNA could hybridize with SV40 DNA.

- 3090 PARTIALLY DOUBLE-STRANDED RNA IN MOUSE SPLEEN CELLS: THE EFFECT OF INFECTION WITH RAUSCHER VIRUS. (Rus.) Kiselev, F. L. (D. I. Ivanovskii Inst. Virol., Moscow, USSR), L. A. Semenova and I. S. Irlin. *Vop Virusol* 16(4):500-502, 1971.

Findings of a study of specific fractions of RNA in spleen cells of mice infected with Rauscher virus are presented. The virus was injected i.v. after suspension in mouse plasma. This gave 50 transformation foci in spleen cells of BALB/c mice in 1:1000 dilution. The mice were autopsied in various stages of infection, the spleens were homogenized, and RNA was extracted with phenol followed by precipitation with alcohol and 2M NaCl. The resulting high-molecular weight RNA preparation was fractionated on a cellulose column with 15% alcohol. The replicative intermediate form was eluted with buffer consisting of 0.1M NaCl, 0.01M tris-buffer (pH 7.0), and 0.001M ethylenediaminetetraacetic acid sodium salt. The replicative intermediate form was eluted as double-stranded RNA in column fractionation using benzoylated diethylaminoethyl cellulose. The RNA from infected cells had a lower sensitivity to RNase (10 µg/ml, 30 min., 37 C). The RNA fraction eluted from normal cells was 2-4% of the total RNA fractionated. This content increased to 12-14% three days after infection, and then decreased. Synthesis of this RNA fraction was observed in infected cells when mice were injected i.p. with ^{32}P - or ^{14}C -orotic acid. There was a correlation between the amount of virus administered and the quantity of double-stranded RNA. In order to clarify whether synthesis of this fraction depended on virus infection, Rauscher virus and spleens of C57/B1 mice (in which Rauscher virus does not multiply) were used. The RNA fraction increased sharply when the leukemic process was stimulated by a complete Freund's adjuvant after Rauscher virus infection, while Freund's adjuvant alone did not have any effect on synthesis of this RNA fraction. This indicates the virus specificity of the fraction. Thus, Rauscher virus increased synthesis of double-stranded RNA by immunocompetent spleen cells in BALB/c mice.

- 3091 LOSS OF CELL SENSITIVITY TO ENDOGENOUS INTERFERON INDUCED BY MURINE SARCOMA VIRUS. (Fr.) Canivet, M. (Saint-Louis Hosp., Paris, France), J. Periés, M. Olivié and M. Boiron. *C R Acad Sci [D] (Paris)* 274(7):1106-1108, 1972.

Cultures of embryonic Swiss mouse cells infected with Maloney murine sarcoma virus (MSV), which are incapable of producing interferon, did produce interferon in the presence of Newcastle disease virus (NDV; Kansas strain) which had been irradiated with UV. When these cultures were inoculated with vesicular stomatitis virus 24 hr later, cells which had been inoculated with MSV + NDV were not protected while those inoculated with NDV alone were completely protected. Apparently MSV inhibits the protective action of endogenous cellular interferon, and the protection induced by irradiated NDV is a result of interferon production in the cells.

- 3092 STUDY OF THE TUMORIGENIC ACTIVITY OF SV40 VIRUS IRRADIATED WITH ULTRAVIOLET RADIATION IN THE SYRIAN HAMSTER. (Fr.) Wicker, R.

(Inst. Sci. Res. Cancer, Villejuif, France) and J. Coppey. *Int J Cancer* 9(3):626-631, 1972.

Syrian hamsters, at least 48 hr old, were inoculated s.c. with native SV40 virus (Hilleman's strain 777) or with SV40 virus which had been irradiated with UV radiation. Irradiation with 10,000 ergs/mm² enhanced the tumorigenic activity of the virus when at least 10⁵ viral particles were present in the inoculum. Enhanced tumorigenic activity resulting from irradiation was completely abolished by mixing control and irradiated virus. Tumors induced by a 1:10 dilution of irradiated virus appeared 4-5 weeks earlier than those induced with nonirradiated virus at the same dilution, while at a dilution of 1:1000 the tumorigenic activities of control virus and virus irradiated with 10,000 ergs/mm² of UV were the same. Tumor development and serum antibody titers for the T antigen of SV40 virus were the same in hamsters inoculated with control and irradiated virus. Irradiation of SV40 virus with 50,000 ergs/mm² UV greatly reduced its tumorigenic activity. It is suggested that tumors induced by SV40 virus irradiated with 10,000 ergs/mm² UV are partially defective in specific transplantation antigens and their growth is less dependent upon the immunological reaction of the host.

- 3093 COMPARATIVE STUDY OF RSV RESCUE FROM RSV-TRANSFORMED MAMMALIAN CELLS. (E.) Svoboda, J. (Inst. Exp. Biol. Genetics, Czechoslovak Acad. Sci., Prague), O. Machala, L. Donner and V. Sovova. *Int J Cancer* 8:391-400, 1971.

Five different lines of virogenic Rous sarcoma virus (RSV)-transformed mammalian cell lines (RSCH, RSH, RVA₂, B mix and XC) were fused with BLEF chicken embryo fibroblasts in the presence of Sendai virus. All individual heterokaryons produced infectious RSV. In contrast, nonvirogenic mammalian cells (RAV₄ and RVP₃), derived from tumors which arose in mice infected with RSV, did not give rise to infectious RSV, even when fused with chicken fibroblasts preinfected with three different types of avian leukosis "helper viruses" (RAV₄₉, RAV₅₀ or leukosis virus F-42). Fusion of four lines of virogenic cells (B mix, XC, RSCH and RVA₂) with mammalian fibroblasts of three different species as well as of virogenic Chinese hamster cells with chicken liver, mesonephros, thymus and macrophage cells did not lead to the formation of detectable RSV or RSV coat antigen. The presence of a "natural" Gs antigen in the indicator BLEF cells was not necessary for RSV rescue as fusion of cells derived from Gs negative chicken and duck embryos with virogenic cells also led to the formation of infectious RSV.

- 3094 MALIGNANT TRANSFORMATION OF HUMAN CELL *IN VITRO* BY THE SV40 DNA AND RELATED ALTERATION IN BIOLOGICAL ACTIVITY OF CELL MEMBRANES. (E.) Kimoto, T. (Okayama U. Med. Sch., Japan), E. Yokomura, Y. Shimizu, M. Yamakawa and S. Seno. *Acta Med Okayama* 25(2):77-86, 1971.

the addition of purified SV40 777 strain DNA (3 µg/ml) to the medium of cultured primary human or hamster embryonic cells, or to hamster kidney cells produced morphological transformation. T-antigen was detected after three months in transformed human cells, and both tumor specific and surface antigens were found in transformed hamster cells. Alterations in the membrane structures of normal and transformed human and hamster cells were determined by their capacity to phagocytize colloidal iron dextran sulfate (Cs-Fe) particles. Whereas transformed cells showed moderate phagocytic activity, their SV40 DNA-transformants were unable to incorporate the Cs-Fe particles. However, transformed cells treated with histone fractions (arg-rich, lys-rich or histone type II) at concentrations which did not affect growth or division showed a marked propensity to phagocytize the Cs-Fe particles when incubated with them for 25 hr. Electron microscopy revealed that ingested particles were incorporated into phagocytic vacuoles. These results indicated that definite changes occurred in the molecular structure of the membranes of cells transformed by purified SV40 DNA. From their phagocytic behavior in the presence of histone, it was concluded that the membrane changes were due to the disappearance of positively charged groups and/or the increase in negatively charged groups on the cell surface.

5 STRUCTURAL PROTEINS OF ADENOVIRUSES: VII. PURIFICATION AND PROPERTIES OF AN ARGININE-RICH CORE PROTEIN FROM ADENOVIRUS TYPE 2 AND TYPE 3. (E.) Prage, L. (Wallenberg Lab., Uppsala U., Sweden) and U. Pettersson. *Virology* 45(2):364-373, 1971.

Double viral core proteins from adenovirus types 2 (Ad2) and 3 (Ad3) labeled with ³H-arginine or ³H-methionine were extracted with acid and subjected to preparative polyacrylamide gel electrophoresis. Both Ad2 and Ad3 core proteins showed the same migration pattern irrespective of the isotope used. The molecular wt of the purified core protein was 17,000 as determined by sedimentation equilibrium centrifugation, and the sedimentation was 1.1S, suggesting an elongated molecular shape. The protein was apparently composed of one single polypeptide chain. Analysis of amino acid composition by an amino acid analyzer showed that the core protein was extremely high in arginine (21-23%) as well as in lysine (18-19%). The protein molecule was calculated to contain two tyrosine residues and one tryptophan residue per 17,000 daltons. The tryptophan residue probably occupied an unshielded position in the molecule. The N-terminal amino acid was determined by the dansyl chloride method to be alanine. No significant difference was observed in physicochemical properties between the arginine-rich core proteins purified from the two different serotypes. In immunodiffusion and complement fixation, the Ad2 and Ad3 core proteins were found to contain a common antigenic determinant. There were also antigenic differences between the core proteins of the different serotypes.

3096 GENETIC STABILITY OF THE SARCOMA VIRUSES IN MURINE AND AVIAN SARCOMA VIRUS-TRANSFORMED NONPRODUCER CELLS. (E.) Stephenson, J. R. (Natl. Cancer Inst., Bethesda, Md), E. M. Scolnick and S. A. Aaronson. *Int J Cancer* 9(3):577-583, 1972.

Clonal lines were obtained by a microtiter technique from cultures of normal rat kidney (NRK) and BALB/3T3 cells transformed by Kirsten murine sarcoma virus (Ki-MSV) or by Schmidt-Ruppin Rous sarcoma virus (SR-RSV). These clones, in which the virus did not productively replicate, were studied for the occurrence of spontaneous or chemical (BrdU or mitomycin-C)-induced morphologic reversion. Although no spontaneous revertants were detected, four morphologically revertant clones were obtained from over 10,000 transformed clones studied. One (K-NRK-R), which was isolated from a BrdU-treated Ki-MSV-transformed NRK culture, was further characterized. The K-NRK-R clone was similar to NRK control cells in saturation density and its ability to grow on monolayers. Infectious virus could be rescued from K-NRK-R cells by superinfection with murine leukemia virus, suggesting that the revertant line arose as a result of a mutation of a cellular gene involved in expression of the transformed state, and not from loss or mutation of the viral genome.

3097 FURTHER STUDIES ON THE MECHANISM OF GROWTH OF A TRANSPLANTABLE VIRUS-INDUCED LYMPHOID TUMOUR OF MICE. (E.) Croft, C. J. (Natl. Inst. Med. Res., London, England). *Int J Cancer* 9(1):212-218, 1972.

A lymphoid tumor, originally induced in CBA/H mice with Moloney virus, was passaged in CBA/H-T6T6 mice by s.c. transplantation or i.p. inoculation enabling mitotic host cells to be distinguished from donor cells by the presence of the T6 marker chromosomes. Three independent lines of evidence, based on chromosome analysis, indicated that mitotic host cells were stromal in nature, and were not host cells which had been altered into tumor cells under the action of the virus. Transplants of this tumor into neonatal or adult mice grew only by the proliferation of donor cells, and the cells of secondary tumors found in the spleens of mice bearing s.c. transplanted tumors were also derived from the cells inoculated. However, electron microscopy of tumor tissue sections consistently revealed the presence of C-type particles 100 nm in diameter, some of which were budding from the plasma membrane. In addition, intracytoplasmic and intracisternal A-type particles were commonly present. Thus, the possible role of Moloney virus in contributing to tumor growth by transformation of host cells in this system is still uncertain.

3098 PROPERTIES OF A MURINE SARCOMA VIRUS ISOLATED FROM A TUMOR ARISING IN AN NZW/NZB F1 HYBRID MOUSE: II. PHYSICAL AND BIOLOGICAL CHARACTERISTICS. (E.) Gazdar, A. F. (Natl. Cancer Inst., Bethesda, Md.), P. S. Sarma and R. H. Bassin. *Int J Cancer* 9(1):234-241, 1972.

The properties of a potent murine sarcoma virus (MSV), which was isolated after *in vivo* passage of a spontaneous tumor arising in an NZW/NZB F₁ hybrid mouse, are described. The agent had the morphological and growth characteristics of a C-type virus. Complement fixation tests using MuLV specific group-specific (gs) antibody showed that both the virus and sera from infected animals contained gs antigen. *In vivo* and *in vitro* neutralization studies and immulogic data indicated that the new MSV strain belonged to the FMR subgroup. The virus induced discrete, focal lesions in both 3T3 and secondary mouse embryo culture (MEC) cells. Focus formation usually followed a "two-hit" titration pattern (i.e., the number of foci decreased as the square of the virus dilution) when assayed on 3T3FL cells. MSV preparations also contained a large excess of an accompanying non-transforming C-type virus. The MSV was stable when stored at -70°C; it was ether-sensitive and had a buoyant density of 1.16 g/cm³ when centrifuged in sucrose density gradients. All these properties were similar to those of the Moloney (M-MSV), Harvey (H-MSV), and Kirsten (Ki-MSV) isolates of MSV. Partially purified virus concentrates of virus-induced mouse tumors rapidly induced tumors in newborn mice, rat, and hamsters. While the viruses produced by hamster and mouse tumors both contained the murine gs antigen, the host range of the MSV was altered by hamster passage. It failed to induce focal lesions in mouse and hamster cell cultures and did not induce sarcomas or leukemias when injected into newborn mice and hamsters. The antigenic properties and infectivity of the virus produced by hamster tumor cells were significantly different from the properties of the hamster leukemia pseudotype viruses obtained from hamster tumors induced by other strains of MSV.

3099 MORPHOLOGIC STUDIES OF A CYTOMEGALOVIRUS ISOLATED FROM AN OWL MONKEY. (E.)

Chopra, H. C. (Nat'l. Cancer Inst., Bethesda, Md.), B. J. Lloyd, Jr. D. V. Ablashi and G. R. Armstrong. *J Nat Cancer Inst* 48(5):1333-1340, 1972.

The ultrastructure of a herpes-type virus, characterized as a cytomegalovirus, isolated from the mouth cavity of an owl monkey and passaged in owl monkey kidney cells were studied. Nuclear and cytoplasmic inclusion bodies, characteristic of cytomegalovirus infection, were observed in infected cells. The pathogenesis of infected cells showed cytoplasmic swellings due to dilated and disorganized endoplasmic reticulum. Electron microscopy of these cells revealed herpes-type virus particles of several configurations. The nuclear virus particles, found in inclusions associated with chromatin aggregates, were either empty 80-90 nm diameter nucleocapsids or contained electron-dense nucleoids. Nucleocapsids with inner ring-type nucleoids were also common in the chromatin aggregates. Cytoplasmic particles were larger (160-190 nm diameter) and were single or clustered within vacuoles. Most cytoplasmic particles were enveloped in an outer envelope or coat. The nuclear particles appeared to

acquire the envelope from the nuclear membrane or from the vacuolar membranes within the cytoplasm. The enveloped particles represented the complete form of herpes-type virus particles. The process of virus release from infected cells could not be resolved.

3100 STUDIES ON A VIRAL NEPHROBLASTIC NEPHROBLASTOMA OF THE CHICKEN: AN ELECTRON MICROSCOPE COMPARISON OF THE SEQUENCE OF DEVELOPMENT OF THE VIRIONS IN DIFFERENT ORGANS. (E.) Weiler, O. (Gustave-Roussy Inst., Villejuif, France), E. Delain and F. Lacour. *Europ J Cancer* 7(6):491-494, 1971.

An ultrastructural study of a serially transmissible nephroblastoma line (DNV) showed the presence of virions morphologically similar to the avian leukosis group viruses. The particles were generally located in the basement membranes and the capillary endothelium. A chronological study of various tissues of brown Leghorn chicks which received i.p. injections of virus suspension indicated that the virus particles appeared and multiplied by 5-6 days exclusively in the main hematopoietic organs (spleen and bone marrow). After 10-12 days, the particles appeared in the viscera and were always found in considerable amount in the lung, liver, pancreas, ovary and digestive tract. In addition, virions were occasionally observed in heart muscle, the adrenal gland, and in the thigh bones (associated with osteoporosis). Virions appeared in the renal distal convoluted tubules after 25 days, and this was accompanied by a simultaneous decrease in virus production in the hematopoietic organs. Later, virions accumulated in the basement membrane, in the lumens of the tubules, and between the cells lining the distal convoluted tubules. Only the kidney underwent malignant transformation with occasional sarcoma production. Also, an unusual differentiation into cartilaginous or osteoid cell was sometimes observed, and these elements produced virus.

3101 INCREASE OF EPSTEIN-BARR-VIRUS-POSITIVE CELLS IN EB3 CULTURES AFTER TREATMENT WITH CIS-DICHLORO-DIAMMINE-PLATINUM (II). (E.) Vonka, V. (Inst. Sera Vaccines, Prague, Czechoslovakia), L. Kutinova, J. Drobnik and J. Brauerova. *J Nat Cancer Inst* 48(5):1277-1281, 1972.

Treatment of Burkitt Lymphoma EB3 cells, an Epstein-Barr Virus (EBV)-positive line, with the platinum compound, cis-dichloro-diammine-platinum (II) (1-10 µM, 20 hr), produced a two- to three-fold increase after three to seven days of cells showing a positive indirect immunofluorescence (IF) test with human sera possessing EBV antibody. Addition of cytosine arabinoside (10 µg/ml), or 5-bromo-2'-deoxyuridine (50 µg/ml) to the incubation medium prevented this enhancement, indicating that DNA synthesis was necessary for the effect. Incubation of treated cells under conditions of arginine deprivation or at high temperatures (32-39 °C) did not affect markedly the percentage of positive cells.

proximately the same increase in cells reactive in the IF test was observed in three EB3 sublines differing in their content of EBV-positive cells. Enhancement of the percentage of IF-positive cells was not observed in the EBV-positive P3J Burkitt lymphoma line. Both treated and untreated NC37 EBV-free peripheral leukocyte cultures were IF-negative.

02 ELUCIDATION OF THE NATURE OF THE MURINE ONCOGENIC VIRUS INHIBITOR ISOLATED FROM JLS-V5 CELL LINE. (E.) Turner, W. (Nat'l. Cancer Inst., Bethesda, Md.), P. Ebert, L. Riechers, J. W. Carson and M. A. Chirigos. *Proc Soc Exp Biol Med* 178(3):1030-1034, 1971.

Inhibitor (STAS) prepared by silicotungstic acid precipitation of the supernatant of JLS-V5 cells (mouse spleen-thymus cell line chronically infected with Rauscher leukemia virus) had previously been shown to inhibit Moloney murine sarcoma virus (MSV) focus-forming ability *in vitro*. The quantitative and temporal aspects of STAS-induced inhibition of MLV replication *in vitro* are reported in this communication. Growth of virus was inhibited in mouse embryo fibroblast (MEF) cells treated with STAS simultaneously with infection, or up to 48 hr after MLV infection, but not in cells pretreated with STAS before MLV infection. However, potent antiviral activity against MLV was also observed with similarly prepared inhibitor from the culture supernatant of the virus-free murine cell line, JLS-V9, from fetal calf serum (FCS), normal Balb/c mouse plasma, MEF+10% FCS, saline, or silicotungstic acid (TA). Inhibitor prepared from JLS-V5 supernatant and by precipitation with $ZnSO_4$, PCA, TCA, or ethanol instead of STA showed little or no activity against MLV *in vitro*. Preparations from JLS-V9 cells using ammonium sulfate as precipitant did show antiviral activity, suggesting the presence of an inhibitor not associated with residual STA in the STA preparation. No viricidal activity was observed when MLV was directly exposed to JLS-V5 STAS. These studies suggest that the active ingredient in the JLS-V5 is silicotungstic acid.

03 A NOVEL DNA POLYMERASE ACTIVITY FOUND IN ASSOCIATION WITH INTRACISTERNAL A-TYPE PARTICLES. (E.) Wilson, S. H. (Nat'l. Cancer Inst., Bethesda, Md.) and E. L. Kuff. *Proc Nat Acad Sci USA* 69(6):1531-1536, 1972.

DNA polymerase activity which promotes the synthesis of poly(dT) was found in association with intracisternal type particles isolated from five different mouse strains. A similar pattern of response was observed in the synthetic template-primer poly(rA)·(dT)₁₄ with reticulocyte polyribosomal RNA as template, suggesting that the A-type particle activity was capable of poly(dT) synthesis only by direction of poly(rA) sequences present in the natural RNA. The polymerase showed optimal activity in 100-250 mM KCl, 5 mM magnesium acetate ($MnCl_2$ was much less effective), and at pH 8.0-8.3, thus distinguishing it from RNA-dependent DNA polymerase activities associated with avian myeloblastosis virus and Rous sarcoma virus and from the poly(rA)-directed activity associated with Rauscher murine leukemia virus (MuLV). No significant incorporation of dAMP, dGMP or dCMP was detected in the presence of several RNA and DNA template-primers. Enzyme activity was not detected in preparations from several normal and MuLV-infected cell types which did not contain A-type particles. Except for a low level of activity in response to poly(rC)·(dG)₁₄, both the patterns of response to template-primers and the divalent cation preference of the A-type particle activity differed from that of the MuLV (C-type particle) activity. Antiserum against MuLV DNA polymerase failed to inhibit the poly(rA)·(dT)₁₄-dependent activity of A-type particles under conditions nearly optimal for MuLV activity.

3104 CHARACTERIZATION OF MURINE RAUSCHER LEUKEMIA VIRUS PROPAGATED IN HUMAN CELLS. (E.) Ablashi, D. V. (Nat'l. Cancer Inst., Bethesda, Md.), W. Turner, G. R. Armstrong and L. R. Bass. *J Nat Cancer Inst* 48(3):615-621, 1972.

Human embryonic kidney (HEK) cells were infected with Rauscher leukemia virus (RLV), and after infection was confirmed by a positive complement fixation (CF) test, indicating induction of mouse group-specific antigen synthesis, the RLV was further passed in HEK cells and designated human Rauscher virus (HRV). Mouse embryonic fibroblast (MEF) cells infected with HRV which had been serially passaged in HEK cells for up to nine passages gave a positive XC response. After ten passages in HEK cells, however, HRV was unable to infect MEF cells. HRV was effectively neutralized by both goat and rabbit anti-HRV sera, whereas murine RLV was neutralized by goat anti-HRV, but not by rabbit anti-HRV. Although inoculation of passage five HRV into weanling BALB/c mice induced splenomegaly, inoculation of two higher passages (12 and 20) did not, indicating a rapid loss of leukemogenicity of HRV. Inoculation of the supernatant from infected MEF cell cultures likewise failed to induce splenomegaly or virus-specific CF antigen in the spleen.

3105 REOVIRUS-SPECIFIC RIBONUCLEIC ACID FROM POLYSOMES OF INFECTED L CELLS. (E.) Ward, R. (Roche Inst. Molecular Biol., Nutley, New Jersey), A. K. Banerjee, A. LaFiandra and A. J. Shatkin. *J Virol* 9(1):61-69, 1972.

Polysomes from actinomycin D-treated mouse L cells infected with reovirus type 3 were purified on glycerol gradients and analyzed for RNA and protein content. Transcription of the reovirus genome resulted in the production of ten distinct species of single-stranded RNA (ssRNA), which were separated in glycerol gradients into three size classes: three large (l), three medium (m), and four small (s). Analysis of ³H-adenosine-labeled ribonuclease-treated reovirus RNA indicated that little,

if any, of the reovirus A-rich RNA was present in polysomes. Although all ten reovirus genome segments were transcribed, only six or seven new proteins were identified in infected cells by polyacrylamide gel electrophoresis. Chromatography of pancreatic RNase hydrolysates of ^{32}P -labeled polysome-associated reovirus mRNA indicated that the 5'-terminus of polysome ssRNA was ppGpYp (Y = pyrimidine) and was identical to the 5'-termini of reovirus genome segments and to ssRNA synthesized *in vitro* by the virion-associated RNA polymerase, as previously reported. RNA isolated from both heavy (>30 ribosomes) and light (five to eight ribosomes) polysomes included similar amounts of 1, m and s ssRNA, suggesting that linkage of the genome segments observed in virions may occur at the single-strand stage of reovirus RNA replication.

3106 ABSENCE OF RIBONUCLEIC ACID METHYLASE IN THE AVIAN MYELOBLASTOSIS VIRUS CORE.

(E.) Gantt, R. (Natl. Cancer Inst., Bethesda, Md.), K. Stromberg and B. Julian. *J Virol* 9(6):1057-1058, 1972.

N^2 -guanine-RNA-methylase had previously been shown to be associated with avian myeloblastosis virus (AMV). To determine whether or not the enzyme was a core component of the virion, intact and surfactant-disrupted AMV preparations were subjected to isopycnic sucrose density gradient centrifugation, and different areas of the gradients were assayed for methylase activity. Although methylase activity was associated with intact virions, disruption with the surfactant, Sterox SL, released 75% of the activity into a lipoprotein fraction which banded at the top of the gradient. Since electron microscopic observation showed that core material from untreated and treated virus preparations was identical, it was unlikely that the methylase was loosely bound to the virus core and that it was released during the process of core isolation. It was therefore concluded that the specific methylase activity was not a core constituent under these conditions.

3107 MORPHOLOGICAL TRANSFORMATION *IN VITRO* OF HUMAN FIBROBLASTS BY EPSTEIN-BARR VIRUS: PRELIMINARY OBSERVATIONS. (E.) Probert, M. (U. Bristol Med. Sch., England) and M. A. Epstein. *Science* 175(4018):202-203, 1972.

Human embryonic skin and muscle fibroblasts were incubated in suspension culture with partially purified Epstein-Barr (EB) virus, and some of the cells were exposed to inactivated Sendai virus. All cells were then grown in monolayer cultures. Although both groups exhibited signs of morphological transformation (colonies of piled-up polygonal cells), Sendai virus-exposed cultures contained seven times as many transformed colonies as did cultures exposed only to EB virus. The polygonal colonies had fine structural features of altered fibroblasts and did not release EB virus.

3108 *IN SITU* HYBRIDIZATION OF ADENOVIRUS RNA AND DNA. (E.) McLaughlin, J. E. (U.

Birmingham Med. Sch., England), A. R. Dunn and K. M. Jones. *Nature* 236(5346):346-348, 1972.

The relationship between the adenovirus type 12 (Ad12) genome and host human embryonic lung (HEL) cell chromosomes was investigated by a hybridization-autoradiography technique. Isotopically labeled complementary viral RNA (cRNA) was synthesized from a purified viral DNA template. Slides of fixed, uninfected and infected, HEL cells were treated with acid to denature the DNA and then incubated with Ad12 cRNA. Autoradiographs of these preparations showed that the grain distribution and count over non-dividing nuclei of infected cells varied with time after infection. The numbers of labeled nuclei were clearly related to multiplicity of infection. In the metaphases from virus-infected cultures, the number of grains was unusually low, indicating that in cells reaching mitosis during the 48-hr period postinfection, there had usually been little or no synthesis of viral DNA. Specific damage induced by Ad12 to chromosome No. 17 was present in up to 40% of the metaphases, but grains were only rarely found in association with this locus. Distribution of grains over the entire karyotype was random. These findings showed that the sites of chromosomal damage were not necessarily those associated with the sites of major viral DNA accumulation. They also tended to confirm previous results which indicated that viral DNA synthesis was not required for the induction of chromosome aberrations by adenovirus. In addition, these results indicated that few cells were capable of undergoing mitosis after massive viral DNA synthesis had occurred.

3109 PROPERTIES OF POLYOMA VIRUS-TRANSFORMED CELLS: II. CHARACTERISTICS OF THE VIRUS-SPECIFIC RNA. (E.) Hudson, J. B. (Dept. Microbiol., U. British Columbia, Vancouver, Canada). *Canad J Microbiol* 18(2):247-254, 1972.

The polyoma virus-specific RNA (Py RNA) synthesized in a line of polyoma-transformed hamster cells was characterized and compared with the viral-specific RNA synthesized "late" in productively infected mouse cells. The PyRNA from the transformed cells sedimented heterogeneously on sucrose gradients with large amounts of PyRNA in the >40S region. The overall sedimentation profile resembled that of "late" PyRNA synthesized in mouse cells. Competition hybridization experiments demonstrated that the bulk of the PyRNA sequences, in the transformed cells, were different from the "late" PyRNA sequences. An estimate of the average number of viral genomes per transformed cell was made by using DNA-DNA hybridization experiments (with polyoma DNA of high specific reactivity). The PyH-1 cells did not contain more than two, and possibly less than one, viral genome per cell. The data suggest that the PyH-1 cells may contain only a fraction of a Py genome, possibly only comprising "early" genes

ence the inability to rescue infectious virus), and that the viral RNA transcribed is covalently linked to host cell RNA moieties.

10 PURIFICATION AND CHARACTERIZATION OF THE DEOXYRIBONUCLEIC ACID POLYMERASE ASSOCIATED WITH ROUS SARCOMA VIRUS. (E.) Faras, A. J. Dept. Microbiol., U. California, San Francisco), M. Taylor, J. P. McDonnell, W. E. Levinson and M. Bishop. *Biochemistry* 11(12):2334-2343, 1972.

The DNA polymerase associated with the Schmidt-Ruppin strain of Rous sarcoma virus was purified a minimum of 500-fold by successive chromatography in the presence of nonionic detergent on DEAE-cellulose, phosphocellulose and Sephadex G-100, followed by glycerol gradient centrifugation. Two fractions (A and B) of activity were eluted from phosphocellulose. Form B comprised 90% of total enzyme activity and had a molecular weight of 105,000. Form A constituted 10% of the total activity, had a molecular weight of 96,000, and was in equilibrium with form B. The proportional template responses for DNA and 70S RNA were identical for the two forms. The purified enzyme was completely template-dependent and free of appreciable amounts of RNase. A similar enzyme response to various templates (endogenous viral RNA, synthetic polynucleotides and exogenous DNA) at all stages of enzyme purification indicated that all template activities resided on the same protein or protein complex. Optimal concentrations for enzyme activity of H⁺, Mg⁺⁺ and Mn⁺⁺ were similar or identical for all three templates. Monovalent cations (Na⁺, K⁺ and NH₄⁺) inhibited enzyme response to both RNA and DNA templates. A K_m for TTP of 2×10^{-5} M was calculated from double reciprocal plots for the initial linear phase of DNA synthesis with viral RNA as template. The amounts of DNA synthesized using the three different templates supported the view that the enzyme carried out only repair synthesis. Comparison of the responses to a number of RNA and DNA-virus-, human RNA- and synthetic templates showed that the 70S oncornavirus RNA was the most efficient template. Purified enzyme preparations had no DNase (pH 5.0 and 8.1) or phosphatase (pH 8.1) activity.

11 ULTRAVIOLET INACTIVATION OF MOLONEY LEUKAEMIA VIRUS: RELATIVE TARGET SIZE REQUIRED FOR VIRUS REPLICATION AND RESCUE OF "DEFECTIVE" MURINE SARCOMA VIRUS. (E.) Nomura, S. Natl. Cancer Inst., Bethesda, Md.), R. H. Bassin, Turner, D. K. Haapala and P. J. Fischinger. *J Virol* 14:213-217, 1972.

Moloney murine leukemia virus (MuLV) suspensions of 10⁶ and 10⁷ IC stocks were irradiated with UV light. Samples were removed at various times during irradiation and assayed for infectivity by either focus induction assay in S+L- cells or XC plaque assay after infection of normal 3T3 cells. Virus

inactivation followed single-hit kinetics. Non-specific effects of ionization on virus infectivity were not observed. A microplate technique for focus induction in S+L- cells was used to determine the ability of the UV-irradiated, non-replicative MuLV stocks to rescue murine sarcoma virus (MSV), but no such ability could be demonstrated. The fact that the ability of MuLV to rescue MSV from S+L- cells and its ability to replicate were equally sensitive to UV irradiation indicated that the entire genome of MuLV was necessary for the rescue of "defective" MSV. The results were also consistent with the assumption that MuLV provides the outer coat for MSV as one of the final steps in the formation of infectious virus. Data indicated that MuLV replication was essential for focus formation in S+L- cells by MuLV. There was no evidence that the MSV genome present in S+L- cells could complement or in some other way reactivate a partially inactivated MuLV genome.

3112 ENHANCING EFFECT OF EXCESS TOPICAL VITAMIN A ON ROUS SARCOMAS IN CHICKENS. (E.) Polliack, A. (Hebrew U. Med. Sch., Jerusalem, Israel) and Z. B. Sasson. *J Nat'l Cancer Inst* 48(2):407-416, 1972.

The right and left wing webs of 36 White Leghorn chickens of both sexes were inoculated with the Schmidt-Ruppin strain of Rous sarcoma virus (SR-RSV), in various amounts, ranging from 5,000 to 100,000 focus-forming units (FFU) per injection. Thereafter, the right wing webs were painted daily with topical 20% vitamin A palmitate in paraffin oil for three weeks. The left wing webs remained untreated for a similar period. In the untreated left wing web 22.2% of the birds developed fibrosarcomas of 1- to 2-cm diameter and 6- to 30-g weight. In the vitamin A-treated right wing webs, 52.8% had large tumors weighing up to 240 g and measuring from 6-13 cm in diameter. Tumors developed in 50% of the webs given smaller doses of SR-RSV (5,000-20,000 FFU) followed by topical vitamin A, as opposed to 15% in webs given similar doses of SR-RSV alone. The tumors developing after topical vitamin A were shown to be more aggressive both macroscopically and histologically; they infiltrated muscle and bone and also metastasized, and large amounts of mucopolysaccharides were detected in the stroma by special stains. When the wings of ten chickens were treated with topical vitamin A palmitate before infection with SR-RSV, tumors weighing from 6-20 g developed in all treated webs, whereas tumors weighing only from 1-5 g developed in six of ten untreated wing webs. The results were attributed to the established membrane-labilizing qualities of vitamin A which probably enhanced tumorigenesis, either by facilitating more effective entry of the virus into the tissues or by altering the structure and function of the virus and target cell in a manner more amenable to malignant transformation.

3113 INOCULATION OF CALVES WITH PARTICLES RESEMBLING C-TYPE VIRUS FROM CULTURES OF

BOVINE LYMPHOSARCOMA. (E.) Miller, L. D. (Dept. Vet. Sci., U. Wisconsin, Madison), J. M. Miller and C. Olson. *J Nat Cancer Inst* 48(2):423-428, 1972.

Lymphocyte cultures containing C-type-like virus particles were obtained from two cows with lymphosarcoma and one with lymphocytosis. Following stimulation with phytohemagglutinin or Concanavalin A, cells were introduced orally or by i.p. or i.v. injection into 16 calves; the existence of C-type-like particles in these inocula had been confirmed by electron microscopy. The number of circulating lymphocytes was determined in each calf at two-month intervals after inoculation. Short-term cultures of circulating lymphocytes from inoculated calves were prepared at intervals of two months or less. C-type-like particles morphologically identical to those described in cattle with lymphosarcoma were observed by electron microscopy in lymphocyte cultures from all calves (including one inoculated with cell-free material) 2-13 months post-inoculation. Virus-positive cultures appeared earliest in calves which were inoculated either on the first day of life or with larger volumes of material. Calves inoculated orally showed the longest delay before appearance of cultures with C-type-like particles. Five calves developed persistent lymphocytosis which first appeared 4-13 months post-inoculation. In each case, demonstration of C-type-like particles preceded development of lymphocytosis.

3114 ORAL INFECTION OF NEWBORN GUINEA PIGS WITH HERPES SIMPLEX VIRUS TYPE 1. (E.) Blaskovic, D. (Komensky U., Czechoslovakia), J. Svobodova, K. Weidnerova and B. Stastny. *Acta Virol* 15:522, 1971.

Newborn guinea pigs were inoculated orally with type 1 herpes simplex virus (HSV) strain KL70 ($2.5 \times 10^{6.5}$ TCID₅₀/ml or a 10^{-1} dilution of this). Two of the eight animals infected with 10^{-1} dilution of HSV developed tongue ulcers 48 hr post-infection (p.i.). No virus could be isolated from these lesions. HSV was recovered from only one animal which died nine days p.i. (10^{-1} dilution) and was detected in suspensions of tongue, esophagus, trachea and lung. HSV was identified by a virus neutralization test, immunofluorescence and bright fluorescence. Sera taken from surviving infected animals 4-6 days p.i. contained no antibodies against HSV type 1, as determined by the virus neutralization test. Attempts to isolate HSV from organs of animals sacrificed 2.5 months p.i. were also unsuccessful.

3115 VIRUS-SPECIFIC RIBONUCLEIC ACID IN CELLS PRODUCING ROUS SARCOMA VIRUS: DETECTION AND CHARACTERIZATION. (E.) Leong, J.-A. (Dept. Microbiol., U. California, San Francisco), A.-C. Garapin, N. Jackson, L. Fanshier, W. Levinson and J. M. Bishop. *J Virol* 9(6):891-902, 1972.

Viral RNA from cells producing the Schmidt-Ruppin strain

of Rous sarcoma virus (RSV) was localized and characterized. Purified 70S RSV RNA was used to direct synthesis of ³H-labeled complementary DNA. Hybridization of the virus-specific radio-labeled DNA to whole cell RNA or to RNA from cell fractions was detected by two procedures: fractionation on hydroxyapatite columns or the extent of hydrolysis with single strand-specific *Neurospora* and *Aspergillus* nucleases. Similar results were obtained with both procedures. The RNA-DNA hybrids were completely resistant to single strand-specific nuclease and showed almost the same melting-curve configuration as hybrids synthesized enzymatically, suggesting a very high degree of precision in base-pairing. Results from hybridization of virus-specific DNA to whole cell RNA agreed with previous reports and indicated that approximately 0.5% of infected cell RNA were virus-specific sequences. Virus-specific RNA was present in both the nucleus and cytoplasm of infected cells. Results from hybridization with virus-specific DNA after rate-zonal centrifugation of RNA extracted from cells at 25 C (which preserves the secondary structure of 70S RNA), showed that virus-specific RNA was remarkably heterogeneous in size. Some RNA molecules, which were probably restricted to the nucleus, sedimented in their native state (90-95S) more rapidly than the viral genome. The nature of the RNA found in cytoplasmic fractions varied from preparation to preparation, but heterogeneous RNA (4-50S), smaller than the viral genome, was always present in significant amounts along with the 70S RNA.

3116 ULTRASTRUCTURAL COMPARISON OF A VIRUS FROM A RHESUS-MONKEY MAMMARY CARCINOMA WITH FOUR ONCOGENIC RNA VIRUSES. (E.) Kramarsky, B. (Inst. Med. Res., Camden, N.J.), N. H. Sarkar and D. H. Moore. *Proc Nat Acad Sci USA* 68(7):1603-1607, 1971.

The ultrastructure and morphogenesis of Mason-Pfizer monkey virus (M-PMV), isolated from a mammary carcinoma in a Rhesus monkey, was compared with those of murine mammary tumor virus (MuMTV), murine leukemia virus (MuLV), L1210 leukemia-associated virus, and avian myeloblastosis virus. The simian virus resembled MuMTV and the L1210 virus in that it produced intracytoplasmic particles that were enveloped during budding. It resembled L1210 virus and MuLV in budding with smooth envelopes. It differed from all the others in being more fragile. This fragility is probably due to an inherent tendency of the supercoiled nucleocapsid to unwind, exerting a pressure upon the virion envelope. The similarities suggest that the monkey virus is an oncogenic virus.

3117 MITOCHONDRIAL DNA FROM CELLS TRANSFORMED BY ADENOVIRUSES AND SV40. (E.) Riou, G. (Inst. Gustave-Roussy, Villejuif, France) and E. Delain. *Biochimie* 53(6-7):831-836, 1971.

Mitochondrial DNA (mtDNA) isolated from mitochondria of tumors produced in newborn hamsters by injections

adenovirus 7 or adenovirus 12, then cultured and maintained in tissue culture and mtDNA isolated from mitochondria of SV40-transformed hamster embryo (HSE) cells were studied. Equilibrium centrifugation of mtDNA in CsCl ethidium bromide gradients resulted in the resolution of two bands of DNA. Electron microscopic analysis of the DNA of the heavier band showed several molecular forms. The mtDNA from these cells has the same buoyant density and the DNA of the heavier bands from the transformed cells showed a narrow band with the same buoyant density ($\rho=1.699$ g/ml), as that from untransformed hamster embryo cells. The mtDNA from cells transformed by the adenoviruses had a large proportion of normal circular oligomers which were not seen in the control hamster embryo fibroblasts. A low proportion of circular dimers, but an unusually high proportion of catenated oligomers, were seen in cells transformed by SV40 or cells spontaneously transformed following successive subculture.

18 EPSTEIN-BARR VIRUS: TRANSFORMATION, CYTOPATHIC CHANGES, AND VIRAL ANTIGENS IN SQUIRREL MONKEY AND MARMOSET LEUKOCYTES. (E.) Miller, G. (Yale U. Sch. Med., New Haven, Conn.), Shope, H. Lisco, D. Stitt and M. Lipman. *Proc Acad Sci USA* 69(2):383-387, 1972.

Human lymphoblastoid cell lines (SLCL) were established in leukocyte cultures that were exposed to Epstein-Barr virus (EBV) from four adult squirrel monkeys and from one cotton-top marmoset. Only one of 26 squirrel monkey cultures (from six monkeys) and one of six marmoset cultures (from two monkeys) were transformed, in comparison to transformation of all seven human cultures that were exposed to EBV (from one subject). Transformation appeared earlier in the monkey cells than in the human cells. The following evidence supports the hypothesis that EBV was responsible for transformation of the monkey cells. First, EBV antigens were detected by immunofluorescent and complement fixation methods in the transformed cells, EBV particles were seen in the cell line by electron microscopy, and infectious virus was present in both cell lines. Second, the monkey cells that were the source of the transformed leukocytes did not possess EBV antibodies detectable by complement fixation test, and thus were presumably noncarriers of EBV. Third, SLCL formed only in cultures exposed to EBV and not in unexposed cultures. Fourth, the cytopathology seen regularly in the B95-8 line of transformed leukocytes and occasionally in the B95-15 line of squirrel monkey leukocytes, consisting of multinucleated cells with intranuclear inclusions, was compatible with cytopathic effects described for the herpesvirus group, of which EBV is a member. Fifth, the SLCL did not yield cytopathic agents when cocultivated as intact cells or cell extracts in monolayer cultures known to be sensitive to human herpesviruses such as Herpes Salmir. Finally, there was no evidence in the SLCL for the presence of other antigens that reacted with the sera of animals whose leukocytes were transformed.

3119 ERYTHROPOIETIC RESPONSES OF MICE TO INFECTION WITH RAUSCHER LEUKEMIA VIRUS. (E.)

Ebert, P. S. (Natl. Cancer Inst., Bethesda, Md.), N. E. Maestri and M. A. Chirigos. *Cancer Res* 32(1):41-47, 1972.

Erythroblastosis, reticulocytosis, splenomegaly and anemia characterize the prelymphoid leukemic phase of Rauscher leukemia virus (RLV) infection. After RLV (0.2 ml of undiluted spleen extract) was inoculated into 4 to 6 wk-old male Balb/c mice, reticulocyte counts increased and RBC, hematocrit, and hemoglobin levels decreased progressively until the 29th day, followed by a slight increase in all three parameters by the 35th day. Splenic and hepatic δ -aminolevulinic acid synthetase activity, per gram of tissue, decreased, as compared with normal activity, but the spleen increased to 25 times its normal size, and therefore, the net δ -aminolevulinic acid synthetase activity increased 1340% compared to normal spleen activity. Liver weight increased slightly throughout the 35-day observation period, but liver enzyme activity per gram of tissue decreased steadily to 30% of the normal level on the 35th day. Phenylhydrazine treatment was given, to mimic RLV infection, and the mice showed a threefold increase in the specific activity of splenic δ -aminolevulinic acid synthetase but only a small increase in spleen size. The results suggest that the RLV-induced anemia does trigger the same erythropoietic response as does drug-induced anemia. When erythropoietin (ESF) production in RLV-infected mice was studied, low levels of ESF were found in plasma from mice infected with RLV for seven to 35 days, but the ESF activity was inappropriate for the extent of the anemia. Bleeding of RLV-infected mice to stimulate ESF production produced no response, suggesting possible erythropoietic blocking factors, although none were demonstrated.

3120 COMPARISON OF THE EFFECTS OF INOCULATION ROUTES AND VIRAL PREPARATIONS ON LEUKEMOGENESIS. (E.) Mariani, T. (U. Minnesota, Minneapolis), P. B. Dent and R. A. Good. *Proc Soc Exp Biol Med* 138(3):889-892, 1971.

The relative effectiveness in leukemogenesis of the intrathymic and i.p. route of inoculation with Gross passage A (GPA) virus from leukemic tissues or from peritoneal fluid is compared. When inbred 2- to 5-day-old C3H/BI mice were given injections of cell-free filtrates of leukemic tissues, intrathymic administration was more efficient in inducing leukemia than i.p. inoculation. Although the intrathymic dose was only one half of the i.p. dose, 100% of the animals receiving intrathymic injection developed leukemia whereas 82% of those inoculated i.p. developed leukemia. In a second series of experiments cell-free ascitic fluid from animals with transplantable Gross lymphoma was used; all animals receiving the virus intrathymically contracted leukemia, as did 96% of the mice given i.p. injections. It was also found that intrathymic virus injection decreased the latent

period in leukemogenesis. These results support the conclusion that the thymus is a site for primary virus-cell interaction during leukemogenesis.

3121 COMBINED NEOPLASTIC EFFECTS OF VACCINIA VIRUS AND 3-METHYLCHOLANTHRENE. II.

GENETIC FACTORS. (E.) Lilly, F. (Albert Einstein Coll. Med., Bronx, N.Y.) and M. L. Duran-Reynals. *J Nat Cancer Inst* 48(1):105-112, 1972.

Female BALB/c and AKR mice, female offspring of crosses of these two strains, and female offspring of the backcrosses (BALB/c x AKR) F_1 x BALB/c and (BALB/c x AKR) F_1 x AKR, were treated with combinations of cortisone (1 mg daily for five days s.c.), vaccinia virus i.d., and 3-methylcholanthrene (MCA) (1% solution painted daily for five days on shaved flank), and susceptibility to vaccinia dermal infection after cortisone, and to papillomas induced by MCA, was observed. BALB/c parents were highly susceptible to vaccinia dermal infection following cortisone, and to MCA tumorigenesis. AKR parents were resistant to both treatments. F_1 offspring of (BALB/c x AKR) and (AKR x BALB/c) crosses were uniformly susceptible to vaccinia dermal infection, although these offspring were not as highly susceptible as the BALB/c parents. MCA tumorigenesis was enhanced in F_1 hybrids by active vaccinia dermal infection; 15 of 31 F_1 mice given cortisone and MCA, but no vaccinia, developed papillomas, whereas 37 of 43 mice given cortisone and MCA plus vaccinia developed papillomas. Although AKR parents were resistant to vaccinia, 78% of the offspring of the backcross (BALB/c x AKR) F_1 x AKR showed an acute, ulcerative response to the virus. Statistical analysis indicated that susceptibility to vaccinia infection was due to two genes. Backcross studies also showed that enhancement of MCA tumorigenesis by vaccinia depended on mice being genetically susceptible to active infection with vaccinia. The incidence of spontaneous leukemia among mice of the (BALB/c x AKR) F_1 x AKR generation was 41%. Leukemia was more frequent among backcross mice resistant to vaccinia infection than among those susceptible to vaccinia. (55 vs 36%, resp.) It is thought that *H-2* or a closely linked gene is a factor in determining degree of susceptibility to MCA skin tumorigenesis in backcross offspring.

3122 HELPER ACTIVITY OF HUMAN LEUKEMIC TISSUE EXTRACTS FOR LEUKEMIA VIRUS EXPRESSION IN MICE. (E.) Steeves, R. A. (Roswell Park Mem. Inst., Buffalo, N.Y.), A. Fjelde and E. A. Mirand. *Proc Nat Acad Sci USA* 68(10):2391-2395, 1971.

BALB/c mice and their hybrids with DBA/2 mice both carry the *Fv-1^D* allele, which reduces the efficiency of spleen focus formation by N-tropic strains of Friend leukemia virus. The spleens of these resistant mice were subjected *in vivo* to both spleen focus-forming virus (SFFV) and tissue culture extracts of spleens from patients with hematopoietic neoplasms to discover whether a helper virus of the

C-type is employed in human leukemia. Helper activity was definitely found in the human leukemia forms, particularly in chronic myelogenous leukemia, and showed many similarities to that observed with murine leukemia virus (MuLV) preparations. It was readily sedimented from tissue culture supernatant fluids, it required injection along with an N-tropic SFFV indicator into a resistant B-type host, and it was sensitive to UV light. However, preliminary electron microscopy has not revealed obvious C-type or other virus-like particles in the human extracts. Also, it has been impossible to demonstrate rapid growth of the helper-inducing entity in mice or to convert antigenicity of SFFV by mixed "infection" of suckling B-type mice. Finally, MuLV-infected spleen cells seem to be more active *in vitro* than human spleen cells.

3123 HERPES ZOSTER: DEMONSTRATION OF VIRUS IN TRIGEMINAL NERVE AND GANGLION BY IMMUNO-FLUORESCENCE AND ELECTRON MICROSCOPY. (E.) Esiri, M. M. (Public Hlth. Lab., Radcliffe Infirmary, Oxford, England) and A. H. Tomlinson. *J Neurol Sci* 15(1):35-48, 1972.

A successful demonstration of varicella-zoster virus in nerve and ganglion is reported. Autopsy material from a patient who died four days after the onset of ophthalmic herpes zoster included skin, the first division of the trigeminal nerve and the trigeminal ganglion. These specimens were examined by conventional histological methods, electron microscopy, immunofluorescence and virus culture. Skin showed virus particles in the nuclei and cytoplasm of epidermal cells. Neural tissue was found to have virus particles present in the cytoplasm of the perineurial cells, in the cytoplasm and nuclei of Schwann cells and exhibited degeneration of axons and myelin of the frontal nerve. A detailed study of the trigeminal nerve showed severe ganglion cell degeneration and satellite cell disarray at specific sites. Virus was not isolated in tissue culture. These findings suggest that varicella-zoster virus spreads in peripheral nerves by growth in endoneurial cells. The value of using immunofluorescence and electron microscopy for virus infection studies of the nervous system is stressed.

3124 INTEGRATION OF SIMIAN VIRUS 40 DEOXYRIBONUCLEIC ACID INTO THE DEOXYRIBONUCLEIC ACID OF PERMISSIVE MONKEY KIDNEY CELLS. (E.) Hirai, K. (Wistar Inst. Anatomy Biol., Philadelphia, Pa.) and V. Defendi. *J Virol* 9(4):705-707, 1972.

The integration of SV40 DNA into the genome of permissive African green monkey kidney (CV-1) cells was studied by DNA-RNA hybridization. Infected confluent CV-1 cultures were split and grown in D-arabinosyl cytosine (Ara-C, 15 μ g/ml). At various times thereafter, DNA was purified from isolated nuclei by the pH phenol method and C_3Cl_4 equilibrium density centrifugation. Association of SV40 DNA to

SV40 DNA began at about 20 hr postinfection and remained at a constant level up to about 48 hr. The total amount of free SV40 in nuclei progressively increased. Alkaline sucrose gradient centrifugation of a mixture of ^{14}C -leucine- and ^{14}C -lysine-labeled CV-1 nuclei and ^3H -labeled SV40 DNA showed that nuclear DNA was clearly separated from SV40 DNA and protein. At six hr postinfection, most of the DNA hybridizable with ^3H -labeled SV40 complementary RNA (c-RNA) was present in the fractions representing free SV40 DNA. However, at 30 hr postinfection, most of the hybridizable DNA was associated with high-molecular-weight cellular DNA by stable linkages. When CV-1 cells were infected in the absence of Ara-C, a large fraction of the DNA hybridizable with SV40 cRNA was found in the fraction corresponding to SV40 DNA component 1 (3S). The specific activity of hybridizable DNA in the faster-sedimenting fractions was similar to that of the corresponding fractions of cells infected in the presence of Ara-C. It was thus concluded that SV40 DNA was integrated into the DNA of CV-1 cells during the early phases of the replicative cycle of the virus.

5 LOCATION OF FELINE LEUKEMIA-SARCOMA GROUP-SPECIFIC ANTIGEN IN INFECTED HUMAN TISSUE CULTURE CELLS. (E.) Ubertini, T. R. (Cornell U., Ithaca, New York). *Infect Immun* 5(3):400-405, 1972.

Human embryo cells were infected *in vitro* with feline leukemia virus (FeLV, Rickard strain) and feline sarcoma virus (FeSV, GA isolate) and were cultured for seven passages. Infected and uninfected control cell cultures were then prepared for immunofluorescent and immunoenzymatic studies at both the light and electron microscope levels. Both techniques showed the presence of feline leukemia-sarcoma group-specific antigens in the infected cells. The antigens were found to be exclusively cytoplasmic, diffuse and located in discrete cytoplasmic foci. Electron microscopic observation indicated that the antigens were located around lysosomal aggregates. It appeared, therefore, that antigenic expression of the viral genome of FeLV and FeSV followed a pattern similar to that of a variety of oncogenic RNA viruses of various families.

6 COMPARISON OF MURINE SARCOMA VIRUSES IN NONPRODUCER AND S^+L^- -TRANSFORMED CELLS. Aaronson, S. A. (Nat'l. Cancer Inst., Bethesda, Md.), R. H. Bassin and C. Weaver. *J Virol* 9(4):701-707, 1972.

The genetic properties of murine sarcoma virus (MSV) transformed nonproducer rat NRK and transformed sarcoma-positive, leukemia-negative (S^+L^-) mouse 3T3 cells were studied. Whereas the nonproducer cells showed no evidence of spontaneous virus production or viral antigens, the S^+L^- cells released biologically inactive virus-like particles and contained

murine leukemia virus (MuLV) antigens. Each virus was found to be genetically stable through at least two cycles of rescue (by infection with MuLV or treatment with bromodeoxyuridine) and transmission to new cells, as determined by analysis of infectious MSV and MuLV production, MuLV complement-fixation antigens, and virus particle production. The fact that the MSV genomes rescued from nonproducer and S^+L^- cells reproduced their respective phenotypes in a common assay cell (NRK) indicated that cellular factors were not responsible for the observed differences in the behavior of the two viral genomes. The observation that none of the focus-derived lines produced by MSV rescued from S^+L^- cells was of the nonproducer type was consistent with the hypothesis that the MSV genomes present in the nonproducer and S^+L^- cells differed, the latter containing genetic information for at least some viral replication functions. There was no evidence for production of a defective MuLV by S^+L^- cells.

3127 SEPARATION OF RETICULOENDOTHELIOSIS VIRUS FROM AVIAN TUMOR VIRUSES. (E.)

Maldonado, R. L. (Dept. Microbiol., U. Texas, Austin) and H. R. Bose. *J Virol* 8(5):813-815, 1971.

Velocity sedimentation in sucrose was used to separate the reticuloendotheliosis virus (REV) from viruses of the avian tumor group. Rous sarcoma viruses with the envelopes from avian leukosis viruses RAV-2 and RAV-3 were used as representatives of the avian tumor virus. The viruses were cultured separately in secondary chicken embryo cell cultures with Eagle's medium. The monolayers were treated with diethylaminoethyl dextran to enhance virus attachment. Two days after infection ^3H -uridine was added to the REV-infected cultures, and $^{32}\text{PO}_4^{3-}$ was added to the RSV-infected cultures. After a 48-hr labeling period, the culture fluids were removed and the virus particles were concentrated by differential centrifugation. The suspended virus preparations were mixed in equal volumes, layered on a 25 to 42% (W/W) sucrose gradient, and centrifuged at $110,000 \times g$ for four hr resulting in the separation of REV from RSV(RAV-2)-RSV(RAV-3). Isopycnic centrifugation in a CsCl gradient was carried out to determine whether REV has a different buoyant density than members of the avian tumor virus complex. It was found that REV had a buoyant density of 1.203 g/cm^3 whereas the RSV particles banded at a density of 1.242 g/cm^3 . The group-specific antigen of the avian tumor virus group was not detected in concentrated REV preparations disrupted by repeated freeze-thaw cycles. The results indicate that REV is not a member of the avian tumor virus complex.

3128 TEMPERATURE-DEPENDENT ALTERATIONS IN SUGAR TRANSPORT IN CELLS INFECTED BY A TEMPERATURE-SENSITIVE MUTANT OF ROUS SARCOMA VIRUS. (E.)

Martin, G. S. (Dept. Molec. Biol., U. California,

Berkeley), S. Venuta, M. Weber and H. Rubin. *Proc Nat Acad Sci USA* 68(11):2739-2741, 1971.

Chicken-embryo fibroblasts transformed by Rous sarcoma virus (RSV) take up 2-deoxyglucose at a faster rate than uninfected cells, under conditions where transformed and nontransformed cells grow at the same rate. In cells infected by a temperature-sensitive mutant, the stimulation of 2-deoxyglucose uptake is temperature dependent: the increase (3-fold higher) is observed at the permissive (36° C), but not at the nonpermissive (41.5° C) temperature. When infected cells are shifted from the nonpermissive temperature to the permissive temperature, the uptake of 2-deoxyglucose increases from a rate equal to that of uninfected cells to a rate equal to that of cells infected by the wild-type Schmidt-Ruppin Rous sarcoma virus. The reverse change occurs when the infected cells are shifted from the permissive to the nonpermissive temperature. By the use of cytosine arabinoside, an inhibitor of DNA synthesis, it was possible to show that DNA synthesis is neither required for the transformation, which occurs when the infected cells are shifted from the nonpermissive to the permissive temperature, nor for the phenotypic reversion, which occurs in the reverse shift.

3129 EFFECT OF SENDAI VIRUS INFECTION ON LIPID METABOLISM IN CHICK EMBRYO FIBROBLASTS.

(E.) Blair, C. D. (Dept. Bacteriology, Trinity Coll., Dublin, Ireland) and P. J. Brennan. *J Virol* 9(5):813-822, 1972.

Lipid metabolism in primary chick embryo cells abortively infected with Sendai virus was examined, with ³²P-orthophosphate, ¹⁴C-glucose and ¹⁴C-glycerol used as precursors. The various classes of lipids were isolated from cell extracts and identified by paper and silica gel thin-layer chromatography. Incorporation of ³²P-orthophosphate and ¹⁴C-glucose into lipids was increased between three and 24 hr after infection. Synthesis of all individual phospholipids was about equally stimulated. Evidence of increased lipid synthesis was also found in more productively-infected rhesus monkey MK cells. Although incorporation of ¹⁴C-glycerol into lipids of infected cells was increased when the precursor was present in high concentrations, incorporation of minute quantities of high-specific-activity ¹⁴C-glycerol was inhibited. This suggested that Sendai virus infection was in some way inhibiting the membrane transport process of ¹⁴C-glycerol, possibly by binding to the transport sites. Even though incorporation of radioactivity from ¹⁴C-glucose was stimulated during long labeling periods, the uptake of this precursor during short pulses was inhibited in infected cells. Results from ¹⁴C-glucose and ¹⁴C-glycerol labeling experiments indicated that when overall incorporation was inhibited in Sendai virus-infected chick embryo cells, increased triglyceride synthesis still occurred. Incorporation of ¹⁴C-glucose into nonlipid components was also stimulated in virus-infected cells, indicating that a general enhancement of metabolism had occurred.

3130 MORPHOLOGY OF TUMORS INDUCED IN HAMSTERS BY CELO VIRUS, TUMOUR TISSUE, AND TUMOUR CELLS GROWN IN CULTURE. (E.) Mancini, L. O. Dept. Animal Path., U. Rhode Island, Kingston), V. Jasty, J. Anderson and V. J. Yates. *Brit J Cancer* 26(1):28-33, 1972.

Tumors were produced in Syrian golden hamsters by s.c. inoculation of chicken-embryo-lethal-orphan (CELO) virus, by transplantation of CELO-induced tumor tissue, or by s.c. inoculation of cells cultured from CELO-induced neoplasms. Tumors were first detected three weeks to eight months post-inoculation, depending on the type of cells implanted. All tumors were fibrosarcomas which were well-circumscribed, solid and covered by a thin capsule-like structure. Histological differences were apparent among the tumors produced by the three inocula. Neoplasms induced by CELO virus were generally less differentiated and were composed of cells with polygonal or oval nuclei and indistinct cytoplasmic boundaries; numerous multinucleated, bizarre giant cells were found. Tumors produced by tumor tissue transplants were more differentiated and were composed of spindle-shaped cells with abundant collagen formation. Neoplasms induced by tumor cells grown in tissue culture were generally undifferentiated with many mitotic figures and numerous giant cells. Cells from tumors induced by CELO virus or tumor transplants produced similar morphologies when cultured *in vitro*. Cell cultures consisted of large cells with oval or rounded large nuclei and prominent nucleoli; multinucleated giant cells, cells in mitosis, and a disorganized growth pattern were also characteristic. However, mitosis and a piling-up of cells occurred more frequently in cultures derived from the CELO virus-induced tumor.

3131 RNA IN HUMAN LEUKEMIC CELLS RELATED TO THE RNA OF A MOUSE LEUKEMIA VIRUS. (E.)

Héhlmann, R. (Coll Phys. Surg., Columbia U., New York, N.Y.), D. Kufe and S. Spiegelman. *Proc Nat Acad Sci USA* 69(2):435-439, 1972.

Molecular hybridization with radioactively labeled DNA complementary to the RNA of the Rauscher leukemia virus was used to probe for homologous RNA in the polysome fraction of human leukemic cells. The leukocytes of 24 out of 27 patients examined contained RNA possessing homology to that of the mouse leukemia agent, but not to that of the unrelated viruses causing mammary tumors in mice or myeloblastosis in chickens. Further, no control human leukocytes or other adult and fetal tissues showed significant levels of the leukemia-specific RNA. It would appear that human leukemic cells contain RNA sequences homologous to those found in a viral agent known to cause leukemia in an experimental animal. The fact that human sarcomas have also been shown to contain this type of RNA points to a remarkable parallelism in the leukemias and sarcomas of mice and men.

3132 DEFICIENCY OF VIRAL RIBONUCLEIC ACID-DEPENDENT DEOXYRIBONUCLEIC ACID POLYMERASE IN NONINFECTIONOUS VIRUS-LIKE PARTICLES RELEASED FROM MURINE SARCOMA VIRUS-TRANSFORMED HAMSTER CELLS. (E.) Peebles, P. T. (Natl. Cancer Inst., Bethesda, Md.), D. K. Haapala and A. F. Gazdar. *J Virol* 9(3): 488-493, 1972.

RNA-dependent DNA polymerase activity was assayed in mouse 3T3FL cells infected with murine leukemia virus (MuLV) or with a new strain (S+H-) of murine sarcoma virus (MSV). S+H- MSV-transformed cells are MSV-positive (S+) and leukemia helper virus-negative (H-) and release noninfectious virus particles. Endogenous polymerase activity, determined by ³H-TMP incorporation in cell-free extracts, was very low in S+H--infected cells (534 cpm/90 min) compared with that of MuLV-infected cells (12,000 cpm/90 min). The synthetic RNA-DNA template poly rA·dT₍₁₂₋₁₈₎ stimulated S+H- polymerase activity only twofold, whereas MuLV enzyme activity was increased 200-fold. The noninfectious virions showed a similar lack of endogenous and poly rA·dT₍₁₂₋₁₈₎-stimulated RNA-dependent DNA polymerase activity. No inhibition of MuLV enzyme activity was found in mixtures of MuLV and S+H- MSV, indicating that the enzyme deficiency in S+H- virions was not due to an inhibitor or to a more rapid degradation of substrate, template or product. Since neither the noninfectious virions nor the S+H- MSV-infected cells had detectable replicating leukemia helper virus, it was suggested that the leukemia virus genome may be required for production of infectious sarcoma virus by contributing information needed for the full expression of functional viral-type reverse transcriptase.

3133 MALIGNANT CELL TRANSFORMATION BY THE SV-40 DNA AND PHAGOCYTIC ACTIVITY RELATED TO ALTERATION OF CELL MEMBRANES. (E.) Kimoto, T. (Osaka U. Med. Sch., Japan), E. Yokomura, K. Moriwaki and M. Yamakawa. *Acta Med Okayama* 25(1):1-12, 1970.

Cultured primary human, hamster and mouse embryo cells which were exposed to purified SV40 DNA for two hr underwent morphological transformation three months later. The transformed cells were epithelioid; multinucleated giant cells were also present. Indirect immunofluorescence revealed the presence of group-specific tumor antigen. Cells were studied for their ability to phagocytize iron chondroitin sulphate (Cs-Fe) particles. After 24 hr, none of the transformed cells showed phagocytic activity, whereas the nontransformed cells showed moderate phagocytosis. However, in the presence of arginine-rich histone at concentrations that did not affect the growth of transformed cells (100-250 µg/ml), transformed human and hamster cells actively phagocytized the Cs-Fe particles. Results of experiments in which cells were treated with various proteolytic and glycolytic enzymes indicated that substances on the cell surfaces of hamster fibroblasts were sialic acids. No difference, however, was observed between the quantity of sialic acids on normal and transformed hamster fibroblasts by electron microscopic histochemical techniques. These results indicated

that the cell membrane structures of transformants which were altered were, at least in part, those responsible for surface change; however, the alterations in phagocytic ability upon transformation were probably due to actual changes in membrane composition rather than to changes in surface coat (i.e., sialic acid).

3134 SIMIAN TUMOR VIRUS ISOLATE: DEMONSTRATION OF CYTOPATHIC EFFECTS *IN VITRO*. (E.)

Fine, D. L. (Bionetics Res. Lab., Kensington, Md.), J. C. Landon and M. T. Kubicek. *Science* 174(4007): 420-421, 1971.

Twenty-one different fetal and infant rhesus monkey and human cell lines were inoculated with Mason-Pfizer monkey virus (MPMV) and observed daily for cytopathic effect (CPE). Control cultures were inoculated with medium, without MPMV. Positive CPE's were repeatedly observed in lines from rhesus foreskin and lung and from human foreskin as early as 24 hr after inoculation with several lots of high-titered virus. CPE's were also seen 24 hr after inoculation of MPMV-infected NC37 cells onto fetal foreskin and lung cell monolayers and six days after inoculation onto tooth bud and heart cell cultures. CPE's were characterized by multinucleated cells containing as many as 18 nuclei, which were generally clustered within the affected cells and surrounded by a large cytoplasmic area. Electron microscopic observation showed the presence of intranuclear, electron-dense, ring-shaped, 81- to 85-nm particles in the infected cells. Examination of purified virus-pellet sections showed similar structures. Twenty-four to 48 hr after infection with one lot of high-titered MPMV, cultures showed areas of clustered, rounded cells, loosely adhering to the culture surface. This change appeared to be associated with a proliferative cellular response.

3135 MURINE SARCOMA AND LEUKEMIA VIRUSES: GENETIC DIFFERENCES DETERMINED BY RNA-DNA HYBRIDIZATION. (E.) Stephenson, J. R. (Natl. Cancer Inst., Bethesda, Md.) and S. A. Anderson. *Virology* 46(2):480-484, 1971.

A relative measure of the genetic information of the Kirsten strains of murine sarcoma virus, KiMSV (KiMuLV), and murine leukemia virus (KiMuLV) is obtained by comparing the ability of *in vitro* DNA products to hybridize with 60-70S viral DNA. KiMuLV and KiMSV (KiMuLV) *in vitro* DNA products were made, and ³²P-labeled 70S RNA was prepared from the supernatant fractions of infected cultures. To determine whether DNA preparations were complementary to the majority of their respective 70S RNA, 70S KiMSV (KiMuLV) RNA was hybridized with its homologous *in vitro* DNA product (0.1-0.2 µg.) resulting in up to 80% protection of the viral RNA from RNase digestion. Similar results were obtained using KiMuLV, ruling out the possibility of preferential transcription of either the sarcoma or leukemia genetic information during *in vitro* DNA synthesis.

3136 INHIBITORY EFFECT OF RIFAMPICIN ON RAUSCHER-VIRUS-INDUCED MURINE LEUKAEMIA. (E.)

Gielkens, A. L. J. (Dept. Biochem., U. Nijmegen, Netherlands), J. Th. M. Burghouts and H. Bloemendal. *Int J Cancer* 9(3):595-598, 1972.

Three-week-old random-bred female Swiss mice who were given i.p. injections of a homogenate of Rauscher virus-induced leukemic spleen, were then given daily oral doses of rifampicin mixed with food, beginning at different times and continued until the 28th day after infection. The animals were then sacrificed and their spleens were weighed. Administration of 5 mg rifampicin/day, starting on day 7, resulted in a 62% reduction of spleen enlargement. Inhibition was greatest (90%) when rifampicin administration was started immediately after infection. Pretreatment of mice with rifampicin for seven days prior to virus infection did not enhance its inhibitory effect. The inhibitory effect of rifampicin was dose-dependent. A single dose of 1250 mg/kg body weight of rifampicin, administered on day 7, was not lethal. It is suggested that rifampicin was more toxic to transformed than to normal cells and that these results might have important implications for a rational leukemia therapy.

3137 MORPHOLOGICAL AND BIOPHYSICAL PROPERTIES OF THE MASON-PFIZER MONKEY VIRUS. (E.)

Manning, J. S. (Sch. Public Hlth., U. California, Berkeley) and A. J. Hackett. *J Nat Cancer Inst* 48(2):417-422, 1972.

Mason-Pfizer monkey virus (M-PMV) was characterized in a line of rhesus monkey embryonic lung cells infected with a cell-free filtrate from a mammary carcinoma cultured from another rhesus monkey (designated MEL III). With one exception, electron microscopy of MEL III cell pellets failed to show the presence of virus particles budding from the cell membrane. Inter-cellular A-type particles were not detected. Numerous virus particles, however, were detected in cell-free extracellular fluid after precipitation with cold saturated ammonium sulfate. Enveloped virus particles had a diameter of 110 mμ. Most virions had a condensed, eccentrically located nucleoid. Several particles contained a distinct intermediate membrane surrounding the nucleoid. Spikelike surface projections were not detected on virus particles. Centrifugation of tissue fluids pre-labeled with ³H-uridine for 16 hr in sucrose gradients led to the formation of a single sharp zone of acid-insoluble material with a peak density of 1.55 g/ml. Incorporation of ³H-uridine into these virus particles was inhibited by 0.05 μg/ml actinomycin D. Cosedimentation with 18S and 28S marker, after extraction with 1% SDS and pronase, indicated a sedimentation coefficient of approximately 65S for M-PMV RNA. Polyacrylamide gel electrophoresis of M-PMV RNA indicated a molecular weight of approximately 7x10⁶ daltons. Several independent lines of evidence indicated that the cultures were free of simian foamy virus. Sucrose density gradient analysis of cell-free fluids from chimpanzee lung cells previously cocultivated with MEL III cells or

with cell-free fluids from MEL III cells showed that virus had been transmitted to the chimpanzee cells.

3138 SV40-INDUCED TRANSFORMATION OF CELLS OF THE LIZARD *GEKKO GEKKO*. (E.) Clark, H. F.

(Wistar Inst. Anatomy Biol., Philadelphia, Pa.), F. Jensen and V. Defendi. *Int J Cancer* 9(3):599-607, 1972.

Attempts to infect four cell lines of reptilian origin, GL1 (*Gekko gekko*), IgH-2 (*Iguana iguana*) and VH2 and VSW (both *Vipera russelli*), with SV40 strain RH911 led to successful infection of only the lizard line, GL1. SV40 infection was determined by the appearance of persisting T antigen in 100% of the cell population (as shown by indirect immunofluorescence) and was obtained in cells inoculated and maintained at 23, 30 or 35 C (GL1 cells grown optimally at 30 C). In early passages, infected GL1 cells exhibited a more orderly growth pattern and a more uniform cell morphology than did uninfected control cells. However, at about the 50th passage level after infection, a more exuberant growth pattern developed, characterized by cell saturation densities exceeding those of control cell cultures by approximately threefold. Infectious virus in low titer was recovered from the cells and media of infected cell lines tested during the first 21 passages after infection. At subsequent passage levels, virus could be rescued from cells maintained at 23, 30 or 35 C only by cocultivation with African green monkey kidney (AGMK) cells. The presence of SV40 tumor-specific transplantation antigen was demonstrated by experiments in which hamsters inoculated with infected GL1 cells received marked protection against SV40 tumor induction. The SV40-infected cells showed increased resistance to inhibition of cell growth by dextran sulfate and an enhanced ability to multiply at supraoptimal temperatures. The viral transformation of the poikilothermic GL1 cells represents a considerable phylogenetic extension of the range of host cells known to be transformable by SV40.

3139 THE SECONDARY STRUCTURE OF REPLICATING POLYOMA VIRUS DNA. (E.) Bourgaux-Ramoisy, D.

(U. Hosp. Ctr., U. Sherbrooke, Quebec, Canada). *Biochim Biophys Acta* 254(3):412-414, 1971.

The replicative intermediate of polyoma virus DNA, referred to as II*, consists of both double- and single-stranded portions. To analyze the extent of each portion, polyoma virus DNA was extracted from infected mouse embryo cells, labeled with tritiated thymidine, and extensively sonicated. The DNA fragments were eluted, first with saline to isolate the mature double-stranded fragments, and then with a saline-caffeine solution to isolate the single-stranded parts. Each elution was then treated with nuclease. Nuclease treatment did not result in any reduction of the acid-precipitable radioactivity present in the saline fraction, while it did result

In a 10% reduction of tritium counts in the caffeine fraction. It is concluded that the single-stranded regions of DNA II* are, at most, 1 to 2% of its length, or approximately 200 nucleotides; this material might be part of the growing points.

3140 PATTERN OF PROTEIN SYNTHESIS IN MONKEY CELLS INFECTED BY SIMIAN VIRUS 40. (E.) Anderson, C. W. (Cold Spring Harbor Lab., New York) and R. F. Gesteland. *J Virol* 9(5):758-765, 1972.

The pattern of protein synthesis in permanent monkey cell lines (CV-1, BSC-1 and MA-134) infected with simian virus 40 (SV40) was analyzed by SDS-polyacrylamide gel electrophoresis of ³⁵S-methionine-labeled extracts. During the first 15 hr after SV40 infection, very little change was seen in protein patterns. Between 15 and 18 hr after infection, a new band (IVP1) appeared which co-migrated with the major capsid protein from purified SV40 (VP1; 43,000 daltons). Three hr later, two more virus-specific bands appeared. One (IVP3) co-migrated with the minor capsid protein, VP3. The second (IVP3.5) migrated between the VP3 and VP4 marker proteins (m.w.=15,000 daltons) and did not correspond to any of the six virion capsid proteins previously reported. The non-capsid protein band (IVP3.5) was induced in the CV-1 and BSC-1 but not the MA-134 cultures by SV40 infection. A fourth virus-induced protein (IVP2; 32,000 daltons) was observed 24 hr after infection. All four proteins appeared to be synthesized at increasing rates as infection progressed. Experiments using inhibitors of SV40 DNA synthesis (ara-C and FUDR) showed that production of all four virus-induced proteins was dependent upon viral DNA synthesis (identified by neutral and alkaline gradient centrifugation with labeled SV40 DNA as marker).

3141 CELL-DEPENDENT DIFFERENCES IN THE PRODUCTION OF INFECTIONOUS HERPES SIMPLEX VIRUS AT A SUPRAOPTIMAL TEMPERATURE. (E.) Crouch, N. A., Milton S. Hershey Med. Ctr., Pennsylvania St. U., (Hershey) and F. Rapp. *J Virol* 9(2):223-230, 1972.

The replication of herpes simplex virus (HSV) was compared in rabbit and hamster cells at optimal and supraoptimal temperatures. Replication occurred in cells of either species at 33 C, but the total infectious virus yield was routinely about tenfold greater in rabbit cells than in hamster cells. At 39 C, this difference was exaggerated to greater than 100,000-fold. Whereas infectious virus was produced and plaques formed in rabbit kidney cell monolayers at the higher temperature, neither developed in those derived from hamster embryos. Elevating the temperature from 33 C to 39 C at various time intervals after exposure of the cultures to virus revealed that production of infectious virus in hamster cells was completely heat-sensitive up to six hr after infection. Specific viral antigens and viral deoxyribonucleic acid (DNA) were

synthesized in both rabbit and hamster cell cultures. In addition, cellular DNA synthesis was depressed and cytopathic effects occurred in both cell systems. These cytopathic effects were not observed in cell cultures treated with HSV previously inactivated with ultraviolet light. Compared with parallel cultures at 33 C, the amount of viral DNA synthesized at 39 C was greatly reduced in both systems. In hamster cells, the reduction was two-fold greater than in rabbit cells. This cell-dependent thermal inhibition of HSV replication in hamster cells did not occur with vaccinia virus.

3142 ELECTRON MICROSCOPE STUDY OF A BALB/c LEUKEMIA VIRUS IN CELL CULTURE SYSTEMS. (E.) Lambertenghi, G. (Sloan-Kettering Inst. Cancer Res., New York, N.Y.), E. de Harven, T. Sato and J. R. Tennant. *Cancer Res* 32(6):1108-1116, 1972.

B/T-L virus, a BALB/c leukemia virus member of the MuLV group, was grown in two cell lines (A and D) originating from normal, infant BALB/c thymus tissue. Cell pellets from lines A (epithelioid) and D (fibroblastic), observed under the electron microscope, showed large numbers of virus particles, mostly C-type, within the extracellular spaces or in contact with the cell surfaces. Cells from old (10-21 days after seeding) confluent monolayer cultures practically never showed budding virus; however, budding viruses were readily observed in all young cultures (2-3 days after seeding). The level of phagocytosis of viral particles, evaluated by the number of phagolysosomes containing viruses, was high in the D cells, but rare in the A line cells. Structurally damaged C-type particles were frequently recognized within phagolysosomes. The membranes limiting the phagolysosomes showed no continuity with other recognizable cytoplasmic organelles and apparently never participated in virus budding. Virus phagocytosis in D line cells was also demonstrated by the combined methods of ferritin tracing, lanthanum staining and acid phosphatase localization. The phagolysosomes could clearly be distinguished from other virus-containing cytoplasmic vacuolar structures which were limited by membranes along which virus budding could be seen.

3143 RESTRICTION BY POLYCATIONS OF INFECTION WITH MYXOMA VIRUS IN RABBITS. (E.)

Wegner, D. L. (Dept. Med. Microbiol., U. Wisconsin, Madison) and H. C. Hinze. *J Infect Dis* 125(2):141-145, 1972.

The effect of polycations on progressive infection of New Zealand white rabbit myxoma virus was studied. Intradermal injection of a mixture of 50 pfu of virus and 9 mg of the polycations, DEAE-dextran, polyornithine, polylysine, produced slightly raised, circular lesions at the injection site but did not cause secondary lesions or other symptoms of systemic disease. All control animals injected with virus in balanced saline followed the classic clinical progression of myxomatosis. In contrast,

weanlings receiving this dose, or adults receiving a larger dose of virus (3×10^5 pfu mixed with 9 mg DEAE-dextran) were not protected from systemic myxomatosis. Administration of DEAE-dextran into the inoculation site either before or after virus infection, or systemic (i.v. or i.p.) inoculation also did not protect animals from progressive disease. DEAE-dextran, when mixed with the related Shope rabbit-fibroma virus and injected intradermally into rabbits, resulted in reduced size of virus induced tumors compared with controls. DEAE-dextran had no effect on the outcome of disease caused by the unrelated pseudorabies virus. The inability of dextran and dextran sulfate to prevent systemic myxomatosis suggests that positive charge, rather than the nature of the molecular backbone, is important in the inhibitory process. Treatment with DEAE-dextran slowed down myxoma virus multiplication and inhibited viremia in infected animals. DEAE-dextran had no enhancing influence on immune response in infected rabbits.

3144 CHROMATOGRAPHIC SEPARATION AND ANTIGENIC ANALYSIS OF PROTEINS OF THE ONCORNAVIRUSES: II. MAMMALIAN LEUKEMIA-SARCOMA VIRUSES. (E.)

Nowinski, R. C. (Sloan-Kettering Inst. Cancer Res., New York, N.Y.), E. Fleissner, N. H. Sarkar and T. Aoki. *J Virol* 9(2):359-366, 1972.

Isotopically prelabeled proteins of leukemia and sarcoma viruses from chicken (AvLV), mouse (MuLV), hamster (HaSV), and cat (FeLV) were analyzed by gel filtration in guanidine hydrochloride. The mammalian viruses contained six major proteins, two of which (m1 and m2) were glycoproteins as judged by their ability to incorporate ^3H -glucosamine. Avian viruses contained seven major proteins. Viral proteins from the different mammalian species had the same molecular wt which also closely resembled the molecular wt of the six equivalent avian viral proteins. Thus, a basic similarity in protein composition was demonstrated between the C-type viruses of avian and mammalian origin. The two glycoproteins (m1 and m2) of murine leukemia virus (MuLV) were identified by "immune electron microscopy" and by indirect immunofluorescence (IF) as constituents of the viral membrane. Antisera prepared against other proteins distinguished individual internal viral antigens in immunodiffusion tests and also reacted in IF with cytoplasmic components of infected cells. Antisera which reacted with the major internal viral proteins did not contain antibodies inhibitory to the viral reverse transcriptase.

3145 HEMOPOIESIS IN RAUSCHER-LEUKEMIA AND THE EFFECT OF HYPERTRANSFUSION (STUDIES WITH BALB/c MICE). (Ger.) Seidel, H.-J. (Div. Clin. Physiol., Ulm U., Germany). *Z Krebsforsch* 77:155-165, 1972.

3146 SPONTANEOUS REGRESSION OF RAUSCHER LEUKEMIA IN AKR MICE. (Rus.) Tsytina, E. N. (Acad.

Med. Sci. USSR, Moscow) and I. S. Irlin. *Soviet Med Biol Med* (12):68-71, 1971.

3147 SENSITIVITY OF NORMAL AND POLIOMA-VIRUS-TRANSFORMED MOUSE AND HAMSTER CELLS TO THE TOXIC ACTION OF ANTINEOPLASTIC AGENTS *IN VITRO*. (Rus.) Parkhomenko, I. I. (USSR Acad. Sci., Moscow), N. I. Surikova and N. P. Konovalova. *Farmakol Tossik* 34(6):723-725, 1971.

3148 VIRAL INTERFERENCE OF TYPES 1 AND 2 PLAQUE-PRODUCING AGENTS DERIVED FROM CAL-1 STRAIN OF MAREK'S DISEASE HERPESVIRUS AND TURKEY HERPESVIRUS. (E.) Kaleta, E. F. (Sch. Vet. Med., U. California, Davis) and R. A. Bankowski. *J Nat Cancer Inst* 48(5):1303-1310, 1972.

3149 EFFECT OF POLY I:C-INDUCED INTERFERON ON HERPES VIRUS HOMINIS INFECTION *IN VITRO* AND *IN VIVO*. (E.) Munk, K. (German Cancer Res. Ctr., Heidelberg) and T. Frick. *Z Naturforsch* 27(3):220-222, 1972.

3150 DIFFERENTIAL RELEASE OF CELLULAR LACTATE DEHYDROGENASE DURING REPLICATION OF ADENOVIRUS TYPES 5 AND 12. (E.) Bardell, D. (Dept. Microbiol., U. New Hampshire, Durham) and T. G. Metcalf. *J Gen Virol* 14:219-222, 1972.

3151 MORPHOLOGICAL STUDIES ON HERPESVIRUS SYLVILAGUS IN RABBIT KIDNEY CELL CULTURES. (E.) Heine, U. (Nat. Cancer Inst., Bethesda, Md.) and H. C. Hinze. *Cancer Res* 32(6):1340-1350, 1972.

3152 MAREK'S DISEASE HERPESVIRUS PARTICLES IN TISSUES FROM CHICKENS FREE OF PRECIPITATING ANTIBODIES. (E.) Frazier, J. A. (Houghton Poultry Res. Station, Huntingdon, England) and P. M. Biggs. *J Nat Cancer Inst* 48(5):1519-1523, 1972.

3153 SIMIAN SARCOMA VIRUS, TYPE 1 (LAGOTHRIX): FOCUS ASSAY AND DEMONSTRATION OF NONTRANSFORMING ASSOCIATED VIRUS. (E.) Wolfe, L. G. (Rush-Presbyterian St. Luke's Med. Ctr., Chicago, Ill.), R. K. Smith and F. Deinhardt. *J Nat Cancer Inst* 48(6):1905-1908, 1972.

3154 APPLICATION OF LASER BEAT FREQUENCY SPECTROSCOPY TO THE DETECTION AND CHARACTERIZATION OF AN ONCOGENIC RNA VIRUS. (E.) Salmeen, I. (Ford Motor Co., Sci. Res. Staff, Dearborn, Mich.), D. Gill and L. Rimai. *Biochim Biophys Res Commun* 47(5):1172-1178, 1972.

- 5 MODULATION OF TRANSFER RNA-METHYLATING EN-
ZYME ACTIVITIES IN MURINE LEUKEMIC CELLS.
Hacker, B. (U. Rochester Sch. Med. Dentistry,
.). *Cancer Res* 32(6):1143-1147, 1972.

See also:

- * (Rev): 2905, 2909
- * (Immun): 3166, 3167, 3171, 3193, 3200, 3204,
3223, 3227

- 3156 NONSPECIFIC STIMULATION OF TUMOR-ASSOCIATED IMMUNITY BY METHANOL-SOLUBLE FRACTION OF *MYCOBACTERIUM BUTYRICUM*. (E.) Esber, H. J. (Mason Res. Inst., Worcester, Mass.) F. F. Menninger, Jr., D. J. Taylor and A. E. Bogden. *Cancer Res* 32(4): 795-803, 1972.

Methanol-soluble fractions of *Mycobacterium butyricum* (MSF-MB) were prepared and injected i.p. into rats in amounts of 0.625 to 40 mg/rat at intervals from 21 days before to four days after injection with sheep erythrocytes (SRBC). The heteroantibody response of rats to SRBC, as modified by MSF-MB, was observed in rats bled at seven, 14, 21 or 28 days post-SRBC. MSF-MB induced a significant enhancement of antibody response to SRBC; the antibody response paralleled MSF-MB dose increase, reaching maximal levels at 10 mg/rat. Optimal enhancement of the antibody response was seen when this dose of MSF-MB was given ten days before SRBC. When MSF-MB was given seven days before SRBC, peak enhancement of the antibody response was seen seven days post-SRBC. When MSF-MB was given simultaneously with, or two to four days after SRBC, peak antibody response was seen on day 14 post-SRBC. The antibody response in MSF-MB-treated rats persisted at high levels for 28 days post-SRBC. Rats bearing grafted mammary adenocarcinomas (13762 and R-35), squamous prostatic carcinomas (11095), or acute monocytic leukemia (R3149), showed a suppressed heteroantibody response to SRBC when tumor-bearing rats were challenged with SRBC during the early or midlog phases of tumor growth. MSF-MB not only abrogated the immunosuppressive effect of grafted 13762 mammary adenocarcinoma and 11095 prostatic carcinoma, but also significantly enhanced the heteroantibody response to SRBC in rats bearing the R-35 mammary tumor or the R3149 leukemia.

- 3157 THE AUSTRALIA ANTIGEN IN AFRICANS FROM DAKAR WITH CIRRHOSIS AND PRIMARY CANCER OF THE LIVER. (Fr.) Sankale, M. (Joint Fac. Med. Pharmacy, Dakar, Senegal), I. Seck, J. Linhard, A.-A. Thiam, A.-B. Wane, G. Diebolt and A. Poll-Gouater. *Bull Soc Med Afr Noire Lang Franc* 16(2): 167-171, 1971.

Ouchterlony's immunodiffusion method was used to test 955 sera from African patients hospitalized at a Dakar hospital for the presence of the Au-1 antigen and its corresponding antibody. These patients included 45 with cirrhosis and 64 with primary liver cancer. Of these 955 sera, 110 (11.5%) were positive for Au-1 and 4 (0.4%) were positive for anti-Au-1. Au-1 antigen was found in 27 of the 64 patients with liver cancer (42.4%), in 11 of the 45 cirrhotics (24.5%), and in 72 of the remaining patients (8.5%). A previous study showed that only 2% of Dakar blood donors had Au-1 antigen and none had the corresponding antibody. Therefore, it is concluded that the Australia antigen is significantly more common among patients with cirrhosis and primary liver cancer than it is in the general population. The incidence of the antigen is significantly higher among liver cancer patients than among cirrhotics.

- 3158 AUTOIMMUNE-LIKE ANTIBODIES TO THE LIGAND-BINDING SITES OF MYELOMA PROTEINS. (E.) Sirisinha, S. (Washington U. Sch. Med., St. Louis, Missouri) and H. N. Eisen. *Proc Natl Acad Sci USA* 68(12):3130-3135, 1971.

BALB/c mice were immunized with three A-myeloma proteins of BALB/c-2 or BALB/c origin (produced by plasmacytomas MOPC-315, MOPC-460, Adj. PC-22A). Non cross-reacting antibodies were formed against Proteins-315 and 460, but the response to Protein-22A was marginal. Proteins-315 and 460 have anti-dinitrophenyl activity, and their reactions with the corresponding BALB/c antibodies were inhibited by dinitrophenyl ligands. It appears that antibodies can be formed in BALB/c mice against unique "idiotypic" determinants in the ligand-binding sites of some BALB/c myeloma proteins.

- 3159 CENTRAL INHIBITION OF CELLULAR IMMUNITY TO LEUKEMIA L1210 BY ISOANTIBODY. (E.) Mitchell, M. S. (Yale U. Sch. Med., New Haven, Conn.). *Cancer Res* 32(4):825-831, 1972.

Four injections of 0.1 ml hyperimmune antibody (Ab) to leukemia L1210 were given to C57BL/6J (C57) mice before or after challenge with viable L1210 cells. Ab consisted of antibody-rich ascitic fluid from C57 mice immunized with repeated injections of L1210 cells. Cellular immunity of AB-treated mice to L1210 cells was measured *in vitro* by observing the ability of their spleen cells to lyse cells of a mastocytoma line. Ab given one to four days before L1210 challenge completely suppressed spleen cell-mediated immunity; spleen cells of mice not given Ab and challenged with L1210 lysed 93-96% of mastocytoma cells, while spleen cells from Ab-treated mice failed to lyse any mastocytoma cells. Ab given one to four days after L1210 cells was relatively ineffective in suppressing immunity. The inhibitory effect of Ab was limited to cellular immunity; formation of isohemagglutinins and cytotoxic antibodies in Ab-treated mice was usually unaffected. The number of L1210 cells was reduced considerably in challenged mice given Ab before or after challenge. The reduced number of tumor cells did not entirely explain the decrease in cellular immunity, however. Pretreatment of mice spleen cells with Ab *in vivo* or *in vitro* before injection into lethally irradiated mice prevented development of cellular immunity to a challenge with L1210 cells. Normal bone marrow cells, injected with Ab-treated spleen cells, partially repleted immunity in irradiated recipients. When the IgG and IgM fractions of Ab were injected separately into recipients prior to L1210 challenge, it was found that the inhibition of immunity achieved by whole Ab was duplicated by its IgG fraction.

- 3160 MEDIATION OF IMMUNITY TO TUMOR-SPECIFIC TRANSPLANTATION ANTIGENS BY RNA INHIBITION OF ISOGRAFT GROWTH IN RATS. (E.) Deckers, P. J.

tl. Cancer Inst., Bethesda, Md.) and Y. H. Pilch. *Cancer Res* 32(4):839-846, 1972.

cher 344/N rats were inoculated s.c. with 10^5 ble cells of a benzo(a)pyrene-induced sarcoma (BP-1R); when palpable tumors appeared they were used to render rats immune to BP-1R. While 90% rats which were not thus immunized developed tumors after challenge with 10^5 BP-1R cells, all immunized rats rejected challenge BP-1R isografts. A study of the adoptive transfer of immunity to BP-1R, rats were inoculated with BP-1R, tumor-bearing rats were amputated, and amputees were challenged with BP-1R cells and found to be immune to BP-1R isografts. Immune rats were given additional inocula of BP-1R cells, and killed; spleens were removed and suspensions of spleen cells from immune rats and from rats not immunized by amputation of sarcoma-bearing limbs were injected into normal recipients. Recipients were challenged with BP-1R cells, those given immune spleen cells resisted the challenge isograft, while those given spleen cells from non-immune rats were not resistant. In related experiments, rats were immunized to BP-1R by amputation of sarcoma-bearing limbs after tumor cell inoculation. Immunized rats were given three doses of BP-1R cells and killed. Spleen cells from non-immune rats were incubated with RNA from immune rats' spleen cells and injected into recipients which were later given challenge inocula of BP-1R cells. The growth of sarcomas arising in rats immunized with spleen cells treated with immune rats' RNA was retarded as compared to tumor growth in rats given spleen cells preincubated with RNA from an unimmunized rat spleen, or in rats given non-treated spleen cells. When BP-1R isografts were inoculated together with the first of three injections of spleen cells incubated with immune rats' RNA, the incidence of development of tumor isografts was reduced as compared to the incidence in recipients of untreated spleen cells. When immune RNA preparations were treated with RNase before incubation with rat spleen cells, the ability of this RNA to inhibit tumor isograft growth and development was abolished.

IMMUNOTHERAPY OF FRIEND DISEASE IN MICE EMPLOYING VIABLE BCG VACCINE. (E.)

on, C. L. (Dept. Microbiol., U. Montana, Missoula), R. E. Baker, R. N. Ushijima, M. B. R and C. Gillespie. *Proc Soc Exp Biol Med* 140:700-702, 1972.

Effect of administration of *Mycobacterium bovis* BCG to Friend's disease virus (FDV)-infected mice was studied. Animals treated by i.v. injection of BCG vaccine (4×10^6 U) three wk after infection with FDV had an increased survival time compared to unimmunized, infected mice. The survival rate at 1 wk after challenge with FDV was 29% (8 of 27) in infected unimmunized mice and 67% (14 of 21) for infected immunized animals. In a second series of experiments, FDV-infected mice were vaccinated i.v. with BCG after seven days and again s.c. on days 14

and 21. The spleens of all mice were examined after 28 days. Spleens of infected unvaccinated mice were greatly enlarged compared to those of normal control mice, but the spleens of infected vaccinated mice were only slightly larger than those of vaccinated uninfected controls. FDV plaque counts were fewer in spleens of vaccinated mice than in those of unvaccinated animals. Infected vaccinated animals took 6-8 wk longer than unvaccinated infected mice to attain a 50% mortality rate.

3162 IMMUNOLOGICAL STUDIES ON URINARY BLADDER TUMORS OF RATS AND MICE. (E.) Taranger,

L. A. (U. Washington Med. Sch., Seattle), W. H. Chapman, I. Hellström and K. E. Hellström. *Science* 176(4041):1337-1340, 1972.

Bladder carcinomas and papillomas induced by implantation of 3-methylcholanthrene (MC) pellets into inbred BALB/c mice and Fischer rats were tested by an *in vitro* microcytotoxicity assay for the presence of tissue type specific (TTS) antigens. TTS antigens were demonstrated to be associated with different bladder papillomas and carcinomas of rats and to be associated with bladder carcinomas of mice. Lymph node cells (LNC) from animals sensitized against sarcomas were not cytotoxic to cultured bladder carcinoma cells but did destroy sarcoma target cells under similar conditions. Likewise, LNC from animals bearing bladder tumors were not cytotoxic to cultured sarcoma cells but were able to destroy cells cultured from bladder carcinomas and papillomas. Preimmunization of rats by injection of a crude suspension of rat papilloma cells combined with either Waymouth's medium or Freund's complete adjuvant suppressed tumor growth *in vivo* compared with unimmunized controls ($P < 0.005$) 4.5 months after bladder implantation of MC pellets. The difference between the experimental and control groups was not significant 6.5 months after insertion of MC pellets. The demonstration of common antigens in chemically induced bladder papillomas and carcinomas was at variance with most findings made on chemically induced murine sarcomas and hepatomas. It did, however, agree with observations made on human neoplasms and may thus provide a better system for the study of the human problem than animal tumors previously studied.

3163 COMPLEMENT-FIXING ANTIMOUSE ANTIBODIES FOUND IN MICE AFTER INOCULATION OF BRAIN, FREUND'S COMPLETE ADJUVANT, AND SARCOMA 180/TG CELLS. (E.) Berman, R. S. (Yale U. Sch. Med., New Haven, Conn.) and R. E. Shope. *Proc Soc Exp Biol Med* 138(3):936-938, 1971.

Female Swiss ICR/KP mice were immunized with mouse brain cells and/or Freund's complete adjuvant (FCA), or with sarcoma 180/TG (S-180/TG) cells plus mouse brain and FCA. Ascitic fluids from immunized mice were harvested by paracentesis and reacted in com-

plement fixation (CF) tests against brain cell preparations from apparently normal mice (MB). In mice given S-180/TG cells, CF antibodies to MB were not detected in ascites fluid collected ten days after immunization, but were detected in fluid taken on day 16. On day 16, 25% of mice given mouse brain and FCA together with S-180/TG cells showed anti-MB CF activity, while 8% of mice given S-180/TG only, and 2% of mice given mouse brain and FCA, showed CF antibody. Antimouse CF antibody was minimal in ascitic fluids of mice given FCA and egg and bovine albumin.

- 3164 MECHANISMS INVOLVED IN THE ANTILEUKEMIC EFFECT OF IMMUNOCOMPETENT ALLOGENEIC LYMPHOID CELL TRANSFER. (E.) Ellman, L. (Nat'l. Inst. Allergy Infect. Dis., Bethesda, Md.), D. H. Katz, I. Green, W. E. Paul and B. Benacerraf. *Cancer Res* 32(1):141-148, 1972.

A marked prolongation of survival time was attained in a group of strain 2 guinea pigs that had received allogeneic strain 13 lymphoid cells six days prior to challenge with L₂C leukemia. The protection resulted from the development of the graft-versus-host reaction, as evidenced by the failure to observe such protection in strain 2 recipients of semisyngeneic 2 x 13 F₁ hybrid donor cells. The capacity to protect against leukemia by passive transfer of parental strain 2 or strain 13 lymphoid cells in 2 x 13 F₁ recipients shows that the concomitant existence of a host response is not required. The possibility that donor cells reject L₂C leukemia on the basis of an immune response directed against strain 2 histocompatibility antigens present on L₂C cells is definitely excluded: Strain 2 parental cells were equivalent to strain 13 cells in affording protection to F₁ recipients. Immunocompetent lymphoid cells appear to exert the primary effector mechanism in the protection phenomenon. The potential promise of allogeneic cell transfers as an approach to immunotherapy of human cancers is considered.

- 3165 EFFECT OF SERA FROM PATIENTS WITH HODGKIN'S DISEASE ON NORMAL LYMPHOCYTE RESPONSE TO PHYTOHEMAGGLUTININ. (E.) Han, T. (Roswell Park Mem. Inst., Buffalo, N.Y.). *Cancer* 29(6):1626-1631, 1972.

Sera from 63 patients with histologically diagnosed Hodgkin's disease were tested for their effect on phytohemagglutinin (PHA) stimulation of lymphocytes from healthy donors. Sera from patients in remission generally had no effect on PHA stimulation of normal lymphocytes when compared with the effect of sera from healthy donors. Sera from some patients with symptomatic disease inhibited the response of normal lymphocytes to PHA stimulation. This inhibitory effect was greatest with serum from patients receiving prednisone (30-40 mg/day) therapy. The inhibition was apparently due to the effects of treatment, since the responses in sera from seven

untreated patients with systemic symptoms were not different from those in normal sera. An apparent stimulation of PHA response was seen with sera from a group of patients with active disease of the mixed cellularity type. Results using Hodgkin's sera were not consistently reproducible. For example, initially, sera from five remission patients stimulated the PHA response of normal lymphocytes; however, when they were retested, no stimulatory effect was observed.

- 3166 HEPATITIS-ASSOCIATED ANTIGEN AND ANTIBODY IN HEPATOCELLULAR CARCINOMA: RESULTS OF A CONTINUING STUDY. (E.) Vogel, C. L. (Uganda Cancer Inst., Kampala), P. P. Anthony, F. Sadikali, L. F. Barker and M. R. Peterson. *J Nat Cancer Inst* 48(6):1583-1588, 1972.

Sera from 90 Ugandan hepatocellular carcinoma patients and from 224 controls were tested for hepatitis-associated antigen (HAA) by counterelectrophoresis (CEP) and complement fixation and for antibody to HAA by CEP and passive hemagglutination. Patients and controls did not differ significantly with regard to the presence of anti-HAA; however, they did differ significantly with regard to the frequency of HAA as 36 of 90 (40%) patients were HAA positive as opposed to only 7 of 224 (3%) controls. No significant differences due to sex or age were found for the distribution of anti-HAA. However, HAA frequency decreased with increasing age. Alpha fetoprotein (AFP)-positive patients with hepatocellular carcinoma were HAA positive significantly ($P < 0.05$) more often (47%) than AFP-negative patients (15%). HAA frequency did not differ significantly between patients whose tumors were superimposed on cirrhotic versus noncirrhotic liver tissue. In the present series, all but one of the patients with hepatocellular carcinoma had macronodular cirrhosis.

- 3167 STUDY OF COMPLEMENT-FIXING ANTIBODY TO THE THERMOSTABLE COMPONENT OF T-ANTIGEN OF ADENOVIRUS TYPE 12 IN THE BLOOD SERUM OF CANCER PATIENTS. (Rus.) Degtyarenko, V. I. (I. I. Mechnikov Res. Inst. Virol. Epidemiol., Odessa, USSR), N. I. Zatsepin, T. M. Rybakova, L. A. Vasyutinskaya, V. D. Dragomeretskii and O. V. Dyumin. *Vop Virusol* 16(4):451-455:1971.

Complement-fixing (CF) antibodies to the thermostable component of T-antigen of hamster tumors induced by adenovirus type 12 were assayed by Selivanov's complement-fixation method in sera from patients with malignant neoplasms, normal subjects, and patients with somatic and infectious diseases. Before the test, sera were heated to 56 C for 30 min to remove thermolabile inhibitors. T-antigen antibodies were most frequently found in sera of cancer patients (167/268 or 62.3%). They occurred less frequently in sera from patients with somatic diseases (atherosclerosis, hypertension, cholecystitis, etc.) (57/238 or 23.9%), infectious diseases (24/110 or 21.8%), and normal subjects (18/180 or 10%). The titers of

F antibodies to the thermostable component of T-antigen fluctuated from 1:4 to 1:128. The highest titers were found in sera from patients with malignant neoplasms of the mammary gland (25/41), larynx and oral cavity (17/28), uterus and adnexa (16/27), skin (6/12), and in sera from patients with mammary fibroadenoma and mastopathy (19/28). Mean titers were highest in sera from patients with cancer. The Ouchterlony test with concentrated adenovirus antigen for serotype 6 gave completely different results. The mean titer for precipitating antibodies in sera from cancer patients was lower ($1:1.20 \pm 0.08$) than in sera from normal subjects ($1:2.6 \pm 0.11$). The frequency with which precipitating antibodies were detected was low in cancer patients (130/321 or 40.5%) and high in normal subjects (107/152 or 67.1%). Antigen to the thermostable component of T-antigen from hamster tumors induced by human adenovirus type 12 in sera from cancer patients indicates that the genome of onco-genic adenovirus type 12 is integrated in the epithelial tissue.

68 IMMUNOGLOBULIN G AND FREE KAPPA-CHAIN SYNTHESIS IN DIFFERENT CLONES OF A HYBRID CELL LINE. (E.) Mohit, B. (Nat'l. Inst. Hlth., Bethesda, Md.). *Proc Nat Acad Sci USA* 68(12):3045-3048, 1971.

clonal cell lines were isolated from a hybrid cell population established by cell fusion between cloned ELB/c myeloma cells that were resistant to 8-azaguanine and produced immunoglobulin G and free kappa chain and C57BL/6n lymphoma cells that were resistant to bromodeoxyuridine and did not produce immunoglobulins. Some of the histocompatibility-2 antigens of both parental cell lines could be demonstrated on all the hybrid clones. Eleven clones synthesized only free kappa chain. Two clones synthesized IgG of ELB/c type, as well as free kappa chain. These clones had higher chromosome number than did the clones that synthesized only kappa chains.

359 SPECIFIC DESENSITIZATION OF RESISTANCE AGAINST A SYNGENEIC METHYLCHOLANTHRENE-INDUCED SARCOMA IN C3Hf MICE. (E.) Vaage, J. (U. of Oslo M.D. Anderson Hosp. Tumor Inst., Houston). *Cancer Res* 32(2):193-199, 1972.

C3Hf/Bu female mice were given sensitizing s.c. implants of living pieces of methylcholanthrene-induced fibrosarcoma or of an unrelated mammary carcinoma. Implanted tumors were removed on consecutive days from four days before to four days after challenge of tumor-sensitized mice with s.c. injections of viable fibrosarcoma cells. Mice whose sensitizing implants had been removed before challenge were completely resistant to challenge; mice from which implants were removed after challenge were less resistant than the others, but more resistant than control mice not given sensitizing implants. The presence or absence of mammary carcinoma at the time of challenge did not affect resistance to the fibrosarcoma. In a

related experiment, mice were sensitized with s.c. implants of the fibrosarcoma; implants were removed four days before tumor cell challenge. Other mice were sensitized with three injections of irradiation-killed fibrosarcoma cells; injections were given from six days before challenge to 12 days after challenge. Injection of killed fibrosarcoma cells decreased resistance of hosts and aided the implantation of challenge tumor cells when injections occurred during the week following challenge. Injections occurring before or after this week did not affect host resistance to challenge. Injections of killed mammary carcinoma cells did not affect resistance. The presence of the sensitizing fibrosarcoma implant until four days after challenge significantly reduced resistance to tumor cell challenge. In a third experiment, mice were sensitized with s.c. implants of fibrosarcoma tissue and implants were removed four days before challenge implantation of fibrosarcoma tissue. Mice were then given injections of irradiation-killed fibrosarcoma cells containing 50 mg to 1 μ g of cells; these injections were given four days before challenge, with challenge, or four days after challenge. Three injections of fibrosarcoma cells in doses of from 50 mg to 50 μ g each depressed resistance to challenge; doses of from 10-1 μ g did not affect resistance. In a final experiment the effect on host resistance of sensitizing implants of different sizes was tested. Resistance to challenge was not affected by small (6 x 6 mm) tumor implants left *in situ* after challenge, while large (13 x 13 mm) tumor implants markedly reduced resistance. Serum factors were apparently not responsible for depression of host resistance to challenge by antigenic tumor tissue; specific desensitization of host resistance factors, rather than immunological enhancement, seemed to be implicated in the depression of resistance.

3170 TUMOR-SPECIFIC ANTIGENS ASSOCIATED WITH AMINOAZO DYE-INDUCED RAT HEPATOMAS. (E.) Baldwin, R. W. (Cancer Campaign Res. Lab., U. Nottingham, England), D. Graves, J. R. Harris and M. R. Price. *Transplantation Proc* 3(3):1189-1191, 1971.

Aminoazo dye-induced rat hepatomas have at least two groups of cell surface antigens which differ from those expressed on normal liver cells; the tumor-specific antigen and the embryonic-type antigen. Embryonic antigens have been demonstrated by direct immunofluorescence on the surface of rat hepatomas by reaction of suspended viable tumor cells with sera from immune multiparous female rats. Most sera reacted with cells of more than one tumor, including those induced by carcinogens other than aminoazo dyes, suggesting that embryonic antigens are common tumor components. Tumor-specific antigens, however, do not show the property of cross-reaction found with the embryonic-type antigens. The membrane-bound tumor-specific antigens may be removed or inactivated by limited papain digestion, or short-term (30 min) lipase or β -glucosidase treatment. The association between membrane and tumor-specific

antigen is apparently specific for the glycoprotein and lipid components, as treatment with α -glucosidase, β -galactosidase, hyaluronidase, neuraminidase or ficin fails to affect surface expressed antigen.

- 3171 IMMUNOFLUORESCENT ASSAY OF HERPESVIRUS TYPE 1 AND TYPE 2 ANTIBODIES IN RABBIT AND HUMAN SERA. (E.) Leinikki, P. (Dept. Virology, U. Helsinki, Finland). *Arch Ges Virusforsch* 35(4): 349-355, 1971.

Three groups of patients were studied to see whether specific herpes simplex virus antibodies could be differentiated by the immunofluorescence technique. The first group consisted of nine children 1-13 yr old with primary herpetic infections. The second group included two children with generalized neonatal type 2 herpes infection. The third group consisted of ten adults with genital herpes infections. The results were compared with antibody responses seen in rabbits after experimental type 1 or type 2 infection. In both rabbits and children with primary herpetic infections, type 1 and type 2 viral antibodies showed considerable cross-reaction, while in patients with genital herpes infections and in neonates, very little cross-reaction was observed.

- 3172 HL-A ANTIGENS AND CHORIOCARCINOMA. (E.) Rudolph, R. H. (U. Washington Sch. Med., U.S. Public Hlth. Service Hosp., Seattle) and E. D. Thomas. *Lancet* 2(7721):408-409, 1971.

A woman who had given birth to a full-term, live infant and who had developed disseminated choriocarcinoma during that pregnancy was studied with respect to histocompatibility factors using both leukocyte serotyping and one-way mixed-leukocyte culture. Differences in HL-A antigens (leukocyte antigens controlled by genes at the HL-A locus) were found between the infant and his mother with both techniques, disproving the hypothesis that the survival and dissemination of post-gestational choriocarcinoma are dependent upon histocompatibility between the malignant graft and the maternal host. Alternative mechanisms, possibly those involving serum blocking or enhancing factors, which permit tumor-graft survival must be sought.

- 3173 HL-A ANTIGENS IN MALIGNANT BLOOD DISEASES. (Fr.) Jeannet, M. (Canton Hosp., Geneva, Switzerland), P. Alberto and M. Wyss. *Schweiz Med Wchschr* 101(49):1798-1800, 1971.

The frequency of 22 well defined HL-A antigens was determined in 170 patients with malignant blood diseases (34 with acute lymphoblastic leukemia, 33 with acute myeloblastic leukemia, 15 with chronic myeloblastic leukemia, 20 with chronic lymphoid leukemia, 33 with Hodgkin's disease, 21 with other types of lymphomas, and 14 with multiple myeloma); this was compared to the frequency of these antigens

in 350 healthy controls. The most marked anomaly noted was the less frequent occurrence of HL-A 11 among patients with all forms of leukemia and with Hodgkin's disease. Increases were found in the frequency of the following antigens: HL-A in chronic myeloid leukemia, HL-A 2 in acute myeloblastic leukemia, W 15 antigen in Hodgkin's disease, and W 28 antigen in other lymphomas. Although these findings were statistically significant, they should be interpreted with caution since the size of the sample populations tested in each category was relatively small and the degree of significance was not very high and because of serological difficulties. Some anti-HL-A sera gave a larger number of positive reactions with lymphocytes from leukemic patients than with those from the controls, even though the frequency of the corresponding antigens, determined by other sera of similar specificity, was significantly different. These were false positive reactions which were only detected because several sera were used to determine each antigen. The possibility that these sera might contain antigens specific for leukemia is currently being investigated.

- 3174 IMMUNITY AND MALIGNANT MELANOMA OF THE UVEA. (Fr.) Verin, P. (No affiliation), J. Meunier, P. Gendre, J. J. Bergeon, A. Sekkat and S. Morax. *Arch Opht (Paris)* 31(11):781-792, 1971.

The case history of a 56-yr-old man is described; he had a slightly pigmented malignant tumor filling the vitreous body which led to enucleation. Histological examination showed the neoplasm was a fusiform type A Callender sarcoma with very little melanin. Ultrastructural examination disclosed a succession of bright and dark cells associated with necrosis and anomalies of cellular organelles, particularly of centrioles and the Golgi apparatus, and the presence of annulate lamellae. Complete examination of the patient revealed the presence of a suspect hepatic zone which could be latently malignant. Tumor material was grafted beneath the renal capsule of a golden hamster (*Chinchilla* strain), the kidney was repositioned in the abdomen and sutured. On the ninth day the material was removed and examined histologically and ultrastructurally. The originally undifferentiated tissue seemed to have been influenced by an immunological system with signs of differentiation and a reduction in its malignancy. Thus, considerable pigmentation was noted and the annulate lamellae disappeared.

- 3175 REACTION OF ANTI-IDIOTYPIC ANTIBODY WITH THE HAPTEN-BINDING SITE OF A MYELOMA PROTEIN. (E.) Brient, B. W. (U. Illinois Coll. Med., Chicago), J. Haimovich and A. Nisonoff. *Proc Nat Acad Sci USA* 68(12):3136-3139, 1971.

Rabbit antiserum was prepared against mouse myeloma Protein-315, an IgA protein with specificity toward the 2,4-dinitrophenyl group. After absorption of the

antiserum with another IgA myeloma protein and with infinity-labeled Protein-315, the antiserum was specific for idiotype-determinants on Protein-315. Monoclonal ligands that bind to Protein-315 with high affinity strongly inhibited the reaction of the protein with its anti-idiotypic antiserum. This indicated that the region of the hapten-binding site is a major idiotype determinant. The myeloma protein is thus similar to rabbit antibenzoate antibody in this respect. These results, considered in conjunction with other data in the literature, indicate that an anti-idiotypic antiserum prepared in an isologous or heterologous series can recognize the same determinant, in this case the region comprising the ligand-binding site. Quantitative aspects of the data indicate that there is competition between the hapten and anti-idiotypic antibodies for the site.

76 **IN VIVO REQUIREMENT FOR A RADIATION-RESISTANT CELL IN THE IMMUNE RESPONSE TO SHEEP ERYTHROCYTES.** (E.) Gorczynski, R. M. (Ontario Cancer Inst., U. Toronto, Canada), R. G. Miller and A. Phillips. *J Exp Med* 134(5):1201-1221, 1971.

Experiments were carried out to establish whether the radiation-resistant or A cell has a specific function in the initiation of an immune response in mice to sheep erythrocytes (SRBC). Two methods were found for creating an A-cell deficiency *in vivo*: (a) A cells disappear gradually from the spleens of irradiated mice, presumably by migration since A-cell function was shown not to be decreased by irradiation. Three days elapse between irradiation and transplantation of mixtures of bone marrow and thymus cells which provide B and T but few A cells, the usual synergistic response does not occur. Addition of large numbers of freshly irradiated spleen cells to the mixture of bone marrow and thymus completely restores the immune response. (b) Injection of 10^{10} sheep erythrocytes into mice suppresses A-cell activity in these mice 24 hr later; a much reduced response to SRBC is obtained when they are given at a later time. The response can be partially restored if irradiated spleen cells are given with the SRBC. This observation formed the basis for a quantitative *in vivo* assay for A cells in which the magnitude of restoration by various suspensions of irradiated spleen cells was used to estimate the A-cell activity of that suspension. A quantitative *in vitro* assay for A cells was also developed. It was essential for this assay that the total cell number, B-cell number, and T-cell number be kept constant and that only the number of A cells be allowed to vary. Only under these conditions was the response a linear function of the number of A cells added. To determine whether *in vivo* and *in vitro* assays were detecting the same class of radiation-resistant cells, the physical properties of the cells active in each assay were investigated. Spleen cells were separated on the basis of both density and sedimentation velocity. Fractions from both separation methods were tested for their content of A cells using both the *in vivo* and *in vitro* assays. Both density and sedimentation profiles of A cells were similar in both assays. The demonstration that a radiation-resistant cell is required *in vivo* and

that this cell has properties identical to the radiation-resistant cell required *in vitro* indicates that this cell (the A cell) is directly involved in the initiation of an immune response to erythrocyte antigens.

3177 **LEVELS OF C'3 IN THE SERUM OF PATIENTS WITH BENIGN AND MALIGNANT DISEASES OF THE PROSTATE.** (E.) Ablin, R. J. (Southern Illinois U. Sch. Med. Springfield), M. J. Gonder and W. A. Soanes. *Neoplasma* 19(1):61-65, 1972.

The concentration of the C'3 component of the complement (C') system was measured in serum of patients with benign prostatic hypertrophy (BPH) and in patients with carcinoma of the prostate (CaP). The C'3 concentration was measured as β_{1A} -globulin using a single radial immunodiffusion plate method. The normal mean C'3 concentration (measured in serum of normal healthy subjects) was established as 134 ± 30.9 mg/100 ml serum. Ten percent of 30 BPH patients showed elevated C'3 levels (i.e., 195.9 mg/100 ml or more). Seventeen percent of BPH serum samples showed depressed C'3 levels (i.e., 72.3 mg/100 ml or less). Twenty-seven percent of 22 CaP patients showed elevated C'3 levels; no CaP patient had a serum C'3 level of less than 120 mg/100 ml serum.

3178 **AVIAN LEUKOSIS ANTIBODY RESPONSE IN INDIVIDUALS GIVEN CHICKEN EMBRYO DERIVED VACCINES.** (E.) Richman, A. V. (Nat'l. Inst. Hlth., Bethesda, Md.), C. G. Aulisio, W. G. Jahnes and N. M. Tauraso. *Proc Soc Exp Biol Med* 139(1):235-237, 1972.

Sera from individuals inoculated with avian leukosis virus (ALV)-contaminated vaccines were examined for the presence of antibodies to ALV using the broadly reactive COFAL test and the more sensitive indirect immunofluorescence (FAB) test. Neutralization tests were performed on some sera. Samples included sera from subjects given single or multiple doses of ALV-contaminated influenza vaccine, typhus vaccine, measles vaccine, and ALV-free yellow fever vaccine. Virtually 100% of individuals given influenza and typhus vaccines contaminated with ALV developed a significant antibody response. COFAL titers ranged from 1:5 (in a patient given contaminated influenza vaccine) to 1:20 (in a patient given contaminated typhus vaccine). All other sera were negative for COFAL antibody, and all sera tested were negative in neutralization and FAB tests. Because the FAB test is considerably more sensitive than the COFAL test, it was concluded that the COFAL reactions were probably false positives. The data corroborated the lack of immediate infectivity of ALV for man.

3179 **IMMUNOGLOBULIN AND θ -BEARING MURINE LEUKEMIAS AND LYMPHOMAS.** (E.) Shevach, E. M. (Nat'l. Inst. Allergy Infec. Dis., Bethesda, Md.), J.

D. Stobo and I. Green. *J Immun* 108(5):1146-1151, 1972.

Twenty-four murine leukemias and lymphomas and eight plasma cell tumors were examined for the presence of the θ isoantigen or surface immunoglobulin (kappa light chain determinants) by both a chromium release cytotoxicity test and the immunofluorescence test. θ Isoantigen signified that tumors contained thymus-derived T lymphocytes responsible for cell mediated immunity, and the kappa light chain determinants signified that tumors contained bone marrow-derived antibody precursor cells (B cells). Twelve of the 24 tumors bore the θ isoantigen and were presumably of T cell origin. No θ -positive tumor bore surface immunoglobulins as detected by the anti-kappa reagent used. Only one non-plasma cell tumor bearing kappa chain determinants could be identified. Eleven tumors bore neither θ isoantigen nor surface immunoglobulin. Four plasma cell tumors had surface kappa determinants; no plasma cell tumors which had the θ isoantigen had kappa light chain determinants, and vice versa.

3180 IMMUNOGLOBULIN RECEPTORS ON A MOUSE MAST CELL TUMOR. (E.) Cline, M. J. (U. California Sch. Med., San Francisco) and N. L. Warner. *J Immun* 108(2):339-345, 1972.

Mouse mastocytoma cells were incubated with IgG immunoglobulin-coated sheep erythrocytes (SRBC) in a protein-free medium. Rosettes of erythrocytes formed around certain mast cells. When certain immunoglobulins, including mouse IgG₁, IgG_a and IgG_{2b} proteins, were preincubated with mastocytoma cells, rosette formation with IgG-coated SRBC was inhibited. Mouse IgG and IgM, and human myeloma proteins IgG, IgA, and IgM, failed to inhibit rosette formation with IgG-coated SRBC. Pepsin-digested IgG antibody-coated SRBC did not bind to the mast cell. Immunoglobulin in combination with specific antigen bound to mastocytoma cells more strongly than did immunoglobulins alone. Seven cell lines other than the mastocytoma line were tested for rosette formation with IgG-coated SRBC. Only one line, from a mouse plasmacytoma, formed rosettes. Fluorescein isothiocyanate, iodacetamide and phospholipase-C inhibited rosette formation on mastocytoma cells, but phospholipase-D, neuraminidase, and azide did not. Treatment of mast cells with trypsin enhanced rosette formation with IgG-coated SRBC.

3181 CORRELATION BETWEEN SERUM ALPHA-GLOBULIN AND PLASMA INHIBITORY EFFECT ON PHA-STIMULATED LYMPHOCYTES IN COLON CANCER PATIENTS. (E.) Hsu, C. C. S. (Columbia Presbyterian Med. Ctr., New York, N.Y.) and P. LoGerfo. *Proc Soc Exp Biol Med* 139(2):575-578, 1972.

Plasma was taken from 15 normals and from 15 patients with colon cancer; most cancer patients were in the early stages of the disease. Plasma was mixed with PHA-treated lymphocytes from two donors in two groups of experiments and the inhibition of the lymphocyte response to PHA by plasma from normals and colon

cancer patients was observed. On the whole, there was no difference between the inhibition of the lymphocyte response to PHA by normal plasma and that of the lymphocyte response by patients' plasma. Within the group of cancer patients' plasma, however, it was found that plasma from patients with higher levels of serum carcinoembryonic antigen (CEA) produced a higher degree of inhibition of lymphocyte response to PHA. It was noted that serum CEA was higher in patients in advanced stages of colon cancer. A high degree of lymphocyte inhibition was also correlated with high levels of serum α -globulin, and with high levels of both CEA and α -globulin in sera from individual patients. No correlations were found between inhibition of lymphocyte response to PHA and serum levels of other fractions of serum proteins and blood urea nitrogen, uric acid, calcium, phosphorous and liver function tests.

3182 ANTIBODY-MEDIATED SUPPRESSION OF GRAFTED LYMPHOMA CELLS: I. PARTICIPATION OF A HOST FACTOR(S) OTHER THAN COMPLEMENT. (E.) Shin, H. S. (Johns Hopkins U. Sch. Med., Baltimore, Md.), N. Kaliss and D. Borenstein. *Proc Soc Exp Biol Med* 139(2):684-689, 1972.

Inbred mice of four strains were given injections of cells from two murine lymphomas mixed with preparations of two humoral antibodies against these lymphomas. An anti-lymphoma antibody developed in AKR mice (AKR anti-L707) suppressed grafts of a lymphoma indigenous to B10.D2-old mice to the same extent in B10.D2-old and B10.D2-new mice. The AKR anti-L707 lacked complement C5 (for which AKR and B10.D2-old mice are congenitally deficient). This indicated that the presence of complement C5 was not essential for the suppressive efficiency of the antiserum. Whether an intact complement system was needed for tumor suppression was further tested with grafts of lymphoma 6C3HED (indigenous to C3H mice). C3H mice, which have an intact complement system, were treated with cobra venom factor to deplete complement graft recipients; cobra venom factor abolished C3 activity. Despite the absence of C3, the anti-lymphoma antibody B6 anti-6C3HED was fully suppressive of lymphoma grafts. Whole body irradiation (400 R or more) abolished graft recipients' capacity to suppress tumor grafts in the presence of antibody despite the fact that irradiation did not diminish complement activity. Results suggested that complements C3 and C5 were not required for antibody-mediated destruction of lymphoma grafts.

3183 "UNMASKING" OF HUMAN LYMPHOID CELL HETERO-ANTIGENS BY NEURAMINIDASE TREATMENT. (E.) Rosenberg, S. A. (Nat'l. Cancer Inst., Bethesda, Md.), B. A. Plocinik and G. N. Rogentine, Jr. *J Nat Cancer Inst* 48(5):1271-1276, 1972.

Cultured lymphoid cells from a patient with lymphoblastic lymphoma were treated with neuraminidase (NASE) prepared from *Vibrio cholerae*. NASE treatment removed $64.9 \pm 8.3\%$ of the sialic acid from the surfaces of the lymphoid cells. The lysis of

SE-treated cells by treatment with normal rabbit serum (NRS) was assayed by a modification of the ^{51}Cr release cytotoxicity technique. NRS released $26.1 \pm 5\%$ of ^{51}Cr from untreated cells and $50.4 \pm 6.0\%$ ^{51}Cr from NASE-treated cells. NRS was also tested for lysis of lymphoid cells in the presence of carageenan, a complement inhibitor. The lysis of NASE-treated lymphoid cells was eliminated by heat activation and by carageenan. Evidently, NASE treatment "unmasked" surface structure (antigens) on the lymphoid cells, structures which were reactive with other structures (probably antibodies) in NRS. The antibody in NRS could be removed by absorption with SE-treated lymphoid cells in the presence of EDTA without lowering complement. The relative amounts of antigen on the surface of normal and NASE-treated cells were determined by absorbing NRS with cells in the presence of EDTA. NASE-treated cells contained three to four times more antigen than untreated cells.

4 RECEPTORS FOR IMMUNOGLOBULIN AND COMPLEMENT ON MOUSE LEUKEMIAS AND LYMPHOMAS. (E.)

Vach, E. (Nat'l. Cancer Inst., Bethesda, Md.), Herberman, R. Lieberman, M. M. Frank and I. Green. *Immun* 108(2):325-328, 1972.

Twenty-one mouse leukemias and lymphomas, some virus-induced, were examined for the presence of two immunoglobulin and complement receptors. One of the receptors, found on B-lymphocytes, monocytes and macrophages, is an antigen-antibody complement complex receptor identified by binding of red cells coated with antibody and complement (EAC); the other receptor, associated with monocytes and macrophages, is for immunoglobulin G, and is demonstrable by the attachment of red cell-IgG complexes (EA) to the cell surface. Receptors were first screened with a rabbit IgM EAC complex which determined only the lymphocyte or monocyte complement receptor. No tumor bore the lymphocyte receptor. Only three tumors reacted with either IgM or IgG EA complexes. One tumor, induced by anti-light chain and pristane, had both the monocyte EAC complement receptor and the immunoglobulin EA receptor. Two tumors bore the monocyte EA receptor alone. Marked inhibition of binding of the IgG EA complex to both tumor cells and to normal monocytes was produced by the γF (γ_1) and γH (γ_{2b}) subclasses of mouse IgG.

CHANGES OF γ GLOBULIN CARRYING CELLS IN NZB MICE BEFORE AUTOIMMUNE DISEASE. (E.)

Herberman, B. (Manitoba Inst. Cell Biol., Winnipeg, Canada) and F. Paraskevas. *J Immun* 108(5):1465-1466, 1972.

Suspensions were prepared from spleens, thymuses, marrows and cervical lymph nodes of NZB mice. Mice, which have a high incidence of autoimmune diseases, especially among females, were studied before the onset of any such disease (mice were 4-12 weeks of age). Cell suspensions were examined for immunoglobulin-carrying cells by the reverse immune cytoadherence test, in which a 5S hybrid antibody carrying

one anti- γ -globulin site and one anti-ferritin site, is so employed that γ -globulin-carrying cells form rosettes. A dramatic decrease in immunoglobulin-carrying cells was seen in female mice. The mean rosette count for male NZB mice and for females below five weeks of age was 216.21 ± 26.42 SD. The mean rosette count for females 8-10 weeks of age was 130.87 ± 26.42 SD. The total number of rosettes in spleens of male and female NZB mice was lower than that of BALB/J mice. Factor(s) in the serum of female NZB mice were thought to be responsible for the decrease in γ -globulin-carrying cells; the identity of this factor(s) remains unknown.

3186 THE INFLUENCE OF CALCIUM, MAGNESIUM AND CYCLIC ADENOSINE 3',5'-MONOPHOSPHATE ON THE MIXED LYMPHOCYTE REACTION. (E.) Whitney, R. B. (Ontario Cancer Treatment Res. Fdn., London, Canada) and R. M. Sutherland. *J Immun* 108(5):1179-1183, 1972.

Human peripheral lymphocytes from venous blood were cultured and the mixed lymphocyte reaction was monitored by assessing the incorporation of methyl- ^3H -thymidine by lymphocytes. Increasing concentrations of ethylenediamine-tetraacetic acid (EDTA), a strong chelator of divalent cations, progressively inhibited the incorporation of ^3H -thymidine in mixed lymphocyte cultures beginning at a concentration of 1×10^{-4} M or higher. This inhibition was not due to cell death. Probably, the EDTA effect was caused by the removal of divalent cations from the medium (in fact, Ca^{++} and Mg^{++} were required for the initiation and completion of the mixed lymphocyte reaction, and transformation of lymphocytes did not occur in cultures deficient in Ca^{++} or Mg^{++}). Low concentrations (10^{-6} to 10^{-4} M) of exogenous cyclic adenosine 3',5'-monophosphate (cAMP) produced a moderate enhancement of the mixed lymphocyte reaction, but only if cAMP was added just before the isotope incorporation period. If cAMP was added at the start of culture all concentrations except 10^{-6} M produced marked inhibition of the mixed lymphocyte reaction.

3187 IMMUNOLOGIC STUDIES OF NORMAL, BENIGN, AND MALIGNANT HUMAN PROSTATIC TISSUE. (E.) Ablin, R. J. (Southern Illinois U. Sch. Med., Springfield). *Cancer* 29(6):1570-1574, 1972.

The antigenic reaction patterns of saline extracts of normal, benign and malignant human prostate tissue (designated NHPE, BPE and CaPE, resp.) to rabbit antisera were studied in double diffusion gel precipitation tests. Absorption of anti-NHPE sera with lyophilized pooled preparations of BPE or CaPE resulted in the removal of lines of precipitation previously seen between anti-NHPE and BPE, and between anti-NHPE and CaPE. This suggested that BPE and CaPE may have been antigenically deficient in comparison to NHPE. The benign and malignant prostatic tissue may have contained reduced concentrations of normal prostate tissue-specific antigens, or may have lacked these antigens altogether.

- 3188 FUNCTIONAL DEVELOPMENT OF THE INTERACTING CELLS IN THE IMMUNE RESPONSE: I. DEVELOPMENT OF T CELL AND B CELL FUNCTION. (E.) Chiscon, M. O. (Dept. Biol. Sci., Purdue U., Lafayette, Ind.) and E. S. Golub. *J Immun* 108(5):1379-1386, 1972.

In an attempt to determine at what time in development thymus cells become capable of interacting with adult bone marrow cells (i.e., at what time thymus cells acquire T cell function), CBA mice were lethally irradiated and injected with syngeneic adult bone marrow cells. After a delay, animals were given syngeneic thymus cells from fetal and neonatal mice of various ages and challenged with sheep red blood cells (SRBC). A second dose of SRBC was given four days later, and eight days after the first SRBC dose, host organs were assayed for the presence of antibody-forming cells (i.e., for B cell function) and for T cell function. Spleen, lung and liver cells, and well as thymus cells, were tested for T and B cell function. Less than 10% of adult T cell function was seen in thymus of unborn mice; by birth thymus cells showed 12% of adult T cell function. By 48 hr after birth, young thymus cells had achieved adult T cell function levels. No T cell activity was found in fetal or neonatal lung or liver cells. With birth, thymus T cell function appeared to increase exponentially. Neonatally thymectomized mice reconstituted with thymic cells of various ages confirmed these results. B cell function was seen in spleen one day after birth, but T cell function did not appear in spleen until day four after birth. B cell function was present in fetal and neonatal liver by five days before birth; as birth approached, B cell function of liver surpassed that of adult bone marrow. By day six after birth, liver B cell function equalled that of adult bone marrow. Apparently T cell function develops after B cell function, the former being delayed until the development of a structural thymus.

- 3189 THE RELATIONSHIP BETWEEN THYMUS AND ONCOGENESIS: A STUDY OF THE INCIDENCE OF NON THYMIC MALIGNANCY IN MYASTHENIA GRAVIS. (E.) Papatestas, A. E. (Mount Sinai Sch. Med. City U. New York, N.Y.), K. E. Osserman and A. E. Kark. *Brit J Cancer* 24(4):635-645, 1971.

To investigate the role of the thymus and the effects of thymectomy on human oncogenesis, a comparison was made between the incidence of extrathymic neoplasms in 1243 non-thymectomized and thymectomized myasthenia gravis (MG) patients. Patients were placed in four groups according to presence or absence of thymomas, and according to whether or not they had been thymectomized. The breast was the most common site of extrathymic neoplasms. Based on age and sex distribution, the expected number of extrathymic neoplasms in the period prior to onset of MG was 56; in fact, 25 extrathymic neoplasms were seen prior to MG onset. By contrast, the observed number of neoplasms in MG patients after onset of MG but before thymectomy was 64, considerably higher than the expected number (28). The annual incidence of neoplasms increased sharply with the onset of MG and remained high throughout the

course of the disease in non-thymectomized patients. Of 64 extrathymic neoplasms occurring after MG onset but before thymectomy, 39 were in women and 25 were in men; the expected figures were 14 and 14, resp. Following thymectomy, the annual incidence of extrathymic malignancies decreased to expected levels. It is suggested that abnormal clones of immunocompetent small lymphocytes of thymic origin may play a part in the influence of the thymus in oncogenesis.

- 3190 ANTIGEN-BINDING IgA MYELOMA PROTEINS IN MICE: SPECIFICITIES TO ANTIGENS CONTAINING β -D 1-6 LINKED GALACTOSE SIDE CHAINS AND A PROTEIN ANTIGEN IN WHEAT. (E.) Potter, M. (Nat'l. Cancer Inst., Bethesda, Md.), E. B. Mushinski and C. P. J. Glaudemans. *J Immun* 108(2):295-300, 1972.

Three myeloma proteins derived from three plasmacytomas of BALB/c-type mice were tested in precipitin reactions with natural antigens present in the environment of mice in which the plasmacytomas arose. Antigens included materials in food and bedding of the mice: milling wheat extract, arabinogalactan (larchwood), gum ghatti and a hardwood bedding extract. Two of the myeloma proteins, S10 and T191B, precipitated with arabinogalactan, gum ghatti and hardwood bedding extract. It was noted that these antigens had side chains containing either L-arabinose or 1 \rightarrow 6 linked β -D-galactopyranoses. Oligosaccharides of β 1 \rightarrow 6D-galactopyranose were potent inhibitors of the precipitation of S10 and T191B with arabinogalactan; the tetraose was the most effective inhibitor. The third myeloma protein, T521, did not precipitate with arabinogalactan or gum ghatti; T521 precipitated with an antigen in wheat other than that antigen with which S10 and T191B precipitated. The wheat antigen identified by T521, but not those identified by S10 and T191B, lost its antigenicity after pronase. This suggested that the T521 antigen was a protein.

- 3191 STUDY OF THE TUMOR CELL-LYMPHOCYTE INTERACTION IN PATIENTS WITH BREAST CANCER. (E.) Deodhar, S. D. (Cleveland Clin. Fdn., Ohio), G. Crile, Jr. and C. B. Esselstyn, Jr. *Cancer* 29(5):1321-1326, 1972.

Mammary tumors were removed from 17 patients with mammary cancer; tumor cells were cultured with lymphocytes taken from lymph nodes of tumor donors. The tumor cell-lymphocyte interaction was studied; formation of lymphocyte clumps around tumor cells, cytotoxic effect, and blast transformation were used as measures of tumor cell-lymphocyte interaction. In all ten patients who had no involvement of tumor with axillary lymph nodes, there was significant interaction between tumor cells and nodal lymphocytes. Interaction consisted of clumping of lymphocytes around tumor cells; sometimes clumps were in the form of rosettes. Clumping was sometimes accompanied by marked cytotoxicity. In four patients with extensive involvement of lymph nodes by tumor, no lymphocyte clumping was seen around tumor cells, and blast transformation was minimal or absent. In three others,

ly one axillary lymph node was involved: of these patients, two showed tumor cell-lymphocyte interaction and one showed no interaction. In six patients with nodal involvement, and in whom both nodal and peripheral lymphocytes were studied, nodal lymphocytes showed more tumor cell interaction than peripheral lymphocytes.

2 CHANGES IN THE OPSONIN AND CELLULAR INFLUENCES ON PHAGOCYTOSIS DURING THE GROWTH OF TRANSPLANTABLE TUMORS. (E.) Kampschmidt, R. F. Samuel Roberts Noble Fdn., Inc., Ardmore, Oklahoma) L. A. Pulliam. *J Reticuloendothel Soc* 11:1-10, 1972.

cravascular clearance and tissue distribution of sensitized reticuloendothelial (RE) test lipid emulsion were measured at various stages of tumor growth in rats. The phagocytic activity of the reticuloendothelial system (RES) was enhanced in rats bearing several different transplantable tumors. Most of the increase could be attributed to hepatic uptake, while less emulsion than normal was found in the spleens and lungs of tumor-bearing rats. Liver opsonins and liver phagocytic potential were measured by incubating liver slices from normal or tumor-bearing rats in RE test lipid media containing emulsion from either normal or tumor-bearing rats. There was some suggestion of an inverse relationship between the opsonic activity found in the plasma and the tumor-bearing rat and the rate of *in vivo* clearance of the lipid emulsion. The alterations in phagocytic activity of the tumor-bearing rats seemed primarily to changes in liver weight and liver phagocytic potential.

3 MAMMARY TUMOR VIRUS-ASSOCIATED ANTIGENICITY OF L-1210 MURINE LEUKEMIA CELLS. (E.) Kozlowski, P. (Inst. Immun. Exp. Therapy, Polish Acad. Sci., Wrocław), C. Radzikowski, J. Steuden, J. Szukdlarek and K. Krawczynski. *Arch Immunol Ther* 19:789-799, 1971.

of BALB/c mice (which carry the same H-2 antigens as DBA/2 mice) injected with leukemia L-1210 cells showed cytotoxic activity against these cells. Antiserum was not cytotoxic to normal peritoneal cells of DBA/2 mice. The cytotoxic activity of anti-L-1210 serum could be removed only by adsorption of mammary tumor cells from DBA/2 or C3H mice and to be naturally infected with mammary tumor virus (MTV). This and the finding that L-1210 cells were insensitive to the cytotoxic action of antiserum for other virus-associated antigens of murine leukemias suggested that L-1210 cells carry a mammary leukemia antigen. Anti-L-1210 sera were obtained from MTV-negative as well as MTV-positive DBA/2, BALB/c and (DBA/2xBALB/c) mice. The results indicate (that neonatally infected mice could produce humoral antibodies against MTV-associated antigens, in spite of the presumed specific immunological tolerance of such animals.

3194 DETECTION OF TUMOR-ANTIGENS IN METASTASIS-AFFECTED REGIONAL LYMPH NODES IN CANCER PATIENTS. (Rus.) Kosyakov, P. N. (D. I. Ivanovskii Inst. Virol., Moscow, USSR) and R. P. Pavlyuchenkova. *Vop Onkol* 18(3):41-45, 1972.

Metastases in the liver and lymph nodes of cancer patients were studied with the complement-fixation (CF) and indirect immunofluorescence tests, using rabbit sera treated with each of these tissues. Primary tumors were found in the lung, pancreas, stomach, rectum, breast, and prostate. Saline and lipid extracts of native tumors, liver and lymph node metastases from the same subjects, and saline extracts from normal human spleen were used as antigens in the CF tests. Unheated immune sera adsorbed on formalin-treated suspensions of normal spleen and lung tissue and donkey serum from animals immunized with rabbit globulin were used in immunofluorescence tests. In CF tests, sera treated with liver metastases from a lung cancer patient reacted only with antigens from the same type of tumor. Sera treated with liver and lymph node metastases from pancreatic cancer reacted with their own antigens and with antigens from a breast tumor and its metastases. Sera treated with liver metastases from pancreatic cancer reacted with liver and lymph node antigens, but not with the other three types of tumor antigens. Thus, new antigens which differed from spleen antigens but were identical with primary tumor antigens were found in lymph node metastases. Immunofluorescence tests gave the same results and showed that these antigens were located in the cytoplasm and not in the nucleus. These new antigens were detected in lymph node metastases in six of eight cancer patients studied.

3195 DECREASE IN RESISTANCE TO TUMOR INDUCTION RESULTING FROM BCG VACCINATION. (Rus.) Volegov, A. I. (A. I. Gertzen Moscow Res. Inst. Oncol., USSR), *Vop Onkol* 17(12):87-89, 1971.

The possibility of decreasing resistance of animals to carcinogens by BCG vaccination was studied in 85 female Wistar and hybrid rats (about three months old). Methylcholanthrene (MC) in apricot oil (10 mg/1.0 ml) was administered s.c. (2 mg/100 g body weight). Thirty-one days before MC administration, experimental animals were vaccinated i.p. with a live culture of BCG (5 mg/1.0 ml). Allergy tests were made with s.c. injections of 0.04 ml of a 20% dry purified tuberculin ten days before and 64 days after MC administration. Tumor induction was observed for 164 days after MC injection, and then animals were autopsied. The first tumors appeared on the 107th day in 1/12 vaccinated and 1/12 intact hybrid rats, and 2/21 vaccinated Wistar rats. The tumor incidence was higher in vaccinated than in unvaccinated animals on subsequent days. 13/21 vaccinated Wistar rats and 9/12 vaccinated hybrid rats eventually developed tumors, in comparison to 7/19 intact animals. The average manifestation of allergic reactions in all three groups of vaccinated rats was high 24 hours after tuberculin tests, decreasing after 48 hours. The effect of BCG

vaccination on resistance to tumor development was studied in two-yr-old Wistar rats given MC 1 yr after vaccination and 1-yr-old hybrid rats given MC three months after BCG vaccination. The resistance to tumor formation did not decrease in these Wistar rats by 3.5 months after MC injection: 4/14 vaccinated Wistar rats and 3/8 control rats developed tumors. BCG vaccination increased resistance in hybrid rats: none of the 11 experimental rats developed any tumors for 4.5 months, while 4/10 control rats did.

- 3196 DEVELOPMENT OF CYTOTOXIC ACTIVITY IN IMMUNE LYMPHOCYTES AS A RESPONSE TO GRAFTING OF LEUKEMIC CELLS IN MICE. (Fr.) Leclerc, J.-C. (Saint-Louis Hosp., Paris, France), E. Gomard, J. Pavie and J.-P. Levy. *C R Acad Sci [D] (Paris)* 274(8):1233-1235, 1972.

Two-month-old mice of the C57Bl/6 strain were given a single i.p. injection of YC8 leukemia cells, but no tumors developed. Subcutaneous injection of YC8 cells in Balb/c mice produced localized tumors in eight days with inoculum of 3×10^6 cells and in ten days with inoculum of 3×10^5 cells. In the latter case, 20% of the animals subsequently rejected the tumor. Spleen cells from immunized and control mice were incubated with YC8 cells labeled with Cr-51, and the radioactivity released in the extracellular medium by the YC8 cells was measured. Three days after inoculation spleen cells developed a cytotoxic effect in C57Bl/6 mice grafted with YC8 cells; this effect reached its peak in 7-8 days, then fell off rapidly. A parallelism was noted between the increase in cytotoxic activity and tumor development. When the tumor was rejected, cytotoxic activity kept increasing, even following rejection, then decreased progressively. These results indicate that lymphoid cells capable of destroying tumoral cells *in vitro* form in response to an isogenic graft. Their development differs from that of lymphocytes following immunization of an allogenic recipient.

- 3197 ABSENCE OF PRIMARY IMMUNE RESPONSE IN ACUTE BOVINE LYMPHOCYTIC LEUKEMIA: I. OCCURRENCE OF NATURAL ANTIBODIES AGAINST *E. COLI*. (E.) Celer, V. (Slovak Acad. Sci., Bratislava, Czechoslovakia), L. Cerny, E. Jelinkova and P. Nedbal. *Neoplasma* 18(5):523-528, 1971.

The immune response of a cow with acute bovine lymphosarcomatosis was studied. Although the cow had up to 800,000 lymphoid cells per ml of peripheral blood (6,000 is normal), no antibody producing cells were detected by a plaque-forming technique on the sixth day following intramammary instillation of 10^{12} sheep erythrocytes. A normal immune response was seen in healthy controls. Natural antibodies to a nonhemolytic strain of *E. coli*, serologic type 0-112, isolated from the digestive tract of an experimental cow were detected in the serum of the cow with lymphosarcomatosis. Colorimetric measurement of protein content in gammaglobulins in serum

fractionated on DEAE-Sephadex showed no significant differences between the diseased and a healthy cow. No differences were observed in immunoelectrophoretic patterns either.

- 3198 THE PRIMARY IMPLANTATION OF HUMAN TUMORS TO THE HAMSTER CHEEK POUCH. (E.) Williams, D. E. (Welsh Natl. Sch. Med., Cardiff, Wales), D. M. D. Evans and R. W. Blamey. *Brit J Cancer* 25(3):533-537, 1971.

The growth of 72 human tumors (including 22 breast tumors, 11 uterine cancers, and 15 gastrointestinal adenocarcinomas) was evaluated ten and 20 wk after primary implantation into the cheek pouches of eight-to-12-wk-old Golden hamsters. Half of the animals implanted with each tumor received s.c. injections of cortisone acetate (2.0 mg) at the time of implantation and thereafter twice weekly. Tumors were considered to be "growing" if mitotic figures were present in easily recognizable tumor tissue. Implants were considered "surviving" when recognizable tumor tissue was present in cheek pouches. Twenty-seven of 72 tumors (37.5%) grew in at least one implant. The uterine (nine of 11) and gastrointestinal (six of 15) tumors grew with greatest frequency. The number of implants growing in cortisone-treated animals (123 of 316 implants) was significantly greater ($P < 0.001$) than those growing in untreated controls (49 of 296). Similar results were obtained when methylcholanthrene-induced rat sarcomas were implanted into cheek pouches of cortisone-treated and untreated animals. Squamous carcinomas of the uterine cervix (45 of 82 implants) showed the best percentage of "takes" in cheek pouches of cortisone-treated animals, followed by adenocarcinomas of the corpus uteri (14 of 48) and adenocarcinomas of the colon and rectum (28 of 106). Only seven of 272 implants of breast carcinomas showed growth. It was suggested that such a method of implantation of human tumors into hamster cheek pouches could provide a means of simultaneously studying the effect of antineoplastic agents on tumors and host vital systems, while preserving the whole architecture of the tumors.

- 3199 IMMUNOTHERAPY OF CANCER: IMMUNOSPECIFIC REJECTION OF TUMORS IN RECIPIENTS OF NEURAMINIDASE-TREATED TUMOR CELLS PLUS BCG. (E.) Simmons, R. L. (Dept. Surg., U. Minnesota, Minneapolis) and A. Rios. *Science* 174(4009):591-593, 1971.

Living cells of a 3-methylcholanthrene-induced fibrosarcoma were mixed with 25 U *Vibrio cholerae* neuraminidase (VCN)/ml/ 10^6 cells and mitomycin C; the treated tumor cells were injected into C3H/H3J female mice bearing firmly established methylcholanthrene-induced tumors of the same type as those from which VCN-treated cells were taken. In some cases, Bacillus Calmette-Guerin (BCG) was added to the tumor cell-VCN-mitomycin C mixture. BCG alone, or tumor cells exposed to heat-inactivated VCN plus mitomycin C, or any combination of these treatments,

ed to produce total regression of established tumors in treated mice. However, a single injection of tumor cells exposed to VCN plus mitomycin C produced regression in two of seven tumors. When treated cells were injected in combination with 16 of 56 tumors regressed. The rejection of methylcholanthrene-induced tumor was immunospecific and could be induced only with VCN-treated cells identical in type with the established tumor.

DEMONSTRATION OF ANTIBODIES TO T-ANTIGENS OF VARIOUS ORIGINS IN SERA OF MONKEYS WITH SARCOMA AND OF MONKEYS INFECTED WITH ADENOVIRUS TYPE 12. (Rus.) Adzhigitov, F. I. (Inst. Path. Therapy, USSR Acad. Med. Sci., Sukhumi), Degtyarenko, N. I. Zatsepin, A. V. Pertaya and Gubeladze. *Doklady Akademii Nauk SSSR* 202(6):1434, 1972.

Sera of nine adult rhesus monkeys with induced sarcomas and the sera of nine rhesus monkeys infected repeatedly with human adenovirus type 12 (from birth to four yr of age) were assayed for antibodies. Tumors were induced in hamsters by virus, human adenovirus type 12, or SV-40 and as antigens together with normal hamster liver. The antigens were freeze dried after ultrasonic treatment and centrifugation. Control tests were done on sera of five healthy rhesus monkeys. Sera from infected and control monkeys were tested with cold micro-complement fixation method from infected and control monkeys. Antibodies to T-antigen of hamster Rous sarcoma were found in sera of all monkeys with Rous sarcoma. This indicates the presence in them of group-specific antigens of the leukemic-sarcoma complex found in chickens. Sera from monkeys infected with adenovirus type 12 reacted positively with T-antigen of hamster Rous sarcoma. High antibody titers to T-antigen of hamster Rous tumors induced by virus SV-40 were found in sera from monkeys with Rous sarcoma. Antibodies to normal liver antigens were found in the sera of both groups of monkeys less frequently. Antibodies to T-antigens in titers not exceeding 1:8. In control sera, reactions were negative with all the antigens studied. The findings indicate that antibodies to antigens commonly found in hamster tumors induced by RNA- or DNA-tumor viruses can be produced in rhesus monkeys infected with Rous virus and adenovirus type 12.

MIGRATION OF TUMORAL CELLS: SPECIFIC INHIBITION BY SENSITIZED LYMPHOID CELLS.

Le Mevel, B. (Paul Brousse Hosp., Inst. Experimental Immunogenetics, Villejuif, France), M. J. Giannakis and J.-F. Dore. *C R Acad Sci [D] (Paris)* 275(5):758-760, 1972.

Effect of adding specifically sensitized lymphoid cells to culture medium on the *in vitro* migration of leukemia cells from capillaries was studied. Leukemia was induced in adult C57Bl/6 mice

with Gross virus, and ascites was transplanted to isogenic recipients. Spleen cells from these C57Bl/6 mice who had been injected seven days earlier with 10^7 leukemia cells were added in different quantities to the culture medium and the migration of tumor cells was compared with that in media to which the same number of spleen cells from normal C57Bl/6 and C3H/He mice had been added. While the addition of allogenic spleen cells did not inhibit the migration of leukemia cells appreciably, addition of spleen cells from leukemic mice had a pronounced migration-inhibiting effect, even in media containing the smallest number of leukemia cells. The specificity of this effect was established by comparing cell migration in the presence of isogenic and allogenic normal mouse cells with cell migration in the presence of allogenic immunized cells (from C3H/He mice immunized three times with a s.c. injection of AkR(K36) cells). Normal allogenic spleen cells had a less pronounced migration-inhibiting effect than specifically immunized allogenic spleen cells. Thus, *in vitro* migration of leukemia cells can be inhibited by lymphoid cells from tumor-bearing mice. However, the nature of the lymphoid cells responsible for this phenomenon and their action mechanism remain unknown.

3202 IMMUNOLOGICAL STUDY COMPARING MITOCHONDRIA, ISOLATED FROM C3H MOUSE MAMMARY GLAND CARCINOMA AND FROM HOMOLOGOUS NORMAL TISSUE. (Fr.) Bourlioux, P. (Rene-Descartes U., Virol. Immunol. Lab., Paris, France) and A. German. *C R Acad Sci [D] (Paris)* 274(9):1438-1441, 1972.

A comparative immunological study of the antigenic properties of mitochondria from mammary tumors of the C3H strain of mice and of mitochondria from corresponding healthy tissues used four types of antigens to immunize rabbits (mitochondria isolated from the tumor, a mitochondrial protein fraction soluble in sodium desoxycholate, a mitochondrial fraction insoluble in sodium desoxycholate, and a mitochondrial protein fraction soluble in dodecyl sulfate). Rabbits were infected i.m. with 1 ml mitochondria or an antigen extract plus 1 ml of complete Freund adjuvant for seven consecutive weeks, followed by two intravenous injections of mitochondria in a sucrose buffer. The reactions induced by the four immunizations were evaluated by Ouchterlony's double-diffusion method on agar by using against these immune sera mitochondrial protein fractions from the tumor extracted by desoxycholate, Triton, Duponol, and dodecyl sulfate, and by using mitochondrial protein fractions from healthy tissue extracted in the same way. Mitochondria from tumor tissue contained an antigen which is absent in healthy tissue. These findings confirm those found previously in an electrophoretic study.

3203 AUTOANTIBODIES TO HUMAN RENAL CELL CARCINOMA. (E.) Ravitz, G. (West Virginia U. Sch. Med., Morgantown), A. L. Watne and D. F. Milam. *J Urology* 107(1):26-28, 1972.

Humoral (globulin) antibodies have been demonstrated against the cells of hypernephroma using immunofluorescent techniques. No common antigen was demonstrable by cross-reaction. One patient with metastatic disease had no antibodies demonstrated. In another patient with a weak reaction metastases soon developed. One patient demonstrated antibody against his own normal kidney. No cross-reaction to pooled normal sera was demonstrated. No cross-reaction with fetal kidney was demonstrated.

- 3204 SUPPRESSIVE EFFECT OF IMMUNIZATION WITH MOUSE FETAL ANTIGENS ON GROWTH OF CELLS INFECTED WITH RAUSCHER LEUKEMIA VIRUS AND ON PLASMA-CELL TUMORS. (E.) Hanna, M. G., Jr. (Oak Ridge Natl. Lab., Tenn.), R. W. Tennant and J. H. Coggin, Jr. *Proc Nat Acad Sci USA* 68(8):1748-1752, 1971.

Male BALB/c mice were injected once a wk for three wk with X-irradiated viable embryo cells from BALB/c mice. Embryo cell-primed mice were irradiated and implanted with Millipore diffusion chambers containing Rauscher leukemia virus (RLV)-infected BALB/c spleen cells. Other embryo cell-primed mice were injected with RLV to induce splenomegaly, or given transplants of an ascites plasma-cell tumor. Recovery of RLV-infected spleen cells in implanted diffusion chambers was depressed to 60 or 49% of normal in mice primed with embryo cells. Splenomegaly induced by RLV and cumulative mortality from a transplanted ascites plasma cell tumor were also suppressed in embryo cell-primed mice. RLV-induced splenomegaly was also suppressed by adoptive transfer of BALB/c spleen cells from newborn mice to BALB/c mice. Injections of neonatal BALB/c cells did not suppress recovery of RLV-infected spleen cells, splenomegaly, or mortality of tumor transplant recipients among BALB/c mice not primed with embryo cells. Priming of mice with embryo cells did not suppress primary immunoglobulin M response to heterologous erythrocyte antigen in normal BALB/c spleen cells. Apparently, BALB/c embryos possessed components, presumably antigens, common to RLV-infected spleen cells and a plasma-cell ascites tumor. Also, the plasma-cell tumor appears to be among those human and animal tumors which contain neoantigens that cross-react with antigens of fetal cells.

- 3205 THE USE OF THE PROTEOLYTIC ENZYME BRINASE TO PRODUCE AUTOCYTOTOXICITY IN PATIENTS WITH ACUTE LEUKEMIA AND ITS POSSIBLE ROLE IN IMMUNOTHERAPY. (E.) Thornes, R. D. (Royal Coll. Surg. Ireland, Dublin), P. F. Deasy, R. Carroll, D. J. Reen and J. D. MacDonell. *Cancer Res* 32(2):280-284, 1972.

The ability of the proteolytic enzyme, brinase, to reproduce complement-dependent autocytotoxicity against leukemia cells, lymphocytes and possibly platelets was studied. Daily infusions of brinase, a proteolytic enzyme isolated from *Aspergillus oryzae*, were given for 10 to 30 days to six acute leukemia patients. Dosage given was 2.5 mg/kg of body weight in children and 100 to 300 mg daily to adults. Autocytotoxicity was assayed

on serum samples from patients by incubating the serum for 2 hr at 37 C in 0.001 ml quantities with 1,000 lymphocytes and 0.005 ml of complement. Testing was considered positive when more than 20% of the cells were killed. Results indicated that the autocytotoxicity initiated by brinase was temporary, lasting from three to 15 days, but repeat courses of brinase, alone or in combination with anti-leukemic drugs, produced further autocytotoxic "antibodies". Remission was obtained in three of five patients given combination therapy and in one patient with acute myeloblastic leukemia who was treated by brinase alone.

- 3206 INCREASED INCIDENCE OF LYMPHOMAS IN THYMECTOMIZED MICE--EVIDENCE FOR AN IMMUNOLOGICAL THEORY OF AGING. (E.) Cornelius, E. A. (Yale U. Sch. Med., New Haven, Conn.). *Experientia* 15(4):459, 1972.

(C57B1/1XA) F₁ hybrid mice were thymectomized after birth and observed twice weekly for the presence of lymphoreticular tumors. Similar F₁ hybrids, not thymectomized, served as controls. Although tumors first appeared in both groups after five months, the incidence of tumor at a given age was significantly higher in the thymectomized group than in the controls for all ages (up to 24 months) observed. Up until the seventh month the rate of increase in tumor incidence was much higher for the experimental group than for the controls. Beginning at about the 17th month, the slope of the control curve plotting the rate of tumor incidence became greater than that of the experimental curve so that ultimate convergence of the two curves was evident. Since the thymus-dependent system is primarily concerned with immunological surveillance, these results were considered as supporting evidence for the gradual exhaustion of this immunological system with aging. Such exhaustion would manifest itself by an increased incidence of tumors in deficient mice.

- 3207 HUMAN CARCINOMA ANTIGENS CROSS REACTING WITH ANTI-EMBRYONIC ANTIBODIES. (E.) Klavins, J. V. (Queens Hosp. Ctr., New York), R. Mesa-Tejada and M. Weiss. *Nature New Biol* 234(48):153-154, 1971.

A 6-7 wk old intact human fetus from a patient with ectopic pregnancy, was homogenized and then centrifuged. The supernatant was dialysed and lyophilized. A New Zealand white male rabbit was immunized and three injections of the lyophilized fetal extract resuspended in bacteriostatic water and emulsified with complete Freund's adjuvant were administered s.c. at weekly intervals and a booster injection was given intramuscularly one wk after the last injection. Thereafter, injections were given intramuscularly at monthly intervals and blood was collected from the marginal ear vein ten days after each booster. The Ouchterlony double diffusion technique was used to demonstrate that the rabbit serum contained antibodies reacting with the extracts of two

inomas of colon, a carcinoma of breast, a sarcoma, a squamous cell carcinoma, a clear cell carcinoma of kidney, a bronchogenic carcinoma and a carcinoma of skin. These antibodies did not react with extracts of adult spleen, kidney, lung, liver, heart and intestine. Indirect immunofluorescence microscopy showed that the absorbed rabbit antiserum, after incubation with various kinds of tissues, was bound to the cells of the six types of carcinomas and to the epidermis of the adult skin. It did not bind to the normal adult tissues. These findings indicate that in man, carcinomas corresponding to the three germinal layers contain antigens which react with the antibodies against the components of embryonic tissues.

HERPES ZOSTER-VARICELLA INFECTIONS AND LYMPHOMA. (E.) Goffinet, D. R. (Stanford U. Sch., Calif.), E. J. Glatstein and T. C. Merigan. *Ann Intern Med* 76:235-240, 1972.

Review of 1130 patients with lymphoma, examined at the Stanford Medical Center over a ten-year period (1959 to 1969), shows 129 (11.4%) patients with one or more episodes of typical herpes zoster-varicella infection. Five hundred and ninety-two patients had Hodgkin's disease, and in this group 91 cases of herpes zoster-varicella infection (15.4%) were detected. Five hundred and thirty-eight patients with lymphoma other than Hodgkin's disease; of these, 24 developed herpes zoster-varicella (7.1%). All patients were analyzed according to age, clinical status, site of lymphoma when infection occurred, and survival after either localized or disseminated disease. The effects of antitumor chemotherapy including combination chemotherapy, are presented. A significantly increased incidence of herpes zoster-varicella infections was found in the 150 patients with Hodgkin's disease who underwent splenectomy either as part of their initial evaluation and staging or during the course of their disease, although survival of this group was apparently unchanged by the infectious complication of their lymphoma.

INDUCTION OF TUMORS IN NEONATALLY THYMECTOMIZED MICE. (E.) Cornelius, E. A. (Yale Sch. Med., New Haven, Conn.). *Transplantation* 19:531-532, 1971.

The incidence of spontaneously occurring tumors in neonatally thymectomized and normal mice of the C57BL/1 strain and age was compared. (C57BL/1 x A)F₁ hybrid mice were subjected to thymectomy 24 hr after birth; sham operated mice of the same strain constituted the control group. Each animal in both groups was examined twice weekly; any tumors detected were confirmed by autopsy. Tumors were detected during the fifth month in both thymectomized and control mice, and the difference in incidence was not significant. At the end of the sixth month a significant difference became

apparent, with four of the test animals having developed tumors versus only one of the control group. At this point the number of tumors increased rapidly in the thymectomized mice while the control mice continued to exhibit a very low incidence of tumor growth. By 22 months, 31 out of 77 mice had developed tumors among the test animals and only 12 out of 149 control animals were tumor-bearing. The tumors were shown histologically to be lymphoreticular. Two possible etiological mechanisms for the greatly increased incidence of lymphoreticular tumors in aged, neonatally thymectomized mice are: 1) immunological deficiency, allowing mutant malignant clones of cells to proliferate; and, 2) autoimmunity, and subsequent hyperplastic change caused by bacterial or viral agents.

3210 IMPAIRED LYMPHOCYTE TRANSFORMATION IN LEUKEMIC PATIENTS AFTER INTENSIVE THERAPY. (E.) Humphrey, G. B. (U. Oklahoma Med. Ctr., Oklahoma City), M. E. Nesbit, Jr., K. K. N. Chary and W. Krivit. *Cancer* 29(2):402-406, 1972.

Lymphocyte transformation was measured to assess immunologic competence in acute lymphatic leukemia. The *in vitro* lymphocyte transformation in response to pokeweed mitogen was studied in three groups of children: 1. 11 normal controls, 2. nine leukemic children in remission who had not received intensive therapy, and 3. nine leukemic children who had completed intensive x-ray and chemotherapy. The responses of the first and second groups were similar. In the third group, lymphocyte transformation was impaired one month after all therapy had been discontinued in 8/9 patients. Six of these nine patients were studied two months after cessation of therapy and the lymphocyte transformation was still impaired (6/6). Serial monthly studies in three patients demonstrated that this impaired transformation persisted for three months or longer. Intensive forms of chemotherapy-radiotherapy used to treat acute lymphatic leukemia can cause prolonged impairment of lymphocyte transformation.

3211 DEMONSTRATION AND PURIFICATION OF A SPECIFIC ANTIGEN IN MORRIS HEPATOMA 5123. (E.) Kyriazis, A. P. (Dept. Path., U. Chicago, Ill.) and R. W. Wissler. *Lab Invest* 26(2):178-183, 1972.

A specific antigen related to the Morris line 5123 minimal deviation hepatoma has been characterized and highly purified. The Morris 5123 hepatomas, which were grown in Buffalo strain adult male rats, were removed, and homogenized; the cell membranes were isolated and digested with papain. Preparatory fractionation on a CM-Sephadex C-25 column revealed four fractions; the first one contained the specific precipitin line developed with the absorbed antiserum and was fractionated further on

Sephadex G-200. When the two fractions resulting from this purification step were studied by analytical disc electrophoresis and immunodiffusion the more slowly moving protein component of fraction I, with an R_f of 0.27 to 0.28, was found to react with the completely absorbed antiserum. The homogeneity of this specific component was demonstrated by polyacrylamide gel electrophoresis. The techniques used in this study may prove useful for solubilizing and isolating tumor-specific antigens in human tumors and for developing immunogens for cancer therapy.

- 3212 ADJUVANT EFFECT OF ENDOTOXIN ON PRIMARY ANTIBODY FORMATION IN IRRADIATED RATS. (E.) Elekes, E. (Natl. Res. Inst. Radiobiol. Radiohyg., Budapest, Hungary), K. Meréty and V. Várterész. *Path Microbiol* 37:302-312, 1971.

Male Wistar rats were irradiated (750 R) to abolish the primary immune response and to hold antibody-forming capacity at a low level for a period of 45 days. The rats were then given sheep red blood cells (SRBC) i.v., either with or without *E. coli* endotoxin, over a period of one month. During the first week after irradiation, endotoxin treatment induced a mild decrease in plaque-forming cells, but after the 10th day, it resulted in a comparatively earlier regeneration of the antibody-forming capacity. By the end of the first month the antibody response to SRBC returned to normal levels in the endotoxin-plus-SRBC-treated group, while irradiated animals remained impaired. Formation of anti-SRBC plaque-forming cells was similar. Endotoxin-induced splenomegaly was seen in all groups to which endotoxin was administered. In addition, increases in serum hemolysin titers could be found earlier and at higher levels in endotoxin-treated irradiated animals than in nonirradiated rats immunized solely with SRBC. These experiments suggest that the endotoxin-induced effects may present a significant contribution to the regeneration of the immune response.

- 3213 FURTHER OBSERVATIONS ON WHETHER HOST IMMUNODEPRESSION IS ASSOCIATED WITH TUMOUR GROWTH IN MICE. (E.) Rees, J. A. (U. Bristol Med. Sch., England) and M. O. Symes. *Brit J Cancer* 25(3):501-504, 1971.

To investigate whether the presence of a tumor was associated with immunodepression in the host, spleen cells from parent A-strain mice bearing A-strain mammary carcinoma transplants were injected i.v. into (AxCBA) F_1 hybrids, half of which carried the same tumor. Other F_1 hybrids, with and without tumors, received spleen cells from non-tumor-bearing parent-line animals. The ability of parent-line spleen cells to induce a graft versus host (GVH) reaction in the four groups of F_1 hybrids was assessed by comparing the mean spleen indices (ratio of the spleen weight of the F_1 hybrid receiving the injection to that of the

control). No differences in GVH responses were observed and it was concluded that parent line cells from tumor-bearing or from non-tumor-bearing donors were equally effective in inducing a GVH reaction, whether or not the F_1 hybrid recipient carried a tumor. Similar results were obtained from parent lines bearing a different mammary carcinoma and lines bearing a 3-methylcholanthrene-induced sarcoma.

- 3214 IN VITRO STUDY OF CELLULAR IMMUNITY AGAINST AUTOCHTHONOUS HUMAN CANCER. (E.) Segall, A. (Inst. Gustave-Roussy, Villejuif, France), O. Weiler, J. Genin, J. Lacour and F. Lacour. *Int J Cancer* 9(2):417-425, 1972.

A study of cell-mediated immunity has been undertaken *in vitro* by the leukocyte migration test (LMT) on 57 patients with operable carcinoma. Tumor extracts induced an inhibition of autologous leukocyte migration in 58% of the cases: 10 out of 17 lymphomas, 10 out of 15 malignant mesenchymal tumors, 8 out of 13 mammary carcinomas, 2 out of 4 melanomas, and 3 out of 8 various other tumors. Migration of mononuclear cells was especially inhibited but not that of neutrophils. Thus a previous sensitization of the lymphocytes by tumor antigen(s) has been shown. On the contrary, 9 extracts of benign and 17 extracts of normal tissue did not significantly inhibit the migration of autologous cells. Almost all tumor extracts were tested against allogeneic leukocytes from patients bearing the same or a histologically different type of tumor, or from healthy subjects (101 cases). Cross-reactions were observed in five melanomas, in one case of Hodgkin's disease, and in one breast carcinoma. In all but two cases, inhibition of leukocyte migration did not occur in patients with a different type of tumor or in non-cancerous patients.

- 3215 THE PRODUCTION OF COMPLETE AND INCOMPLETE ANTIBODIES IN PATIENTS WITH NEOPLASTIC DISEASE. (E.) Wagner, V. (Inst. Care Mother Child, Prague, Czechoslovakia), O. Janku, M. Wagnerova, J. Mates and Z. Konickova. *Neoplasma* 19:(1):75-87, 1972.

Antibody formation (complete and incomplete) after single s.c. injection of heat-killed *Brucella* was examined in patients with malignant diseases. Blood specimens were collected 1, 2 and 3 wk after immunization. The results were correlated with clinical data and compared with two control groups. In the 1st and 2nd wk the patients with malignancies showed a decreased complete antibody formation and lower titers of incomplete antibodies. No significant differences were found in antibody response related to the stage of malignant tumor, or the length of survival of the patient. The defect of antibody formation in patients with malignancies is discussed. It is proposed that lower antibody formation in patients with malignant tumors is not a consequence of malignant tumor, but seems to be a property of every malignant disease.

- 16 IMMUNOLOGIC BEHAVIOUR BEFORE AND DURING CYTOSTATIC TREATMENT IN BRONCHUS CARCINOMA. (E.) Lopes Cardozo, E. (Dept. Intern. Med., Vrije Univ., Amsterdam, Netherlands) and M. C. Harting. *Immunology* 25(6):520-527, 1971.
- 17 IMMUNOELECTROPHORETIC STUDIES ON THE BLOOD SERUM PROTEINS IN MALIGNANT LYMPHOGRANULOMATOUS PATIENTS. (Pol.) Adamczyk, B. (Inst. Oncol., Krakow, Poland), H. Glinka and J. Kulpa. *Przeegl Lek* 28(12):759-762, 1971.
- 18 A METHOD FOR THE PREPARATION OF CARCINO-EMBRYONIC ANTISERA FROM COLON TUMOR ISSUES. (Fr.) Luzzi, M. (Med. Inst. Marseille, France) and R. Depieds. *Ann Inst Pasteur* 122(12):341-358, 1972.
- 19 PRIMARY CARCINOMA OF THE LIVER AND ALPHAFETOGLOBULIN (AFG). (Sp.) Daiber, A. (Hosp. Barros Luco-Trudeau, Santiago, Chile), A. Armona and R. Soerensen. *Rev Med Chile* 99(12):634-637, 1971.
- 20 IMMUNOLOGICAL MECHANISM AFFECTING ONCOLYSIS BY *CLOSTRIDIUM BUTYRICUM*. (Ger.) Schweizer, K. (Dept. Med. Technol. U. Aachen, Germany). *Z Immun-Forsch* 142(5):455-467, 1972.
- 21 CERTAIN CYTOLOGIC IMMUNOLOGICAL TESTS IN PATIENTS WITH LUNG CANCER. (Rus.) Sergel, S. (A. V. Vishnevskiy Surg. Inst. Acad. Med. Sci., Moscow, USSR), A. P. Kachkov and A. A. Admayan. *Sov Khir Anest* 16(6):20-22, 1971.
- 22 HL-A ANTIGENS IN HODGKIN'S DISEASE AND MULTIPLE MYELOMA: INCREASED FREQUENCY OF BOTH IN BOTH DISEASES. (E.) Bertrams, J. (Inst. Med. Microbiol., Essen, West Germany), E. Kuwert, U. Böhme, E. Reis, W. M. Gallmeier, O. Wetter and C. G. Schmidt. *Tissue Antigens* 2:41-46, 1972.
- 23 THE SPONTANEOUS DEVELOPMENT OF LYMPHOMAS IN NEW ZEALAND MICE: (NZB/W_F₁ HYBRID). (E.) C. (Juntendo U., Internal Med., Japan), T. Okada, Shiohara and K. Tanaka. *Jap J Allergology* 20(11):164, 1971.
- 24 UNIMPEDED GROWTH OF TUMOUR IN HOSTS PRE-IMMUNIZED WITH TYROSYL- OR DINITROPHENYL-COATED TUMOUR CELLS. (E.) Bauminger, S. (Weizmann Inst. Sci., Rehovot, Israel) and S. Yachnin. *Brit J Cancer* 26:77-83, 1972.
- 3225 BONE MARROW STEM CELL RESPONSE TO TUMOUR GRAFTS. (E.) Croizat, H. (Inst. Radiobiology Clin., Villejuif, France) and E. Frindel. *Rev Europ Etudes Clin Biol* 17(2):200-204, 1972.
- 3226 CELLS MEDIATING SPECIFIC *IN VITRO* CYTOTOXICITY: II. PROBABLE AUTONOMY OF THYMUS-PROCESSED LYMPHOCYTES (T CELLS) FOR THE KILLING OF ALLOGENEIC TARGET CELLS. (E.) Golstein, P. (Karolinska Inst., Stockholm, Sweden), H. Wigzell, H. Blomgren and E. A. J. Svedmyr. *J Exp Med* 135(4):890-906, 1972.
- 3227 IMMUNOLOGIC AND VIROLOGIC PROPERTIES OF CHEMICALLY AND γ -IRRADIATION-INDUCED THYMIC LYMPHOMAS IN MICE. (E.) Chan, P. L. (U. Western Ontario, Canada) and N. R. St.C. Sinclair. *J Nat Cancer Inst* 48(6):1629-1640, 1972.
- 3228 MATERNAL MODIFICATION OF RESPONSIVENESS IN THE OVA-TRANSFER SUBSTRAIN DBA/2eB. (E.) Uphoff, D. E. (Natl. Cancer Inst., Bethesda, Md.). *J Nat Cancer Inst* 48(5):1317-1322, 1972.
- 3229 IMMUNODEFICIENCY OF THE THYMUS-DEPENDENT SYSTEM OF THE AMES DWARF MOUSE. (E.) Duquesnoy, R. J. (Med. Coll. Wisconsin, Milwaukee). *J Immunol* 108(6):1578-1590, 1972.

See also:

- * (Rev): 2903, 2907, 2914
- * (Chem): 2930, 2931, 3001
- * (Viral): 3035, 3039, 3042, 3051, 3054, 3065, 3104, 3125, 3146

- 3230 DISTINCTION BETWEEN THE PRENEOPLASTIC AND NEOPLASTIC STATE OF MURINE MAMMARY GLANDS. (E.) Hazlewood, C. F. (Baylor Coll. Med., Houston, Tex.), D. C. Chang, D. Medina, G. Cleveland and B. L. Nichols. *Proc Nat Acad Sci USA* 69(6):1478-1480, 1972.

Nuclear magnetic resonance spectroscopy was used to measure the relaxation times (T_1 and T_2) and diffusion coefficient (D) of water protons in primary mammary adenocarcinomas arising from nodule outgrowth lines D₁ and D₂ in Balb/c mice and from a nodule outgrowth line in C3Hf mice. The relaxation times and diffusion coefficients of water protons in the carcinomas were almost doubled relative to those of mammary gland tissue from normal pregnant mice and nodule tissue. The relaxation times and diffusion coefficients for the nodule (preneoplastic) tissues were slightly longer than those from mammary gland of normal pregnant females. The possibility that the increased diffusion coefficient of tumor tissue was due to a decreased cell lipid content relative to normal mammary and pre-neoplastic tissues was excluded by the fact the exchange of lipid protons and water protons was found to be negligible.

- 3231 THE PATHOLOGY OF SO-CALLED MEDITERRANEAN ABDOMINAL LYMPHOMA WITH MALABSORPTION. (E.) Rappaport, H. (Chaim Sheba Med. Ctr., Tel-Hashomer, Israel), B. Ramot, N. Hulan and J. K. Park. *Cancer* 29(6):1502-1511, 1972.

Surgical specimens and/or postmortem materials from 22 patients with the syndrome designated as "Mediterranean abdominal lymphoma with malabsorption" were studied in detail. Eighteen of the patients were followed at Tel-Hashomer Hospital, Israel, and four at other institutions. All patients exhibited a malabsorption syndrome. In most of those followed from the onset of the disease, the syndrome seemed to have preceded the development of palpable abdominal masses. The characteristic gross finding in all cases was a diffuse thickening of the mucosa of the small intestine with loss of the intestinal circular mucosal folds. In histological specimens obtained from all 20 patients so studied, diffuse severe plasma cell infiltrations were evident in the intestinal mucosa and submucosa. Malignant lymphomas in the form of single or multiple circumscribed intestinal tumors occurred in 14 of these 20 patients, and malignant lymphomas of the mesenteric lymph nodes in two. In four patients, no malignant lymphomas were evident. These observations suggest that the diffuse plasma cell infiltrations, rather than the malignant lymphomas, were responsible for the malabsorption syndrome. There was no morphological evidence that the malignant lymphomas observed in 16 of 20 patients were histologically related to the diffuse plasma cell infiltration. The possibility is suggested that this abnormal, though probably not neoplastic, proliferation of plasma cells is a morphological manifestation of an immune deficiency state which predisposes the patients to the development of malignant lymphoreticular neoplasms.

- 3232 PRE-LEUKAEMIA IN CHILDREN WITH A MISSING BONE MARROW C CHROMOSOME AND A MYELOPROLIFERATIVE DISORDER. (E.) Humbert, J. R. (U. Colorado Med. Ctr., Denver), W. E. Hathaway, A. Robinson, D. C. Peakman and J. H. Githens. *Brit J Haemat* 21(6):705-716, 1971.

A child is reported who progressively 'lost' a C-chromosome in bone marrow metaphases in a proportion increasing from 9% to 100% over a three yr period. Hematologically the patient had hepatosplenomegaly with myeloid metaplasia, refractory anaemia, leucocytosis and thrombocytopenia. Immature granulocytes and erythrocytes and monocytosis were present in peripheral blood. The patient also had increased fetal hemoglobin and leucocyte alkaline phosphatase. Her blood lymphocyte and skin fibroblast chromosomes were essentially normal. Recent progression of the patient's disorder and study of information available from the literature suggest that this myeloproliferative disorder may represent a preleukemic state.

- 3233 MURAMIDASE IN MYELOPROLIFERATIVE DISORDERS TERMINATING IN ACUTE LEUKEMIA. (E.)

Skarin, A. T. (Harvard Med. Sch., Boston, Mass.), Y. Matsuo and W. C. Moloney. *Cancer* 29(5):1336-1342, 1972.

Studies on serum muramidase (lysozyme) activity (SMA) were carried out on 168 patients with leukemia and a variety of myeloproliferative disorders. Among the cases were three with chronic myelogenous leukemia, one with polycythemia vera, and four with myeloid metaplasia; in these eight cases, transition to acute myeloblastic or acute myelomonocytic leukemia took place. Studies on these eight patients are presented with detailed serial observations in three cases terminating in acute myelomonocytic leukemia. Acute leukemic transition in the latter three cases was associated with striking elevation of SMA and marked muramiduria. In the eight patients in which myeloproliferative disorders progressed to leukemia, leukemia had its onset between two months and five yrs after the onset of the myeloproliferative disorder. The three patients studied in detail showed significant hypokalemia, possibly related to toxic effects of an excess of muramidase on renal tubules.

- 3234 GROWTH *IN VITRO* AND INDUCTION OF DIFFERENTIATION IN CELLS OF BASAL CELL CANCER.

Flaxman, B. A. (Temple U. Hlth. Sci. Ctr., Philadelphia, Pa.). *Cancer Res* 32(3):462-469, 1972.

Human basal cell carcinomas were excised and the epidermis and superficial portions of tumors were dissected away; tumor nodules were established in culture and observed under light- and electron-microscopes. Prior to culturing, tumor nodules showed no keratinization. Three to four days after the start of cultures, epithelial outgrowths appeared around each nodule. Outgrowths formed monolayers at the peri-

eries of nodules, while the central regions were multi-layered and consisted of stratified squamous epithelium. Cell division and DNA synthesis occurred outgrowths wherever outgrowths were multilayered. 30 days, opaque areas had formed in the nodule cultures; significant keratinization was found to have commenced in opaque areas as they formed. Peripherally located cells tended to break away from the outgrowths. Peripheral cells also showed contact inhibition of overlap among themselves, and when confronting normal human epidermal cells. Young nodule cultures consisted primarily of immature undifferentiated cells like those of nodules *in vivo*; older cultures showed differentiation in the form of keratinization. Older cultures also had diminished growth rates.

35 THE DUBREUILH MELANOSIS: A PRECANCEROUS STATE OF MUCOUS MEMBRANES. HISTOLOGICAL AND ULTRASTRUCTURAL ASPECTS. (Fr.) Bonneau, H. (Anticancer Ctr., Marseille, France) and J. P. Cesari. *Bull Cancer (Paris)* 58(2):307-314, 1971.

The histological picture of Dubreuilh's melanosis is characterized by a proliferation of melanocytes which over the basal membrane of the epidermis almost completely; in some specimens very few keratinized cells are present. The histological picture suggests this precancerous melanosis is a true cancer *in situ*. The ultrastructural picture always reveals the presence of keratinized cells, but these are sometimes smaller than 1 μ and thus difficult to see in a light microscope. The melanophores are disorganized with frequently missing peripheral membranes. In Dubreuilh's melanosis of buccal origin a certain number of melanophores have no central opacification, are elongated or rectangular, and are uneven in size. When the keratinized cells disappear, leaving the melanocytes in direct contact with the basal membrane, melanophore anomalies become more frequent and autophagosomes containing melanophores appear. Occasionally, the melanocytes passed through the basal membrane, producing a malignant melanoma. Melanophores in Dubreuilh's melanosis definitely show some characteristics of cancer cells, but to a lesser extent and much less frequently than true cancerous melanophores.

36 HORMONE DISTURBANCES IN WOMEN WITH PRECANCEROUS DISEASES AND CANCER OF THE BREAST. (S.) Kuzmin, V. I. (Republican Oncology Dispensary Chuvash Autonomous SSR, Public Hlth. Ministry, USSR). *Akush Ginekol* 47(9):39-42, 1971.

A total of 640 women with diseases of the breast including 270 with mammary gland cancer, 207 with mastopathy, and 163 with fibroadenoma of the mammary gland and 142 normal controls were studied clinically, and vaginal smears from 177 of these women were cytologically examined to diagnose hormone disturbances associated with breast diseases. Twenty-eight patients with cancer, 31 with mastopathy, and 31 with fibroadenoma had a history of hepatobiliary

disease as compared to two (1.4%) of the control group. Of 177 patients, whose vaginal smears were examined cytologically, 32 had breast cancer, 131 fibrocystic mastopathy, and 14 fibroadenoma. A total of 86 or 48.6% (11 cancer and 75 dys hormonal hyperplasia) had increased estrogen levels, 43 patients (17 cancer and 26 dys hormonal diseases) had hypoestrogenism, and the remaining 48 (4 cancer and 44 dys hormonal diseases) had normal values. Thus, patients with dys hormonal diseases and breast cancer very often have hormone disorders which could accelerate the development of pathological processes in the breast.

3237 PATHOGENESIS OF HODGKIN'S DISEASE. (E.) Order, S. E. (Harvard Med. Sch., Boston, Mass.) and S. Hellman. *Lancet* (7750):571-573, 1972.

A hypothesis, based on clinical and laboratory observations, relates viral infection and host immunity to the pathogenesis of Hodgkin's disease. In this hypothesis, T cells (thymus-derived lymphocytes) are infected by a tumor-inducing virus causing a change in cell-surface antigen. Normal T cells begin to react against the virus-transformed cells in a fashion similar to a chronic graft-versus-host reaction and this interaction results in the production of neoplastic reticulum cells (histiocytes) which are the malignant component of the disorder. These neoplastic reticulum cells eventually appear as end-stage multinucleated Reed-Sternberg cells. This hypothesis is compatible with each of the salient clinical features of Hodgkin's disease, including primary site of the disease, histological pattern, preclinical status, loss of cell-mediated immunity, and prognosis.

3238 MUTATION AND CANCER: A MODEL FOR WILMS' TUMOR OF THE KIDNEY. (E.) Knudson, A. G., Jr. (Grad. Sch. Biomed. Sci., U. Texas, Houston) and L. C. Strong. *J Nat Cancer Inst* 48(2):313-324, 1972.

Statistical analysis of cases of Wilms' tumor supports a 2-mutation model previously reported for retinoblastoma. Comparison of data for familial, bilateral, unilateral, and unselected cases from 97 patients seen between 1944 and 1970 at the M.D. Anderson Hospital and Tumor Institute and from 58 previously published cases reveals that familial and bilateral cases have an early average age of diagnosis (two yr compared with a median age of 3-4 yr), while unilateral and unselected cases do not. Familial cases have a 21% incidence of bilaterality which is higher than that of unselected cases (5-10%) and a pattern consistent with autosomal dominant inheritance. These findings suggest that Wilms' tumor may be attributed to a 2-mutational model (i.e. 2 mutations are required in all cases), but, in approximately 38%, one mutation has occurred in the germinal line of a parent and is inherited. Persons acquiring this germinal mutant develop an average of one second mutation each, which gives rise to tumor. Approximate

mately 37% of gene carriers do not develop tumor, and 15% develop bilateral tumors. About 62% of cases of Wilms' tumor are nonhereditary, both of the mutations occurring in somatic cells. The previously reported association of Wilms' tumor with aniridia, hemihypertrophy, and genitourinary anomalies is fitted to the model. The familial pattern is noted to be similar to that of a delayed mutation; new germinal mutations may be attributable to a vertically transmitted tumor virus resembling the virus causing embryonal renal sarcoma in chickens.

- 3239 PATTERNS OF NUCLEIC ACID AND PROTEIN SYNTHESIS IN NORMAL HUMAN GASTRIC MUCOSA AND ATROPHIC GASTRITIS. (E.) Deschner, E. E. (Cornell U. Med. Coll., N.Y.), S. J. Winawer and M. Lipkin. *J Nat Cancer Inst* 48(6):1567-1574, 1972.

Gastric tissue obtained from biopsy of three patients with normal gastric mucosa and from 16 patients with histologically documented gastritis was incubated with ^3H -thymidine, ^3H -uridine, or ^3H -leucine. Incorporation was analyzed by autoradiography. In normal gastric mucosa, incorporation of precursors into DNA, RNA and protein was greatest in the neck and isthmus cells. However, in mucosa in various stages of atrophic gastritis, alterations in the gradients of precursor incorporation could be correlated with the severity of the gastric lesion. The earliest abnormalities were increased RNA and protein synthesis as well as DNA synthesis in surface epithelial cells of normal gastric mucosa. This gradient continued when the mucosa became lined with immature cuboidal cells and extended into the stages of increased atrophy and early intestinalization. During the period of severe atrophic gastritis, the intestinalized gastric mucosa was characterized by a labeling pattern seen in the normal small bowel--with DNA synthesis and greater RNA and protein synthesis in the lower portions of the glands.

- 3240 ORAL CONTRACEPTIVES AND PATHOLOGIC CHANGES IN THE BREAST. (E.) Taylor, H. B. (St. Louis U. Med. Sch., Mo.). *Cancer* 28(6):1388-1390, 1971.

A comparison is made of the histologic appearance of normal breast tissue and a variety of benign and malignant epithelial lesions in women using oral antiovolants and in age-matched controls. No histologic changes have been found that can reliably be attributed to the oral steroids by either light or electron microscopy. Reported changes in fibroadenomas and in carcinomas associated with oral contraceptive use have not been confirmed in studies utilizing controls. Additionally, no differences in the prevalence or in the age of patients at the time of diagnosis have been found for fibroadenomas, chronic cystic disease, or carcinoma. The lack of any demonstrable morphological changes in women's breasts related to oral contraceptive does not necessarily mean that these agents do not have a

carcinogenic or cocarcinogenic potential, but it makes such a possibility seem quite remote.

- 3241 EXPERIMENTAL STUDY ON CANCER CELL DIFFUSION IN THE EMBRYO-CARRYING CHICKEN EGG. (Fr.) Mouton, Y. (Cancer Res. Inst. Lille, France), A. Demaille and J. Driessens. *C R Soc Biol* 165(4): 850-853, 1971.
- 3242 CELL PROLIFERATION IN PANCREATIC ACINAR EPITHELIA OF RATS: AUTORADIOGRAPHIC STUDIES WITH ^3H -THYMIDINE. (Ger.) Wenzel, G. (Wurzburg, U., Germany), E. Stöcker and W.-D. Heine, *Virchows Arch B* 10(2):118-126, 1972.
- 3243 CONCERNING HISTOGENESIS OF NEURINOMAS. (Rus.) Shcherbakova, M. G. (USSR Ministry Public Hlth., Leningrad). *Vop Onkol* 17(12):49-56, 1971.
- 3244 SIMULTANEOUS EPIDERMID CARCINOMA IN SITU OF THE PORTIO/CERVIX AND THE ENDOMETRIUM OF THE UTERUS. (E.) Hou-Jensen, K. (Bispebjerg Hosp., Copenhagen, Denmark). *Acta Path Microbiol Scand* 80:1-4, 1972.
- 3245 INCREASE OF PEROXIDATION IN CARCINOGENESIS. (E.) Shamberger, R. J. (Cleveland Clin. Fdn., Ohio). *J Nat Cancer Inst* 48(5): 1491-1497, 1972.

See also:

- * (Rev): 2907
- * (Chem): 3014
- * (Viral): 3044
- * (Epid-Biom): 3287

RECENT MORTALITY FROM CANCER OF THE CERVIX
IN THE UNITED STATES AND UNITED KINGDOM.

Higgins, I. T. T. (Sch. Public Hlth., U. of Michigan, Ann Arbor). *Lancet* (7734):1141-1143, 1971.

rates from cancer of the cervix in the United States in 1950-67 are compared with similar data for England and Wales. In the United States, unlike England and Wales, the crude mortality rates for cancer of the cervix have declined. The trend was noted both White and non-White women. Among White women there has been a consistent downward trend in all decennial age-groups. Among non-White women there has been a downward trend in each decennial age-group under 60 years. But among those aged 60-79 the rates in each ten-year group though fluctuating considerably from year to year, have shown no tendency to fall. Among White women the mortality-rates in the United States are higher than in England and Wales for women aged 25-39 and lower for those aged 60-74. Among women aged 40-79 the pattern is mixed, the rate being higher in the United States in the earlier years but lower in the later years on account of the cohort effect. In all decennial age-groups mortality from cancer of the cervix seems to have declined somewhat more in the United States than in England and Wales. A small degree of the differences noted may be attributed to differences in the way cancer of the cervix is coded and classified in the United States and United Kingdom.

CANCER OF THE ETHMOID BONE AND SOCIO-
OCCUPATIONAL CATEGORIES. (Fr.) Gignoux,

(P. Bernard and B. Gignoux. *Ann Otorhinolaryng* 20(9):1055-1056, 1971.

of malignant ethmoid tumors observed in a 15-yr study, 17 (30.7%) were found in wood workers. These included 12 cabinetmakers, three carpenters, one cooper, and one cooper. Ethmoid tumors in woodworkers appeared at a mean age of 58 yr, while these tumors appeared between 60 and 70 yr of age in other subjects. All of the woodworkers had been employed in their occupation since they were 16 yr old, indicating that the latent period for ethmoid tumors is about 40 yr. They are caused by occupational factors. Histological examination of the tumors showed that ethmoid tumors in woodworkers consisted of one reticulum-cell carcinoma and 16 glandular adenocarcinomas. The other ethmoid tumors included a greater variety of histological types: 15 spinocellular carcinomas, 12 glandular carcinomas, two basal-cell carcinomas, one papillary carcinoma, one cylindroma, one malignant plasmoma, and three lymphosarcomas. These findings confirm reports by English and American authors that ethmoid adenocarcinomas are an occupational disease of woodworkers.

COMPARATIVE HISTOLOGY OF GASTRIC CANCER IN
MIGRANT GROUPS IN ISRAEL. (E.) Munoz, N.

(Agency Res. Cancer, Lyon, France) and R. Steiner. *Israel J Med Sci* 7(12):1479-1487, 1971.

total of 278 cases of histologically confirmed gastric carcinomas diagnosed from 1960 to 1966 were

identified from files of the Cancer Registry of Israel. They were classified into one of three groups: intestinal type, diffuse type, or "others". The intestinal type of carcinoma was the most frequent type in the high-risk group (migrants from Europe, Morocco and Tunisia), representing 58.4% of all cases. The diffuse type accounted for 28.6%, and 13% were classified as "others". In the low-risk group (Israel and migrants from Iraq, Iran, Yemen and Greece), 45% were of the intestinal type and 50% were of the diffuse type. In both risk groups and both sexes, the ratio of intestinal to diffuse types of carcinomas increased with age. In both high- and low-risk groups, a significantly higher frequency of intestinal metaplasia was observed in the intestinal type than in the diffuse type of gastric cancer. Metaplasia associated with the diffuse type was graded as "mild" in 71% of the cases and no cases were graded as "severe", whereas in the intestinal type, 50% of the metaplasias were graded as "mild" and 50% as "moderate" or "severe". Seventy-nine of 110 cases studied for metastases had lymph node metastases of the same histological type as the primary tumor. When the primary tumor was a mixed type, however, there was a strong tendency for the most differentiated component (intestinal) to metastasize.

3249 STATISTICAL OBSERVATIONS ON CANCER AND
LEUKEMIA. (Fr.) Pizon, P. (Paris, France).
Rev Path Comp 71(815-816):243-246, 1971.

A statistical study was made of changes over five-year periods in the ratio of mortality from cancer and from leukemia to mortality from all causes in France between 1906 and 1968. During the period under study there were 3,133,199 deaths from cancer and 35,230,596 deaths from all causes. Cancer accounted for 3.97% of all deaths between 1906-1910 and for 18.39% in 1968. The mortality curve from cancer is increasing exponentially and will reach 57.8% by 2000 if it keeps increasing at the same rate. No distinction between cancer and leukemia as the cause of death was made in France until 1944, but the figures can only be considered reliable starting with 1953. There were 46,189 deaths from leukemia between 1953 and 1968 and 9,010,394 deaths from all causes. A detailed statistical analysis of leukemia data revealed that mortality from this cause is also increasing exponentially. The 1% mortality from leukemia extrapolated for 1979 will increase to 2.3% in 2000 if the present rate of increase continues. It is possible to infer from past evidence that leukemia did not appear among humans until towards the middle of the 19th century. It would seem that the experimental increase in mortality from cancer and from leukemia is due to the extension of the life span, which is also increasing exponentially with time and will reach 74 years in France in 2000. However, a comparison of the three exponential equations governing the three phenomena considered does not support this hypothesis. If the increase in life expectancy is a factor in the exponential growth of mortality from cancer and leukemia, then it is at most only a contributing factor.

- 3250 GESTATIONAL CHORIOCARCINOMA IN DENMARK: 1940-1969: A REAPPRAISAL BASED ON MODERN HISTOLOGIC CRITERIA. (E.) Mogensen, B. (Danish Cancer Soc., Aarhus, Denmark) and S. Olsen. *Acta Obstet Gynec Scand* 51(1):63-69, 1972.

Ninety-four cases of trophoblastic disease diagnosed in Denmark between 1940 and 1969 as choriocarcinoma (CHC) or "probably CHC" were reappraised and classified according to criteria laid down by the Armed Forces Institute of Pathology. Fifty of the cases were classified as CHC, 18 as invasive mole (IM), and 26 as other trophoblastic proliferations (OTP). Among the CHC patients, 30 died of generalized disease and one from postoperative complications. Eighteen patients (36%)--10 of them with metastases--recovered. Four of these patients were observed for 2-5 yr and 14 for more than five yr. One patient still has active disease. Forty-four patients suffering from IM (18) or OTP (26) were cured, including five with metastases. Based on the findings at the re-evaluation, the frequencies of IM and CHC were one case per 126,000 and 49,000 births, resp. The ratio of IM to CHC was 1 to 2.6. Compared with Norway and Sweden, Denmark seemed to have the lowest incidence of these diseases. During the yr 1943-1963, CHC accounted for approximately 0.03% of all malignant neoplasm in Danish females.

- 3251 TESTICULAR CANCERS IN CHILDREN: EPIDEMIOLOGIC CHARACTERISTICS. (E.) Li, F. P. (Nat'l. Cancer Inst., Bethesda, Md.) and J. F. Fraumeni, Jr. *J Nat Cancer Inst* 48(6):1575-1581, 1972.

To study risk factors for testicular cancers in childhood, an examination was made of 253 death certificates for U.S. children dying from these neoplasms in the period 1960-67, and 70 medical records from 14 institutions. Death rates exhibited an age peak in early childhood and a marked rise after puberty among whites. In contrast, persistently low rates occurred in black children and adolescents. Several reports have indicated a rising frequency of testicular tumors in young adults in recent decades, but mortality rates for children have remained stable. Embryonal carcinoma was the most common cell type reported in early childhood, and seminoma and choriocarcinoma were rare before puberty. Of the 70 children in the hospital series, 15 (21%) had inguinal hernia, undescended testis, or other genitourinary defects, a frequency which appears excessive. Since genitourinary defects also accompany Wilms' tumor, it is likely that the relationship between oncogenesis and teratogenesis is especially close in the developing genitourinary tract.

- 3252 A COMPARISON BETWEEN ENGLAND AND WALES AND SWEDEN IN THE INCIDENCE AND MORTALITY OF MALIGNANT SKIN TUMOURS. (E.) Lee, J. A. H. (Sch. Pub. Hlth., U. Washington, Seattle) and H. J. Issenberg. *Brit J Cancer* 26(1):59-66, 1972.

Although mortality from malignant skin tumors gen-

erally is similar in England and Wales and in Sweden, the incidence and death rate for malignant melanoma are higher in Sweden than in England and Wales. The melanoma incidence figures among males in England and Wales and in Sweden are 14.3 and 39.4 cases/million/yr, resp., while the same figures for females are 24.0 and 42.3 cases/million/yr, resp. These differences do not appear to be due to differences in statistical and medical care systems in the two regions. Rather, they are probably due to important genetic, occupational, or behavioral factors. It has been suggested that the high female melanoma incidence in England and Wales is caused by greater exposure of female limbs to sunlight in ordinary female dress. The increased male:female ratio for melanoma in Sweden compared to England and Wales is probably due to the fact that about twice as many males are employed in outdoor work (with attendant exposure to sunlight) in Sweden than in England and Wales.

- 3253 ASPECTS OF LUNG CANCER IN JAMAICA. (E.) Bras, G. (Dept. Path. Surg., U. West Indies, Jamaica), W. F. Whimster, A. L. Patrick and M. Woo-Ming. *Cancer* 29(6):1590-1596, 1972.

The incidence of lung cancer in the approximately one-half million population living in the parish of Kingston and St. Andrew of Jamaica--a tropical developing country--has been investigated for the years 1958-1970 inclusive. When compared--on an age-standardized basis--with figures published from other areas, Jamaica's figures appear to be substantially above those from Africa, but much lower than those from Britain and the United States. The incidence appears to be rising both in males and females. Clinical and pathologic data on 105 cases of lung cancer were obtained through the postmortem and surgical pathology services of the University Hospital of the West Indies, a 500-bed general hospital. The three main histologic types were equally represented at postmortem, but the squamous carcinoma type was more frequently seen in the surgical pathology material. The patients had an inadequate follow-up and were small in number; the data, therefore, did not allow an evaluation of the use of the W.H.O. histologic classification as to its prognostic significance. The duration of symptoms from onset to death or operation was generally less than six months. Figures presented here may be used as a base line from which future changes in the pattern of lung cancer in Jamaica may be measured.

- 3254 PRIMARY LIVER CARCINOMA IN ISRAEL. (E.) Costin, C. (Ministry Hlth., Jerusalem, Israel) and R. Steinitz. *Israel J Med Sci* 7(12):1471-1474, 1971.

Primary liver carcinoma (PLC), although rare in Israel (1.02% of all male and 0.38% of all female malignancies), shows considerable differences in its incidence and association with cirrhosis of the liver among various population groups in Israel. Two hundred and eleven cases were reported to the Israel Cancer Registry between 1960 and 1966. The male:female ratio was 3:1. In both males and females the majority of cases occurred between the ages of 55 and 64. Ninety percent were histologically con-

ed; almost 75% of these were hepatocarcinomas the rest consisted of cholangiocarcinoma, mixed carcinoma with cholangiocarcinoma, hepatoblastoma or chymal malignancies. World-standardized rates, calculated for ages 50 to 64 by sex and origin, suggest higher incidence in Jews from Balkan countries, Iran and Iraq and in non-Jews. The large number of cases confirmed by autopsy, compared with the generally low postmortem rate in Israel, and the expected findings of PLC at autopsy, point to an early diagnosis of this condition, especially among the groups where death occurs primarily at home - Jews and Jews originating from Asia or Africa). Association with cirrhosis of the liver was found in 1.2% of hepatocarcinoma in males, and in only 0.2% of females. However, there were striking differences in the different population groups, ranging from an association in 33.3% of male Iranian Jews in Israel to 75.0% of male Jews born in Iran.

VIRAL HEPATITIS, CIRRHOSIS, AND PRIMARY LIVER CANCER IN THE IVORY COAST: ETIOLOGICAL FACTORS COMPARED. (Fr.) Bertrand, E. (Hosp., Abidjan, Ivory Coast), M. Lebras, J. L. Leda and Y. Attia. *Concours Med* 93(51):8538-8540, 1971.

Epidemiological study of infectious hepatitis, cirrhosis, and primary liver cancer among hospital patients in Abidjan suggests that these three diseases are interrelated. Of patients hospitalized in various medical departments in Abidjan, 3.84% had infectious hepatitis, 3.80% cirrhosis, and 1.60% primary liver cancer. The morbidity of all three diseases is higher in males than in females. This is more pronounced for liver cancer: for each case in females there are 11 in males. While hepatitis was found primarily in patients 10-29 years old, cirrhosis and liver cancer were diagnosed primarily in patients 30-59 years old. The incidence of cancer decreased progressively in patients aged 30-59 years, while the incidence of cirrhosis had a second peak in patients 50-59 years old; this appears to be associated with alcoholism and cirrhosis. A study of the geographic origin of the patients suggests that cirrhosis is a sequel of infectious hepatitis and that cirrhosis is a precursor of liver cancer.

STUDIES ON THE FREQUENCY AND SPREAD OF GYNECOLOGIC MALIGNANT TUMORS WITHIN THE FRAMEWORK OF A DISTRICT HOSPITAL. (Ger.) Tilch, H. (Auerbach Dist. Hosp., Obergöltzsch, Germany), H. Schink, R. Treichel and F. Unger. *Zbl Gynaek* 124:94-100, 1972.

In a 15-year period, 503 malignant genital tumors (253 invasive carcinomas and 250 carcinomas *in situ*) were diagnosed in female patients at the Auerbach District Hospital. The invasive carcinomas included 147 cervical carcinomas (47.1%), 147 uterine carcinomas (33.7%), 72 ovarian carcinomas (16.5%), 7 vaginal carcinomas (1.6%), 3 vaginal carcinomas

(0.7%), 1 carcinoma of the fallopian tubes (0.2%), and 1 choriocarcinoma (0.2%). During this period the number of uterine and ovarian carcinomas tended to increase, but no decrease occurred in invasive cervical carcinoma. However, a significant increase occurred in the number of early cervical carcinomas with a significant decrease in the number of advanced cases, indicating that the early diagnosis of cervical cancer has improved. A tendency has also been noted for an increase in the number of early uterine carcinomas and a decrease in the number of advanced cases; the number of early ovarian carcinomas showed a slight tendency to increase.

3257 SURVIVAL OF BURKITT'S LYMPHOMA PATIENTS IN GHANA. (E.) Wosornu, J. L. (Burkitt's Tumor Project, Accra, Ghana), F. K. Nkrumah and I. V. Perkins. *Brit J Cancer* 25(3):479-486, 1971.

Of 141 suspected cases of Burkitt's lymphoma referred from all areas of Ghana between November 1965 and June 1969, the diagnosis of Burkitt's lymphoma was confirmed histologically in 60. Survival rate was determined in 50 treated and evaluable cases and was correlated with tumor stage. All patients were treated initially with cyclophosphamide. Second line drugs used for relapse and/or non-response were vincristine, methotrexate and cytosine arabinoside. The age distribution of cases was in agreement with previous reports (between four yr and puberty). The sex ratio was 1.6:1 (37 boys and 23 girls). More than half the patients had localized disease (stages I and II). The overall long term survival rate (52 wk or longer) was 38.5%. Stage I patients had the best prognosis (60% at 190 wk). No difference was seen between stage II and stages III and IV (disseminated) with 20 to 25% survival. No marked differences in survival rate between age groups was observed. All six stage I patients who died had large tumors. Eleven of 12 patients who had only an initial partial remission subsequently developed resistance to chemotherapy. Fifteen of 50 treated patients (representing all stages- five girls and ten boys) survived one yr or longer. Sixteen of the 50 patients were free of tumor as of December 1969. Thirteen of these had no tumor recurrence following initial treatment (seven stage I, one stage II and three stage III).

3258 GASTROINTESTINAL CANCER IN ISRAEL: WITH EMPHASIS ON FACTORS AFFECTING PATIENT SURVIVAL. (E.) Modan, B. (Chaim Sheba Med. Ctr., Tel-Hashomer, Israel) and H. Kallner. *Israel J Med Sci* 7(12):1475-1478, 1971.

Data on the incidence of and survival rates for gastrointestinal cancer diagnosed in Israel between 1955 and 1966 were collected and analyzed according to sex and birthplace. In general, gastric cancer was the most frequent (19.2 per 100,000 population) followed by cancer of the colon and rectum (15.4 per 100,000) and esophageal cancer (2.3 per 100,000). The male/

female ratio was 1.6:1 for both gastric and esophageal cancer and was close to 1:1 for large intestinal cancer. A comparison of the age-adjusted incidence rates of the main gastrointestinal cancer sites between European and Asian born patients revealed a ratio of 1.0 for the esophagus, 1.8 for the stomach and 3.2 for the colon and rectum. The European to African ratio was lowest (1.3) for gastric cancer but highest (3.3) for the colon and rectum. When age-matched groups were compared, the median survival of European born patients who underwent a curative type of operation for gastric cancer was almost twice that of the non-European patients who underwent surgery for gastric cancer. This difference in survival was limited to patients with regional metastases and was not observed with patients having distant metastases. European born patients had a higher frequency of papillary and well-differentiated adenocarcinoma while non-Europeans had a relatively higher frequency of anaplastic carcinoma. Thus, consideration of histologic grading along with ethnic group eliminated interethnic differences in the more malignant grades but not in the less malignant ones. It is concluded that ethnic differences do exist and that they are not caused by earlier diagnosis but are probably due to different disease types with a possible contribution of socioeconomic status.

- 3259 BRONCHIAL CARCINOMA IN YOUNGER PEOPLE.
(Ger.) Orban, E. (Clin. Lung Dis.
Zschadrass, Germany). *Z Erkr Atmungsorg* 135(3):
273-280, 1971.

Between 1954 and 1970, lung cancer was diagnosed in 75 patients (55 men and 18 women [sic!]) who were less than 45 years old. Of these 75 patients, 30 had lymph node metastases. The histological forms of lung cancer diagnosed were squamous cell carcinoma (28/75), small cell carcinoma (17/75), adenocarcinoma (11/75), polymorphocellular carcinoma (5/75), and a mucopidermoid tumor (1/75); a histological diagnosis could not be made in 3/75 patients. A comparison of these findings with others in the literature show that small cell carcinoma is significantly more common in patients less than 45 years old, while squamous cell carcinoma is significantly more common in older patients. The tendency to metastasis formation appeared more pronounced in the younger age group, but the difference was not significant. Surgery was performed on 72/75 patients. Of the 31 patients operated on more than five years before, 12 have survived for five years. The five year survival rate was higher in younger patients than in those over 45 years old; this may be due to the small number of younger patients and the increase with age of intercurrent causes of death. Case reports are presented for a 12-year-old boy with a "carcinoma adenomatousum psammosum" and a 23-year-old man with an undifferentiated small cell carcinoma; the latter patient had smoked 10 cigarettes/day for three years. It is difficult to attribute these cases of lung cancer to chronic exposure to exogenous factors.

- 3260 EPIDEMIOLOGY OF TUMORS OF THE NERVOUS SYSTEM IN ISRAEL. (E.) Hershowitz, E. (Hadassah, U. Hosp., Jerusalem, Israel), M. Fabianski and M. Alter. *Israel J Med Sci* 7(12):1491-1499, 1971.

The incidence of tumors of the nervous system in Israel was analyzed from records of the Central Tumor Registry for the years 1961-1966. A total of 1,354 tumors were recorded, and the annual incidence for this period was quite stable with a range of only 11.1 to 14.2 per 100,000 population. All tumors, except meningiomas were more prevalent in males than in females. The majority of tumors were more common in the latter half of life, with a peak frequency in the sixth and seventh decades. Neuroblastoma and medulloblastoma, however, occurred mainly as tumors of the young (under 20 yr of age). The overall age-corrected incidence of tumors of the nervous system was highest among immigrants from Europe and least common among immigrants from Africa. Native born Israelis has intermediate tumor frequency but were closer to Europeans, whereas Asian immigrants were closer to the African group. In each ethnic group, the brain was the most common tumor site, with peripheral nerve tumors occurring next in frequency. Spinal cord tumors were least common in all ethnic groups. Although the rates of most tumors were highest among European immigrants, gliomas and pituitary tumors had the highest incidence among native born Israelis. The relatively low incidence among Afro-Asian immigrants was not due to a decrease in the incidence of any one type of tumor. The best prognosis was associated with pituitary adenoma and craniopharyngioma, whereas glioma and neuroblastoma had the poorest prognosis.

- 3261 WORLD-WIDE DIFFERENCES IN THE SEX RATIO OF BRONCHIAL CARCINOMA. (E.) Belcher, J. R. (London Chest Middlesex Hosp., England). *Brit J Dis Chest* 65:205-221, 1971.

Information on the distribution and sex ratio of bronchial carcinoma was compiled from World Health Organization statistics for 1965, statistics from the University of Sendai, Japan, for 1965, publications from individual countries, and personal communications. The sex ratio of the incidence of bronchial carcinoma varied widely in different parts of the world, ranging from 13.5:1 (male:female) in Holland to 1:1 in Nigeria. In general, the national sex ratios of bronchial carcinoma incidence fall into two general groups. The countries of Europe, North America, Australasia and the European parts of the other continents had the highest sex ratios, and the rest of the world (non-European) the lowest. The incidence, proportion of cell types, and the site of growth also differed between European and non-European peoples. When European and non-European groups were considered separately, the sex ratio was not related to the total incidence of the disease as had been previously believed. When the incidence of bronchial carcinoma was expressed as a proportion of all malignant disease, the incidence in women was surprisingly constant

between 3.2 and 6%). However, wide variation occurred for males (7 to 39%) and the variation was correlated well with the observed world-wide variations in sex ratio of bronchial carcinoma. Statistical evidence indicated that the variation in sex ratio of bronchial carcinoma among countries was not due to differences in tobacco consumption. Variation in the sex ratio was also not due to different age structures of the different populations. The sex ratio was related neither to living standards nor to climate. With only one exception (citizens of foreign birth), the sex ratio of each ethnic group tended to follow the pattern of the country of origin no matter what was the country of residence. It is suggested that genetic factors may play a role in the etiology of bronchial carcinoma.

CANCER MORTALITY IN NEW YORK CITY FOR COUNTRY-OF-BIRTH, RELIGIOUS, AND SOCIO-ECONOMIC GROUPS. (E.) Seidman, H. (Amer. Cancer Society, New York, N.Y.). *Environ Res* 4(5):390-1971.

Cancer mortality in New York City from 1949 through 1963 is classified according to cancer site, sex, country-of-birth, religion and socioeconomic status in the non-Puerto Rican white population aged 25 to 64 years. In general, males classified according to country-of-birth showed high mortality for Catholics, an intermediate rate for Protestants and a low rate for Jews, with females classified similarly showing the opposite pattern. The mortality rates for Jewish males in the various country-of-origin groups were much closer than the rates for Jewish males and non-Jewish males in the same group; the same pattern was noted to lesser extent for Jewish females. Mortality and socioeconomic level varied inversely among males of all religions within a given country-of-origin group. The same relation was noted for Catholic and Protestant females. U.S.-born Jewish males of high socioeconomic status had a high mortality rate. Cancers of the breast, ovary, stomach and leukemias were especially prominent in this group.

CANCER MORTALITY AMONG ETHNIC GROUPS IN HAWAII. (E.) Kagan, A. (Honolulu Heart Center, Hawaii). *Israel J Med Sci* 7(12):1451-1454, 1971.

A comparison was made of cancer mortality rates among the various ethnic groups in Hawaii, using data based on death certificate summaries by the Hawaii State Health Dept. for the years 1957-1963. Among men, the highest cancer mortality was seen among the Japanese (225 per 100,000 population), closely followed by the Hawaiian/part-Hawaiians. Among women, the highest mortality was seen in the Chinese Hawaiian/part-Hawaiians (145 per 100,000). Japanese showed a higher than average mortality for cancers of the bronchus and lung, prostate and

ovary. A high mortality from cancers of the stomach, bronchus and lung, and breast and uterus was seen among the Hawaiian/part-Hawaiians. Chinese of both sexes showed higher than average mortality from cancers of the pharynx and buccal cavity, large intestine and rectum; and among Chinese women, from cancers of the lung, uterus and ovary. Filipino cancer mortality was characterized by low rates for all sites except those of the lymphatic and hemopoietic tissues, where the ratio was similar to that of other ethnic groups. Japanese men and women had an unusually high mortality from cancer of the stomach.

3264 LEUKOPLAKIA-AN EPIDEMIOLOGIC STUDY OF 1504 CASES OBSERVED AT THE TATA MEMORIAL HOSPITAL, BOMBAY, INDIA. (E.) Gangadharan, P. (Tata Mem. Ctr., Bombay, India) and J. C. Paymaster. *Brit J Cancer* 24(4):657-668, 1971.

The features of 1504 cases of leukoplakia seen from 1941-69 were studied and compared with cancer cases seen during 1950-59 at the Tata Memorial Hospital, Bombay. The oral cavity was the site of the disease in 96% of males and in 88% of females with leukoplakia. The buccal mucosa was the commonest site affected in all religious communities of Western India except among Parsis. The average age for oral leukoplakia cases among males (45.0 yr) was lower than that for oral cancer cases (50.3 yr); it was also lower for both leukoplakia (49.5 yr) and cancer cases (49.4 yr) among females. The male to female ratio of oral leukoplakia cases was 4.3:1, whereas for oral cancer the ratio was 2.3:1. The site distribution of oral leukoplakia and cancer differed among the different religious communities. Parsis, a majority of whom are nonsmokers and non-chewers of tobacco, had leukoplakia and cancer more often on the anterior two-thirds tongue than on the buccal mucosa. Hindus from Gujarat, who smoke often, had leukoplakia most commonly in the buccal mucosa, but cancer was more evenly distributed between the buccal mucosa, anterior two-thirds tongue and other sites. Statistical computation of the risk of malignant transformation indicated that males have a 4.8-fold higher risk of developing cancer when they have leukoplakia than the normal population, and females have a 7.1-fold higher risk of developing cancer in the presence of leukoplakia. Half of the leukoplakia cases which developed cancer at the same site did so within two yr, whereas those who developed cancer at a different site did so within four yr in 50% of the cases. It was felt that leukoplakia not associated with smoking habits had a greater chance of malignant transformation.

3265 GASTRIC CANCER IN ICELANDERS IN MANITOBA. (E.) Choi, N. W. (Manitoba Cancer Treatment Res. Fdn., Winnipeg, Canada), D. W. Entwistle, W. Michaluk and N. Nelson. *Israel J Med Sci* 7(12):1500-1508, 1971.

Previous analysis of reported deaths due to cancer in Manitoba between 1956 and 1965 had shown that first generation Scandinavian, Icelandic, Ukrainian and Jewish immigrants had a high risk of dying from gastric cancer. However, gastric cancer mortality among the descendants was much reduced. The Icelandic ethnic population was singled out because of the unusually high incidence of gastric cancer, and a dietary survey was conducted by questionnaire in order to determine the food items whose consumption differed between generations and to establish whether or not these changes were associated with the decreased cancer incidence in the descendants. Icelandic born Icelanders in Manitoba who were over 65 yr old (highest risk of gastric cancer) ate significantly more smoked or singed meats, blood pudding, skyr and salted or pickled meats than non-Icelandic born Icelanders. There was also a highly significant difference in the consumption of singed and smoked meats between the first generation immigrants and their descendants in Manitoba. Thus, the consumption of smoked and singed meats, which have been shown to contain high amounts of the carcinogen 3,4-benzopyrene is correlated with the high incidence of gastric carcinoma in immigrant Icelanders and the relatively lower incidence in their descendants.

- 3266 POPULATION TRENDS IN CIGARETTE SMOKING AND BLADDER CANCER. (E.) Hoover, R. (Harvard U. Sch. Public Hlth., Boston, Mass.) and P. Cole. *Amer J Epidemiol* 94(5):409-418, 1971.

An association between cigarette smoking and bladder cancer has frequently been demonstrated. The causal nature of the association has, however, remained in doubt. Because of this, trends in smoking habits and bladder cancer experience were examined for successive birth cohorts of men and women in the United States, Denmark and England and Wales. Increasing rates of the disease were observed in populations characterized by an increase in smoking among successive birth cohorts. The association is consistent in both sexes, different nationalities and in urban and rural groups. This makes it unlikely that the findings result from an association both of smoking and bladder cancer with a third variable.

- 3267 STOMACH AND LUNG CANCERS: INCIDENCE IN PIEDMONT WITH REFERENCE TO THE ENVIRONMENT. (E.) Anglesio, E. (Tumor Registry For Piemonte and Valle D'Aosta, Torino, Italy), A. P. M. Cappa, M. Panero and M. Pietroiusti. *Cancro* 24(1):17-24, 1971.

Data on the incidence of stomach and lung cancer obtained from the Cancer Registry of Piedmont, Italy, was analyzed for the years 1965-1966. The male:female ratio for both years was 4:1 for lung cancer and 2:1 for stomach cancer. For 1965-1966, 1398 cases of stomach cancer and 1095 cases of lung

tumors were recorded, representing 9% and 7.1%, resp. of the total number of tumors reported for all body sites. Gastric tumors were more frequent in people 55-80 yr of age with a peak age of 60-64 for males and 65-69 for females. Lung tumors were most prevalent between the ages of 60-64 for both sexes. The incidence of stomach tumors in small towns of mountain areas and hills was higher than the average regional values, whereas that for lung tumors was lower than the average regional values. Gastric tumors showed the highest incidence in the highly rural areas. Lung tumors were most prevalent in the large urban areas and of relatively low incidence in the rural towns. The incidence of lung tumors was highest and that of stomach tumors was lowest in the more industrialized areas. It was felt that atmospheric pollution might be an important factor in the development of lung tumors, and that poor socio-economic conditions and food intake patterns might play a role in the etiology of stomach cancer.

- 3268 SOCIAL TRAUMA IN THE EPIDEMIOLOGY OF CANCER OF THE CERVIX. (E.) Graham, S. (State U. New York, Buffalo), L. M. Snell, J. B. Graham and L. Ford. *J Chron Dis* 24(11):711-725, 1971.

Four hundred and forty-seven cases of cancer of the cervix were compared to 711 controls with other types of cancer and non-neoplastic diseases of other than genital organs from Roswell Park Memorial Institute. Cancer of the cervix cases were somewhat more likely to have been married two or more times, with 22.3 per cent having experienced at least two marriages as compared to 14.5 per cent of the controls. They were slightly more likely to have been married at a younger age. Thus, 26.1 per cent of the cases were married before the age of 19 as compared to 21.2 per cent for the controls. Only 3.1 per cent of the cases were first married over 30 yr of age as compared to 9.1 per cent of the controls. Cases of cancer of the cervix were of slightly lower socio-economic status and had had more pregnancies and live births than the controls. Further comparisons were made considering differences between cases and controls in age; size of family, including spouses, children, siblings, grandchildren, parents and other relatives; and whether the life events under consideration occurred among family members living in the subjects' or other households. Comparisons were made on the extent to which they and their family members had experienced death, divorce, illness, economic want, residential mobility, and feelings of being upset in the five yr prior to onset of the illness under consideration. The proportion of cases and controls experiencing various numbers of these incidents was also examined. No differences between cases and controls were found for any of these variables.

- 3269 PRIMARY INTRACRANIAL TUMORS IN THE ELDERLY. (E.) Cooney, L. M., Jr. (Boston U. Sch. Med., Mass.) and G. B. Solitare. *Geriatrics* 27(1):94-104, 1971.

detailed review of the anatomic findings in 1000 consecutive autopsies performed at the Yale-Haven Hospital yielded 497 patients with primary intracranial tumors, of whom 176 were 60 years of age or older. An examination of the hospital records of these elderly persons was undertaken to determine if a diagnostically significant clinical picture could be developed. Tumor symptoms were not commonly the vague complaints normally associated with aging and senility (i.e., mental status change, memory loss, disorientation). The rate of symptom onset provides a clear distinction between the slower growing meningiomas and the more rapidly progressing glioblastomas. The two lesions varied greatly in their effect on visual field defects and sensory defects, with 30% of glioblastoma patients having visual field defects and 28% having sensory losses; only 8% demonstrated these changes in the meningioma group. Special diagnostic procedures used include radioactive brain scanning, electroencephalography, cerebral arteriogram, contrast study, lumbar puncture and skull x-rays. Although clinical history and neurologic examination can often offer valuable diagnostic information, the most important element in establishing correct diagnosis remains a high index of suspicion.

ASBESTOS AND MESOTHELIOMA IN SCOTLAND: AN EPIDEMIOLOGICAL STUDY. (E.) McEwen, J. Dundee, Scotland), A. Finlayson, A. Mair and A. M. Gibson. *Int Arch Arbeitsmed* 28(4):301-311, 1965.

In 1965 an apparently low incidence of asbestos-induced mesothelioma had been recorded in Scotland, as compared to other areas of the United Kingdom. Since it seemed unlikely that the real incidence of mesothelioma would differ substantially, pathological reports for the years 1950-1967 were reviewed. Eighty substantiated cases were ultimately traced and detailed histories of residence, occupation and degree of exposure to asbestos were obtained from all available reliable sources. Exposure to asbestos was categorized as: 1) residential, 2) domestic and free time, and 3) occupational. This review of the records indicated that there had, in fact, been a larger number of mesothelioma cases than were initially reported as such. An increase in the number of recorded cases occurred from 1960 to date. Increased awareness in recent years of the link between asbestos exposure and malignancy has probably led to more patients with chest conditions and histories of exposure to asbestos being admitted to hospitals and their cases recorded.

INTESTINAL LYMPHOMA WITH MALABSORPTION IN MEDITERRANEAN POPULATIONS. (E.) Ramot, (Tel Aviv U. Med. Sch., Israel). *Israel J Med* 7(12):1488-1490, 1971.

Syndrome of small intestinal lymphoma with malabsorption has been shown to be relatively common among Arabs and Jews of Eastern and North African origin and correspondingly rare among Jews of European origin. Case material of 22 patients was

reviewed in an attempt to explain the etiology of the condition. Most of the patients belonged to the 15-30 yr age group, a distribution differing from that observed for similar cases in Western countries. The biopsy and autopsy material available could be divided into three main categories: 1) cases with massive plasma cell infiltration of the gut and lymph nodes without evidence of lymphoma (four cases); 2) plasma cell infiltration of the gut and malignant lymphoma in the mesenteric nodes (two cases), and 3) malignant lymphoma of the small intestine with a plasmacytic response in the uninvolved mucosa. Two of the cases from the first category had a protein abnormality manifested by the presence of a heavy chain of IgA. Contrary to previous reports, it was felt that the plasma cell response of the intestine was secondary to the lymphoma and was not the primary lesion. Examination of immunoglobulin levels in 99 persons from 11 families, including the families of the two patients with the heavy chain of IgA, provided no evidence for an immune deficiency state in patients with intestinal lymphoma. Unpublished reports have shown a high incidence of intestinal lymphoma and malabsorption among South African Negroes of the Cape region. The age distribution, clinical features and course of the disease were similar to those observed in the Mediterranean region. Patients from both regions belonged to an economically underprivileged population with a high incidence of gastrointestinal infections. Although genetic factors may play a role, environmental factors probably are most closely associated with the etiology of intestinal lymphoma with malabsorption.

3272 THE RELATIONSHIP OF INCIDENCE OF CERVICAL CANCER AND SOCIOECONOMIC STATUS IN SEVEN CITIES, 1959-1964. (E.) Christine, B. W. (Connecticut State Dept. Hlth., Hartford), W. H. Groff, T. H. Pitt and M. F. Chapple. *Conn Med* 36(2):80-83, 1972.

The relationship between the incidence of cervical cancer (*in situ* and invasive) and socioeconomic status based on data from seven combined metropolitan areas in Connecticut shows that the incidence of cervical cancer is inversely related to socioeconomic status. The lower the socioeconomic status of an area, the higher the incidence of cervical cancer. This inverse relationship is also seen for *in situ* and invasive cervical cancer taken separately. However, the inverse relationship is not constant when the cities are studied separately. In some, the rates after rising, reached a peak and then decreased in the lowest socioeconomic areas. It is believed that this reversal in the inverse trend is due to a lack of detection rather than a lack of cervical cancer among the very poor. Further studies now being conducted should help explain the differences in the cervical cancer rates observed.

3273 IDENTIFICATION OF HIGH RISK GROUPS IN BREAST CANCER. (E.) Zippin, C. (Cancer Res. Inst. Dept. Int. Hlth., U. California, San Francisco) and

N. L. Petrakis. *Cancer* 28(6):1381-1387, 1971.

In addition to a brief review of earlier work on the epidemiology of breast cancer, recently observed genetic, socioeconomic, and viral associations with this disease are discussed. Some of the associations, e.g., genetic, may be of a primary nature while others, such as socioeconomic status, are clearly indirect reflections of the operation of more fundamental factors. Most of the work referred to has assumed breast cancer to be a single entity. It is believed that more refinement in classification is necessary in attempting to study the etiology of this disease. It may be that when the various forms of breast cancer are sorted out, etiologic and epidemiologic relationships which still elude identification will emerge.

3274 CANCER MORTALITY IN 1962-66 AMONG POLISH MIGRANTS TO AUSTRALIA. (E.) Staszewski, J. (Inst. Oncology, Gliwice, Poland), M. G. McCall and N. S. Stenhouse. *Brit J Cancer* 25(4):599-610, 1971.

The 1962-66 cancer mortality of Polish migrants to Australia is compared with the cancer mortality prevailing in Poland and in Australia. Small numbers compelled the authors to limit their analysis to the most frequent cancer sites only. The main findings are: (a) stomach cancer mortality of Polish migrants to Australia is intermediate between the high mortality in Poland and the much lower one in Australia; (b) intestinal tract and breast cancer mortality of Polish migrants is displaced upwards, from the low Polish level to the much higher Australian one; and (c) lung cancer mortality of Polish male migrants does not differ distinctly from the mortality observed both in the country of origin and of adoption of these migrants. The presented findings are compared with the results of a similar study of Polish migrants to the U.S.

3275 THE ROLE OF MOTHER'S AGE IN THE RISK OF CHILDHOOD LEUKEMIA. (E.) Spiers, P. S. (Sch. Public Hlth., U. North Carolina, Chapel Hill). *Amer J Epidemiol* 94(6):521-523, 1971.

Maternal age as an etiologic factor in childhood leukemia is proposed. The plausability of this relationship is supported by the occurrence of other observable errors of meiosis which occur with increasing maternal age. Data indicate that the increased risk to leukemia is limited to children succumbing to the nonmyelocyte form of the disease between the fourth through eighth year of life. Partial correlation based on maternal age, order of birth and exposure to post-natal infectious agents are presented. Although they are considered statistically significant, these results are not considered to provide a definitive answer for the proposed role of the mother's age. Continued investigation into the problem is recommended.

3276 MALIGNANT TUMORS IN A PREDOMINANTLY BLACK HOSPITAL: A 20-YEAR RETROSPECTIVE STUDY AT FREEDMEN'S HOSPITAL, WASHINGTON, D.C. (E.) Kovi, J. (Howard U., Coll. Med., Washington, D.C.), M. Y. Heshmat and M. D. Gerald. *J Nat Med Assoc* 64(1):14-18, 1972.

The frequency of cases of malignant tumors in a major, virtually all-black, hospital in the United States is reported. Biopsy and autopsy records over a 20-year period (1951-1970) were reviewed, and all malignant tumors were classified according to primary site. Distribution of tumors by site, age and sex was tabulated. The following findings resulted: 1) no cases of Kaposi sarcoma and Burkitt tumor in any of the patients treated; 2) a low incidence in both sexes of tumors of the lip; 3) moderately high incidence of bronchial, tracheal and pancreatic tumors for both sexes; 4) high rates of occurrence of esophageal, gastric and intestinal tumors for both sexes, and 5) site of highest incidence to be cervix in females and prostate in males. The median age and diagnosis for cancer of the esophagus, rectum, larynx and kidney were significantly lower than the national average, especially so for females.

3277 CANCER OF THE OESOPHAGUS IN AFRICA: A SUMMARY AND EVALUATION OF THE EVIDENCE FOR THE FREQUENCY OF OCCURRENCE AND A PRELIMINARY INDICATION OF THE POSSIBLE ASSOCIATION WITH THE CONSUMPTION OF ALCOHOLIC DRINKS MADE FROM MAIZE. (E.) Cook, P. (M.R.C. Statistical Res. Services Unit, London, England). *Brit J Cancer* 24(4):853-880, 1971.

Three marked peculiarities exist in the occurrence of cancer of the esophagus in Africa; they are: 1) uneven geographical distribution; 2) changing pattern of frequency with time; and 3) the vagaries of the sex ratio. In all geographical areas the disease is more common among males than females. An unusually high frequency in specific geographical areas strongly suggests the influence of an environmental factor. Variations which exist in the sex ratio seem to indicate that the relevant contributing factor lies in the cultural environment. Extensive investigations show the present high frequencies developed from a negligible incidence 30 to 40 years ago. A detailed analyses based on registry data and personal interviews describing gradients of frequency in southern, central and east Africa compare the nutritional environmental and cultural habits of high risk populations to the no-risk groups. Further studies are planned in the southern area of the continent including chemical analyses of food and beverages for possible carcinogenic agents.

3278 STUDIES ON THE ETIOLOGY OF TROPHOBLASTIC TUMORS: III. TRANSPLANTATION OF NORMAL HUMAN TROPHOBLASTS AND TROPHOBLASTIC TUMORS TO HAMSTER CHEEK POUCHES. (Jap.) Nishio, Y. (Gifu U. Sch. Med., Japan). *Acta Sch Med Univ Gifu* 18(5):464-478, 1971.

- 9 THE ANALYSIS OF DATA ON THE MORTALITY RATE FROM MALIGNANT NEOPLASMS IN THE USSR. (Rus.)
kov, A. M. (Moscow, USSR). *Vop Onkol* 17(12):43-1971.
- 0 CANCER OF THE STOMACH IN SENEGAL. (Fr.)
Simaga, D. (Cancer Inst. Dakar, Senegal),
A. Menye and A. Sanou. *Bull Soc Med Aft Noire*
g Franc 16(3):366-368, 1971.
- 1 PATHOGENIC FACTORS INVOLVED IN THE ETIOLOGY OF CANCER. (Ger.) Schmahl, D.
delberg, Germany). *Langenbeck Arch Chir* 329:
-302, 1971.
- 2 COLON- AND RECTUM-CARCINOMA. (Ger.)
Linder, F. (Heidelberg, Germany).
Langenbeck Arch Chir 329:302-311, 1971.
- 3 TUMOURS IN CHILDHOOD ACCORDING TO BIOPTIC DATA ACCUMULATED BY OUR INSTITUTE. (Ser.)
acic, O. (Military Med. Acad., Beograd, Yugoslavia) and V. Mahnovski. *Srpski Arh Celok Lek* 90(12):
-1473, 1970.
- 4 EPIDEMIOLOGIC STUDY ON CANCER IN THE CHEMICAL INDUSTRY. (Ger.) Bittersohl,
(Occupational Hyg. Ctr. Chem. Industry Leuna,
any). *Arch Geschwulstforsch* 38(3-4):198-209,
- 5 STATISTICAL FEATURES OF NEOPLASTIC DISEASES RECORDED IN SARDINIA IN 1967. (It.)
ano, A. (Radiol. Inst. U. Cagliari, Italy) and
oddo. *Gazz Int Med Chir* 74(24):2457-2469, 1969.
- 3286 CANCER EPIDEMIOLOGY PROBLEMS OCCURRING IN THE CASE OF SMALL POPULATIONS. (Ger.)
Möpert, S. (Tumor Clin. Humboldt-U. Berlin, Germany) and H. J. Herold. *Radiobiol Radiother (Berlin)* 12(5):599-605, 1971.
- 3287 THE EPIDEMIOLOGY OF GASTRIC CANCER: PRE-CANCEROUS GASTRIC CONDITIONS. (Fr.)
Dubarry, J.-J. (No affiliation) and A. Quinton. *Bordeaux Med* 4(12):3445-3466, 1971.
- 3288 EPIDEMIOLOGICAL STUDY OF INTRACRANIAL TUMOURS IN NORTH MORAVIA. (Cz.)
Hromada, J. (Reg. Hosp. Ostrava, Czechoslovakia), F. Beska and J. Machacek. *Cesk Neurol* 35(68):95-102, 1972.
- 3289 CANCER PATIENTS REGISTERED IN THE KRUSEVAC REGION FROM 1967 TO 1969. (Ser.)
Marjanovic, A. (Med. Ctr., Krusevac, Yugoslavia). *Srpski Arh Celok Lek* 99(4/5):271-281, 1971.
- 3290 A NOTE ON THE DISTRIBUTION OF CANCER IN SOME ENDOGAMOUS GROUPS IN WESTERN INDIA. (E.) Jayant, K. (Cancer Res. Inst., Bombay, India), V. Balakrishnan and L. D. Sanghvi. *Brit J Cancer* 24(4):611-619, 1971.
- See also:
* (Chem): 2939, 2987, 3008
* (Immun): 3157

- 3291 A CYTOPHOTOMETRIC STUDY OF BENIGN AND MALIGNANT PHAEOCHROMOCYTOMAS. (E.) Lewis, P. D. (Royal Postgraduate Med. Sch., London, England). *Virchows Arch Abt B Zellpath* 9:371-376, 1971.

Feulgen-stained nuclear DNA content of 15 pheochromocytomas was measured cytophotometrically with an integrating microdensitometer and on the basis of these measurements the tumors fell into two distinct groups. Most nuclei in 12 of the tumors showed the same densitometer readings as normal diploid controls, although readings in some showed DNA values ranging from $4n$ to $40n$. The other three tumors, however, had a hyperdiploid or triploid mode and a smaller range of values. Case histories revealed that all three tumors with a hyperdiploid mode had metastasized, whereas none of the 12 tumors of the first group had done so. These results seemed to support the hypothesis that giant and atypical nuclei, which were related to a great variation in DNA content, were associated with tumor endocrine activity rather than malignancy. Since densitometry measurements appeared to separate metastasizing from benign tumors, the method might be of some practical and prognostic value.

- 3292 ACTIVITIES OF HEXOKINASE AND GLUCOKINASE IN VARIOUS HUMAN AND ANIMAL TUMORS. (Rus.) Parshin, A. N. (N. N. Petrov Res. Inst. Oncol., Leningrad, USSR) and L. A. Voronova. *Ukr Biokhim Zh* 43(5):605-608, 1971.

Human brain, stomach, and uterine tumors, rat rhabdomyoblastomas MOP and TsRM-1, and mouse hepatoma 22^a were studied. Hexokinase and glucokinase activities in tissue extracts and mitochondria were determined by a colorimetric method. The enzyme activities were measured in terms of 2-deoxyglucose-6-phosphate. The activities of hexokinase and glucokinase were 20 times higher in extracts from mouse hepatoma 22^a than in normal mouse liver and five times higher in the mitochondria of hepatoma 22^a than in normal mouse liver mitochondria. In contrast to this, the activities of both enzymes were 1/3 of normal values in human brain tumors and were not found at all in human uterine fibromyoma. A determination of the Michaelis constant showed that human stomach cancer and mouse hepatoma had higher affinities for the substrate (2-deoxyglucose) than healthy tissues; this was not true of human brain and uterine tumors and of rat rhabdomyoblastomas.

- 3293 SPONTANEOUS NEOPLASTIC TRANSFORMATION IN VITRO OF MOUSE WHOLE EMBRYO CELLS AND NEWBORN HAMSTER LUNG CELLS. (E.) Akagi, T. (Okayama U. Med. Sch., Japan). *Acta Med Okayama* 25(3):167-178, 1971.

Several characteristics of two mouse embryo cell lines (MWE-1 and MWE-2) and one hamster lung cell

line (NHLu-1) which spontaneously transformed *in vitro* are reported. The cells were separately prepared and subsequently maintained in a supplemented Eagle's medium. Growth rates were determined and the doubling time was found to range from 12 to 18 hrs. Autoradiographic techniques were used to determine generation time, pre-DNA synthesis gap, DNA-synthesis phase, post-DNA synthesis gap, and mitotic phase in all cell lines. Karyotyping of all cultured cells provided chromosome numbers and a marked aneuploidy was noted in all three cell lines. Inoculation of the cells into experimental animals resulted in tumor growth; histological examination of these tissues showed them to be usually fibrosarcomas.

- 3294 A STUDY OF ANDROGEN BIOSYNTHESIS PATHWAYS IN VIRILIZING TUMORS OF HUMAN ADRENALS. (Rus.) Smirnova, N. B. (Inst. Exp. Endocrinol. Chem. Hormon., Acad. Med. Sci. USSR, Moscow). *Probl Endokrinol* 17(5):16-21, 1971.

Formation of androgens was studied in virilizing adrenal tumors of two women with amenorrhea and hypertrophy of the clitoris and three girls with precocity, accelerated maturation of the skeleton and hypertrophy of the clitoris. Tumor tissues were incubated with radioactive pregnenolone and progesterone dissolved in methanol in doses 1-10 mcg/g tissue. After methanol was evaporated, 6 ml Krebs-Ringer solution (pH 7.4) with 200 mg% glucose was poured into each tube containing the tissue to incubate at 37 C for 30-60 min. Nonradioactive steroids were added to homogenates of the tissue with distilled water to effect steroid separation. Nonconjugated steroids were extracted by ethylacetate. The percentage of incorporation of labeled pregnenolone in 17α OH-pregnenolone and dehydroepiandrosterone exceeded the rate of incorporation of labeled pregnenolone into progesterone and 17α OH-progesterone in two women and one girl (12 yr old). This indicates formation of androgens through 17α OH-pregnenolone by way of pregnenolone \rightarrow 17α OH-pregnenolone \rightarrow androstenedione. In two children, incorporation of labeled pregnenolone in 17α OH-pregnenolone and dehydroepiandrosterone only insignificantly exceeded the incorporation into progesterone, 17α OH-progesterone. Together with free compounds, formation of dehydroepiandrosterone-, pregnenolone-, and testosterone-sulfates was seen in the tumors. The data lead to the conclusion that the transformation of pregnenolone into androgens occurs via 3β OH- Δ^5 -compounds and Δ^4 -3-ketocompounds.

- 3295 REGULATION OF TYROSINE- α -KETOGLUTARATE TRANSAMINASE IN RAT LIVER: REGULATION BY L-LEUCINE IN CULTURED HEPATOMA CELLS. (E.) Lee, K.-L. (Oak Ridge Natl. Lab., Tenn.) and F. T. Kenney. *J Biol Chem* 246(24):7595-7601, 1971.

The level of tyrosine transaminase (L-tyrosine:2-oxoglutarate transaminase, EC 2.6.1.5) in cultured hepa-

cells was markedly elevated by increasing the concentration of amino acids in the medium. The active component of the amino acid mixture was identified as L-leucine. D-Leucine, DL-trifluoroleucine, the deaminated product of leucine, α -ketoisocaproic acid, were inactive. At the optimum concentration (5 mM) L-leucine elicited an 8- to 10-fold increase in the transaminase level; the response was maximum at 12 to 14 hr and persisted for at least 24 hr. The half-life of the transaminase, estimated indirectly from kinetics of change in enzyme activity after addition or withdrawal of the amino acid and directly by isotopic-immunochemical methods, was six hr in the presence of 5 mM L-leucine and 12 hr after return of the cells to the basal medium (2 mM L-leucine). Pulse labeling experiments indicated that L-leucine also increased the rate of tyrosine transaminase synthesis by a factor of 3 to 4. Thus L-leucine increased the level of tyrosine transaminase by a dual effect on both synthesis and degradation of the enzyme. Combinations of L-leucine with the hormonal inducers hydrocortisone and insulin had additive effects on the transaminase levels. Hydrocortisone or insulin effectively induced the transaminase in leucine-free medium, and L-leucine further increased, in an additive manner, the enzyme activity of the cells which had been maximally previously induced by hydrocortisone or insulin. These results indicate that induction of the enzyme by either hydrocortisone or insulin is not mediated by leucine and imply that the mechanism of the induction of L-leucine is different from that effected by either of these hormones.

SYNTHESIS OF COAGULATION FACTORS BY A CLONAL STRAIN OF RAT HEPATOMA CELLS. (E.) Stad, H. E. (Dept. Microbiol., U. Oslo, Norway), Rydz and B. Johansson. *Exp Cell Res* 71:41-44, 1972.

A clonal strain of rat hepatoma cells (MHC) grown *in vitro* in a chemically defined medium was tested for its ability to synthesize blood coagulation factors. Human plasma from patients congenitally deficient in the respective factors was used in the assays. Factor VII activity in the culture medium increased linearly with time up to at least three days with a maximal rate of 20 U per mg deoxyribose/hr. The increase in factor VII could be prevented by actinomycin D or cycloheximide indicating that synthesis was endogenous. Warfarin slightly reduced the rate of appearance of factor VII activity in the culture medium. Treatment of cells with vitamin K increased the rate of appearance and also the total activity of factor VII. In addition, a procoagulant activity was detected in the culture medium which could correct the defect of factor V deficiency plasma. This activity could be removed by BaSO_4 treatment and could be eliminated by gel filtration, suggesting that this factor was not identical with Factor V which was unaffected by such treatment. Factor V-like activity was not enhanced by treatment with vitamin K. Neither thrombin, factor II, or antithrombin III activity was found in cells or culture medium.

3297 ETIOLOGY AND CLINICAL PICTURE OF PRIMARY LIVER CANCER. (Rus.) Fishzon-Ryss, Yu. I. (S. M. Kirov Mil.-Med. Acad., Leningrad, USSR) and I. A. Mogilevskaya. *Terapev Arkhiv* 43(10):14-18, 1971.

A study was made of 120 patients (69 males and 51 females, 111 over 40 yr old) with primary liver cancer diagnosed by autopsy or biopsy findings. The most common associated diseases were inflammatory alterations of the liver and bile ducts (45.0%) followed by alimentary disorders (including alcoholism) in 32.6%. Alcoholism was found in 22.5%, histories of infectious hepatitis in 12.5%, cirrhosis in 9.2%, malaria in 11.7% (associated with cirrhosis in 2.5%), gastrointestinal dystrophy in 10.1%, closed liver trauma in 5%, and surgical removal of other malignant tumors in 4.2%. Three clinical forms were distinguished: typical or hepatomegalic (36.6%), cirrhosis-like (23.3%), and masked (40% with metastases and complications). In most cases, patients survived 4-6 months from the onset of symptoms, but in some cases the patients survived for 1-1.5 yr.

3298 CARCINOGENESIS BY VAGINAL TRANSPLANTS FROM OVARIETOMIZED, NEONATALLY ESTROGENIZED MICE INTO OVARIETOMIZED NORMAL HOSTS. (E.) Takasugi, N. (Fac. Sci., Okayama U., Japan). *Gann* 63(1):73-77, 1972.

Female C57BL/Tw mice were given s.c. injections of 20 μg 17 β -estradiol or 0.02 ml sesame oil (controls) for ten days beginning at birth. Estrogen-treated mice were ovariectomized at 55-65 days of age and killed at 796-831 days of age. Vaginas were dissected and transplanted under the abdominal skin of 18 female mice which were ovariectomized at the time of transplantation. Vaginas in estrogen-treated donors showed a hyperplastic epithelium. By two months after transplantation of hyperplastic vaginas into ovariectomized mice, two grafts had transformed into basal cell carcinoma with a small number of squamous cells. In grafts recovered from the remaining 16 mice 127 days after transplantation, the epithelium was hyperplastic. No carcinoma or hyperplasia were seen in vaginal grafts implanted in ovariectomized mice from donors which had not received estrogen. Cancerous vaginal transplants from ovariectomized recipients were excised and transferred for a third or fourth time to new ovariectomized recipients. Two of four mice receiving the fourth transfer and killed 70 days after transplantation showed metastatic nests of cancer cells in mesentery and pancreas.

3299 GROWTH OF SARCOMA 180 IN SPLENECTOMIZED MICE BEARING DIFFUSION CHAMBERS CONTAINING SPLEEN OR TUMOR CELLS. (E.) Rumi, L. (Nat'l. Acad. Med., Buenos Aires, Argentina), C. D. Pasqualini and S. L. Rabasa. *Europ J Cancer* 7(6):551-555, 1971.

Murine sarcoma S-180 was implanted s.c. into BALB, AKR, A and Rockland mice; the tumor was 100% lethal in BALB mice, while a spontaneous, complete and permanent regression of the tumor was seen in some of the mice of the other strains. Splenectomy performed seven days before tumor challenge increased tumor regression in mice of all four strains, 28-100% of splenectomized mice surviving tumor challenge. Splenectomy performed after tumor challenge also increased regression of tumors. Hepatectomy did not increase the survival of mice implanted with S-180, and with s.c. transplantation of fibrosarcoma cells seven days after splenectomy no increase of survival of splenectomized mice over non-splenectomized mice was seen. This indicated that only S-180 could evoke a stimulatory effect of splenectomy on tumor regression. The response to S-180 transplants of splenectomized BALB mice, bearing i.p. 0.22 μ filter diffusion chambers implanted at or seven days before S-180 challenge and containing either syngeneic spleen cells or S-180 cells, was observed. The trend towards tumor regression in splenectomized mice was reversed by the presence of diffusion chambers containing spleen cells or S-180 cells. This reversal of tumor regression by diffusion chambers was not seen in mice implanted with chambers containing cells from a different tumor, or in mice implanted with empty chambers. It was suggested that S180 in diffusion chambers introduced before S-180 challenge elicited circulating antibody production. These antibodies would then be available before the development of an effective cellular immune response to S-180 challenge, and would foster progressive tumor growth.

- 3300 TUMOUR GROWTH AFTER INTRAVENOUS, INTRAPERITONEAL AND SUBCUTANEOUS INJECTION OF SYNGENEIC MONODISPersed TUMOUR-CELL SUSPENSION. (E.) Boeryd, B. (Dept. Pathol., U. Göteborg, Sweden), P. M. Lundin and K. Norrby. *Europ J Cancer* 7(6):557-559, 1971.

CBA and C57BL/6J mice were given injections of 3-methylcholanthrene-induced sarcoma cells and spontaneous melanoma cells, resp. Routes of injection were i.v. in the tail vein, i.p. or s.c. The number of tumor takes produced by each mode of injection was observed. For tumors to grow after i.v. injection 10^2 - 10^4 times as many cells were needed as were needed after i.p. or s.c. injection. It was thought that more tumor cells were needed in i.v. injections because tumor cells in the vascular system were placed in a less suitable micro-environment than cells in the peritoneal cavity or in s.c. tissue. Specifically, close proximity of tumor cells would be less likely to be achieved in the vascular system than in other regions.

- 3301 PHYTOSTEROLS IN NORMAL AND TUMOR-BEARING RATS. (E.) Nes, W. R. (Dept. Biol. Sci., Drexel U., Philadelphia, Pa.), N. S. Thamp and J. T. Lin. *Cancer Res* 32:1264-1266, 1972.

Gas-liquid chromatography and mass spectroscopy were used to examine sterols in normal and Morris hepatoma-bearing rats. Two typical phytosterols, 24-methyl- and 24-ethylcholesterol, were found to make up about 1.1% of total sterols in both normal and tumor-bearing rats. A hepatoma-bearing rat was given i.p. injections of 22,23- ^3H -24-ethylcholesterol to examine deposition of the phytosterols in tissue. Neutral lipid from liver contained 1.5% of injected radioactivity, hepatoma contained 0.25%, and the remaining carcass contained 13%. Similar injections of cholesterol-4- ^{14}C were given to another rat. The amount of label found after two wks in the liver was 2.3% of the amount injected, while the amount of label in the tumor was 0.90%, and the amount in the remaining carcass was 82%. The radioactive 24-ethylcholesterol did not lead to incorporation of label into cholesterol or into any other observable sterol. 24-Methyl- and 24-ethylcholesterol are usually the dominant sterols of higher plants. Probably, these phytosterols seen in the rats were of dietary origin.

- 3302 LEUKOCYTE ADENOSINE DEAMINASE PHENOTYPES IN ACUTE LEUKEMIA. (E.) Bloom, G. E. (U. Florida Coll. Med., Gainesville). *Cancer* 29(5):1357-1360, 1972.

Peripheral blood and bone marrow samples were taken from 20 patients with leukemia; samples were sedimented and the leukocyte-rich portions were disrupted by sonication and subjected to electrophoresis. The electrophoretic patterns of 14 enzyme systems in the leukemia patients were compared. No altered electrophoretic mobilities compared to normal leukocyte patterns were seen for any enzyme except adenosine deaminase (ADA). In blood and bone marrow of six patients with acute myelomonocytic leukemia, and in one patient with acute myelogenous leukemia, there was an extra band of ADA activity proximal to the normal appearing bands of ADA activity. In acute lymphoblastic leukemia patients no alterations in ADA electrophoretic mobility were seen.

- 3303 CELL POPULATION KINETICS OF A SPONTANEOUS RAT TUMOUR DURING SERIAL TRANSPLANTATION. (E.) Steel, G. G. (Inst. Cancer Res., Belmont, Surrey, England), K. Adams, J. Hodgett and P. Janik. *Brit J Cancer* 24(4):802-812, 1971.

Studies were made on the growth and cell population kinetics of a spontaneous mammary fibroadenoma in an inbred August strain female rat, and of ten successive s.c. transplantation passage in syngeneic hosts. The tumor volume doubling time, determined from vernier caliper measurements, decreased from about 30 days in the primary tumor to 1.7 days in the tenth transplant. Estimates of the duration of the different phases of the cell growth cycle based on *in vivo* ^3H -thymidine pulse-labeled mitotic wave curves showed that the accelerated volume doubling was accompanied by a considerable shortening

the S and G₁ phases without a change in the proportion of time spent in S. There was also a reduction in the apparent extent of cell loss and a considerable decrease in the fraction of growing cells. Density measurements of Feulgen-stained tumor sections of successive passages indicated a gradual shift in chromosome number from hyperdiploid to hyperdiploid. This change was accompanied by increases in cell density (nuclei per unit area of section) and mean nuclear diameter. Also, the proportion of the tumor which consisted of fibroblasts, macrophages, polymorphs and most cells decreased with serial passage.

CHROMOSOME STUDIES IN EXPERIMENTAL MOUSE GLIOMAS. (E.) Yamashita, J. (Natl. Inst. Cancer, Mishima, Shizuoka-ken, Japan). *Gann* 63(2):187, 1972.

Chromosome studies were conducted on different populations of 3-methylcholanthrene-induced gliomas in BALB/c mice and in one C57BL/He mouse. Growing tumor cells were arrested *in vivo* in metaphase by the colchicine arrest technique. Tumor tissue was excised, trypsinized and prepared for chromosome analysis. The tumors were histologically classified as gliomas and the diagnosis confirmed by analysis of their aldolase activity patterns. All three tumors showed considerable variations in karyotype with no common specific chromosomal changes. After a few passages *in vivo*, all three lines tended to become tetraploid and then hypotetraploid. In the BALB/c glioma, 98% of the cells in the sixth transplant generation contained one metacentric marker chromosome. Although cells from the glioma induced in C57BL/He mice contained a variety of centric and minute markers, the presence of two metacentric marker chromosomes in each cell was a relatively constant feature. Although the karyotype of all three tumors was followed with serial transplantation, they could not easily be followed.

IN VIVO KINETICS OF NUCLEIC ACIDS IN HUMAN CANCER CELLS. (Fr.) Duprez, A. (U. Hosp. Nancy, France) and M. Bessot. *Ann Med Nancy* 8:329-336, 1969.

The method is described for determining *in vivo* the rate at which ³H-thymidine and ³H-uridine are incorporated into DNA and RNA, respectively, in tumor cells. This method involves intraarterial injection of the tumor during surgery for one hr with a radioisotope. After serial sectioning of the tumor tissue two successive sections were taken, one for autoradiography and the other for digestion with DNase or RNase. Extraction was performed in a liquid scintillation counter and counting was taken. By taking into consideration the rate of perfusion, the quantity of radioactivity injected, and planimetric measurements of the tissue

section, the radioactivity in a unit of volume of tissue is calculated.

3306 INHIBITION OF A SPECTRUM OF ANIMAL TUMORS BY DIETARY ZINC DEFICIENCY. (E.) DeWys, W. (U. Rochester Sch. Med. Dentistry, N.Y.) and W. Pories. *J Nat Cancer Inst* 48(2):375-381, 1972.

Zinc deficiency had previously been shown to inhibit growth of Walker 256 carcinosarcoma, a rapidly dividing solid tumor, in rats. To ascertain whether tumor inhibition is a general effect of zinc deficiency, the growth of the more slowly dividing, solid, Lewis lung carcinoma in male C57BL/6 mice of several ascites tumors in CDF male mice was studied in zinc-deficient animals. Growth of Lewis lung tumor transplants in mice pretreated for 11 days with a zinc-deficient diet was markedly reduced compared with tumor implants in control mice on a zinc-supplemented diet. Mice on the deficient diet also showed a delay in appearance of palpable tumors, and survival, although prolonged, was probably limited by the adverse effects of zinc deficiency. Pretreatment with a zinc deficient diet also significantly prolonged survival of mice inoculated with L5178yf and L1210 but not with P388 mouse leukemia. Survival of the leukemic mice was much shorter than survival of Lewis lung tumor bearing mice on the zinc deficient diet. To investigate whether this apparent difference was related to the mode of tumor growth (i.e. ascitic vs. solid), the effects of zinc deficiency were compared in both the ascites and solid tumor forms of Walker 256 carcinosarcoma in male Sprague-Dawley rats. Survival was prolonged to the same extent for the two forms, apparently excluding the possibility that the results were due to differences in the site of tumor growth. It is concluded that tumor inhibition is a general effect of zinc deficiency, irrespective of cell type, cell growth rate, or site of growth.

3307 ESTROGEN PRODUCTION BY TROPHOBLASTIC TUMORS IN TISSUE CULTURE. (E.) Pattillo, R. A. (Med. Coll. Wisconsin, Milwaukee), R. O. Hussa, W. Y. Huang, E. Delfs and R. F. Mattingly. *J Clin Endocrinol Metab* 34(1):59-61, 1972.

Established cultures (BeWo and Jar lines) of pure trophoblastic cells derived from human gestational choriocarcinomas were incubated (eight to 20 hr) with either of two androgens, androst-4-ene-3,17-dione-1,2-³H (H-Δ⁴) or dehydroepiandrosterone-7-³H (³H-DHEA). Labeled estrogens synthesized by the cells during the incubation period were separated from neutral steroids and analyzed by reverse phase and direct phase partition chromatography on Celite columns. Identity of labeled estrogens was confirmed by isotope dilution and derivative formation. Estrone (E₁) and 17-estradiol (E₂) were synthesized from ³H-Δ⁴ in Jar cells, and from ³H-Δ⁴ and ³H-DHEA

in BeWo cells. When $^3\text{H}-\Delta^4$ was precursor, E_2 production (135-14,200 ng/g cells/day) exceeded that of E_1 (43-2120 ng/g cells/day) by two to ten times in both cell lines. It was concluded that potential steroidogenic pathways for estrogen synthesis similar to those of the normal placenta are retained in malignant trophoblastic tumor cells *in vitro*.

- 3308 REGULATION OF ADENOSINE 3':5'-CYCLIC MONOPHOSPHATE PHOSPHODIESTERASE ACTIVITY IN FIBROBLASTS BY INTRACELLULAR CONCENTRATIONS OF CYCLIC ADENOSINE MONOPHOSPHATE. (E.) D'Armiento, M. (Nat'l. Cancer Inst., Bethesda, Md.), G. S. Johnson and I. Pastan. *Proc Nat Acad Sci USA* 69(2):459-462, 1972.

Cyclic AMP-phosphodiesterase is present in various mouse fibroblasts. Contact-inhibited 3T3 cells contain two forms of the enzyme, one with a K_m of 2.5 μM and the second with a K_m of 71 μM . As 3T3 cells grow to confluency and cAMP concentrations rise, the activity of the first enzyme increases, whereas that of the second is unchanged. A line of SV40-transformed 3T3 cells with low cAMP concentrations also has low levels of the cAMP-phosphodiesterase with a K_m of 2.5 μM . Treatment of 3T3 and SV40-transformed 3T3 cells with dibutyl cAMP and theophylline increases cAMP-phosphodiesterase accumulation. This accumulation is blocked by cycloheximide and actinomycin D. The newly formed enzyme resembles the higher affinity enzyme present in unstimulated cells, since it has a K_m of 1.2-2.0 μM , and is stimulated by snake venom. In L cells in which cAMP concentrations are elevated by treatment with prostaglandin E_1 , cAMP phosphodiesterase also accumulates. It is concluded that intracellular concentrations of cAMP regulate the synthesis of cAMP-phosphodiesterase, and that cAMP functions as an inducer of the enzyme.

- 3309 THE FLUORESCENT PATTERN OF NORMAL CHROMOSOMES IN BIOPSIES OF MALIGNANT LYMPHOMAS, AND ITS COMPUTER DISPLAY. (E.) Fleischmann, T. (Inst. Genetics, U. Lund, Sweden), T. Gustafsson, C. H. Hakansson and A. Levan. *Hereditas* 70:75-88, 1972.

Tumorous lymph nodes from seven patients with histologically diagnosed Hodgkin's disease, lymphosarcoma, reticulum cell sarcoma and malignant lymphoma of uncertain type were extirpated from the neck, from the axilla and from the inguinal regions and short term cultures made. Normal-looking chromosomes from a total of 150 metaphases were stained by a modified fluorochrome procedure using atetrin, and densitometer scans of well-stained preparations were further analyzed by computer. Results were presented as photomicrographs, as contour maps of isobrightness curves and as three-axis diagrams for each of the 22 somatic and two sex chromosomes. Banding patterns of "normal" tumor chromosomes and previously published fluorescence patterns of

normal leukocyte chromosomes were similar. The only deviation from normality in the "normal" tumor chromosomes was a more pronounced variation in size sometimes noticed both among the different pairs and between the homologues of each pair.

- 3310 A CYTOGENETIC ANALYSIS OF HUMAN SEMINOMAS. (Rus.) Lelikova, G. P. (Inst. Exp. Clin. Onkol. Moscow, USSR), A. V. Laskina, A. F. Zakharov and E. E. Pogonyants. *Vop Onkol* 17(11):20-28, 1971.

Human seminomas (18) were karyotyped to determine the extent to which the different groups of chromosomes are responsible for variability in the karyotype and to clarify the correlation between histological characteristics of the tumors and their karyotype. The modal classes of cell populations in these tumors were 3n-6n, indicating that human seminomas are heteroploid. A comparison of the number of chromosomes and tumor morphology showed the existence of two groups: tumors characterized by triploid sets of the chromosomes with differentiated structures and tumors made up of highly polymorphic cells which had more than four sets of chromosomes. There was a tendency for the number of chromosomes in seminoma cells to increase as cell differentiation decreased. Thirteen of 18 seminomas had marker chromosomes. In three cases marker chromosomes were characterized by extreme distention of the centromere region in small submetacentric or acrocentric chromosomes. Most frequent were long subtelocentric chromosomes, which varied in size. An analysis of seminoma chromosomes by groups (A to G) also showed heterogeneity of the cell populations. A statistical study made of the seminoma chromosomes revealed that the average number of chromosomes per cell differed greatly in different groups, ranging from 59.6 to 136.1. In all 12 tumors studied, the number of chromosomes was decreased in group B and increased in group C; they were decreased in Group E in 11/12. In other groups of chromosomes, the numbers fluctuated greatly.

- 3311 ISOENZYMES OF ISOCITRATE DEHYDROGENASE IN CYTOPLASM OF HUMAN CANCER CELLS. (E.)

Opher, A. W. (VA Hosp., Fort Howard, Md.), J. W. Leonard, Jr. and J. M. Miller. *Exp Med Surg* 29(1-2): 15-18, 1971.

Homogenates of tissues obtained from histologically diagnosed squamous cell carcinoma from esophagus, larynx, penis and tongue were assayed for nicotinamide-adenine-dinucleotide phosphate (NADP)-dependent isocitrate dehydrogenase (ICDH) activity by a spectrophotometric method. In addition, isoenzymes of ICDH were analyzed by electrophoresis and the fractions were quantitated by densitometry. All four carcinomas tested contained "enhanced" amounts of total ICDH activity ranging from 180 U for penis to 674 U for esophagus. Whereas normal control tissue contained the expected three isoenzyme fractions, six fractions possessing ICDH activity were recog-

in the four carcinomas. ICDH from tongue
ted as one fraction. Each of the other three
nomas contained four bands although the percent-
distribution and migration pattern differed
them. The appearance of four fractions in
carcinomas was not consistent with the proposed
ic subunit structure of ICDH, thus supporting
upposition that the carcinoma may change the
e of the various fractions and alter their
ity.

ENERGY EXCHANGE IN EHRLICH'S TUMOR CELLS AND
Nk/Ly LYMPHOMAS IN THE PROCESS OF TUMOR
(Rus.) Kaz'min, S. D. (Kiev Res. Inst.
lin. Oncol., USSR) and N. N. Mel'nikova. *Vop*
18(3):66-70, 1972.

y was made of glucose and oxygen requirements
anges in two types of ascites tumors: Ehrlich's
/Ly lymphoma. The tumor cells were injected
nto hybrid male mice, and the glucose and
uptake was determined by the rise in their
trations in cell-free ascites fluid. Glucose
etermined by a fermentation method, and the
concentration by polarography, using
inum microelectrode inserted into the peritoneal
of the animal. Kinetic curves of tumor growth
eir corresponding polarographic curves show
ponential character of the tumor growth in the
l period, with a decreased of growth rate in
periods in both tumors. The exponential phase
four days from the tumor inoculation, when
cells were in the peritoneal cavity. Oxygen
into the tumor was low, being 2.6 $\mu\text{M/hr/mouse}$,
 10^6 cells were present in the peritoneal
This uptake will support respiration for a
a of 30×10^6 cells. Thus, hypoxia occurs in
stages of tumor development. This state is not
ed in the rate at which tumor cells multiply,
remains high for four days. With the develop-
hypoxia, glycolysis intensifies, compensating
iciency in ATP resynthesis during respiration.
e of glucose uptake by the plasma was 49 $\mu\text{M/hr}$ /
which could satisfy the glucose requirement
at 200×10^6 cells. Thus, all subsequent tumor
must occur against a background of glucose
iciency. ATP resynthesis curves in Ehrlich's
cells show that a sharp decrease occurs in the
respiration and that more than 85% of the ATP
nthesized in the glycolytic cycle. Thus, a
ed rate of energy exchange and reduced glycol-
e the main factors in reduced multiplication
r cells in the later periods.

CARBOHYDRATE METABOLISM IN THE NEOPLASTIC
PROCESS. (Rus.) Miloslavskii, I. M.
an Inst. Postgrad. Med., Kharkov, USSR),
yshlevaya and YA. M. Buntser. *Vop Onkol*
4-78, 1972.

Carbohydrate metabolism was studied in 646 patients
(272 male and 374 female) with various localized
tumors (220 stomach, 127 brain, 100 breast, 100
lung, 78 rectum, and 21 large intestine) by glucose
tolerance tests. The carbohydrate metabolism was
also studied by the same method in 50 ulcer patients,
35 with benign mastopathies, 237 with inflammatory
diseases of the central nervous system, and 80 nor-
mal subjects. Disturbances in carbohydrate metabo-
lism occurred frequently in cancer patients (10-55%).
The disturbance was more pronounced in cancer of the
brain (55%), stomach (55%), and intestine (37%).
Diabetes-like curves were seen with about the same
frequency in patients with various tumors of the
gastrointestinal tract (24-29%). Hyperglycemic and
glycosuric disturbances were seen in brain cancer
patients. Disturbances in carbohydrate metabolism
became more pronounced as tumor growth advanced.
Functional and morphological disturbances were
observed in the pancreas (especially beta cells)
of subjects who had died from malignant neoplasms.
Administration of easily assimilated monosaccharides,
small divided doses of insulin, and the use of
anabolic preparations (nerobol, methandrostenolone)
prevented disturbances in carbolism in 91 operated
patients with visceral tumors.

3314 ROLE OF 3',5'-ADENOSINE MONOPHOSPHATE IN REGULATION OF MORPHOLOGY AND GROWTH OF TRANSFORMED AND NORMAL FIBROBLASTS. (E.)

Johnson, G. S. (Nat'l. Cancer Inst., Bethesda, Md.)
and I. Pastan. *J Nat Cancer Inst* 48(5):1377-1387,
1972.

Morphology and growth properties of various normal
and virus-transformed mouse and hamster fibroblasts
were altered when the cells were grown in the
presence of 1.2 mM N^6, O^2' -dibutyryl 3',5'-adenosine
monophosphate (dbc-AMP). During treatment with
dbc-AMP, the cell body and processes were elongated.
Cells became spread out and flatter, and the area of
cell surface in contact with the substratum was
greatly increased. Although morphologic changes
were seen with all cell lines tested (including
Swiss/3T3, BALB/3T3, and these two lines transformed
by polyoma virus, murine leukemia and sarcoma
viruses, and SV40), the changes observed in the
transformed lines were not so extensive as those
seen in the untransformed ones. L-2071 cells, a
line that grows on a chemically defined, protein-
free medium, and BHK-21 cells growing in monolayers
also showed a significant response to dbc-AMP. An
exception to the lack of great response in SV40-
transformed cells was one transformed BALB/3T3 line.
The extensive vacuolization of this line was also
reduced by dbc-AMP. Dibutyryl c-AMP decreased the
growth rate of all cell lines; the effect was
potentiated by 1 mM theophylline. The treatment
decreased by seven-fold the saturation density
of 3T3 cells but did not markedly decrease the
saturation density of the non-contact-inhibited
transformed cells, even in the presence of theo-
phylline.

- 3315 CHROMOSOMAL ANEUPLOIDY DURING THE COURSE OF ACUTE LYMPHATIC LEUKEMIA IN A SUBJECT WITH TRISOMY 21. (It.) Crisalli, M. (G. Gaslini Inst., Genoa, Italy), R. Monteverde and F. Dagna-Briccarelli. *Minerva Pediat* 23(43):1791-1797, 1971.

A girl with trisomy 21, diagnosed at 12 months, developed acute lymphatic leukemia at 3.25 years. At the onset of leukemia, the only chromosome abnormality was the extra G chromosome. Administration of cortisone and antileukemic agents (unspecified) for one month induced a partial remission which lasted for six months with maintenance therapy. During this remission other abnormalities developed in the karyotype. These included the loss of a C group chromosome, either alone or associated with the loss of a D group chromosome; the loss of a D group and a G group chromosome; and the loss of a C group chromosome associated with trisomy F. Drug therapy does not appear to be responsible for the chromosome abnormalities in this patient. A recurrence treated with cortisone and antileukemic agents was followed by a two month remission after which the patient died.

- 3316 BASIS FOR THE SERINE REQUIREMENT IN LEUKEMIC AND NORMAL HUMAN LEUKOCYTES: REDUCED LEVELS OF THE ENZYMES IN THE PHOSPHORYLATED PATHWAY. (E.) Pizer, L. I. (U. Pennsylvania Sch. Med., Philadelphia) and J. D. Regan. *J Nat Cancer Inst* 48(6):1897-1900, 1972.

Enzymes of the "phosphorylated pathway" for serine biosynthesis were assayed by spectrometry or by conversion of isotopically labeled precursors in extracts of normal leukocytes and extracts of leukocytes from patients with acute or chronic granulocytic leukemia. Activity of all enzymes assayed was lower in the leukocyte (both normal and leukemic) preparations than in comparable preparations of cultured human diploid fibroblasts and HeLa or KB cells. Mixing of extracts demonstrated that the low activity in the leukemic cells was not due to the presence of diffusible inhibitors. The greatest difference between leukocytes and other cell types was in the specific activity of glycerate 3-phosphate dehydrogenase, indicating that this enzyme might limit serine synthesis and give rise to the serine requirement exhibited by blood cells.

- 3317 CYTOGENETIC STUDIES IN MALIGNANT LYMPHOMAS: A STUDY OF 28 CASES. (E.) Coutinho, V. (Fac. Med., Sao Paulo, Brazil), C. Bottura and R. P. Falcao. *Brit J Cancer* 24(4):789-801, 1971.

Chromosome studies were carried out, by a direct method, in 28 subjects with malignant lymphomas. All patients were untreated at the time of the study,

except for one with Hodgkin's disease. Lymph node cells were analyzed in 24 of the cases, ascitic fluid sediments in three, and bone marrow cells in one. Chromosome abnormalities, both numerical and structural, were found in 12 of 14 cases of well-differentiated and poorly differentiated lymphocytic lymphomas and reticulum cell sarcomas, and in eight of 14 cases of Hodgkin's disease. The karyotypes were different from case to case and there was no correlation with the histology of the tumors. In individual cases, the abnormalities followed a clonal pattern indicating a common precursor for the abnormal cells. The modal number of chromosomes was near-diploid in the lymphocytic lymphomas and reticulum cell sarcomas, except for one case which was hypertetraploid. Hodgkin's disease showed two main features; a predominant population of cells with normal karyotype which were thought to be normal mitotic lymphocytes, and a small number of cells with a predominantly hypertriploid number of chromosomes. These latter cells were considered to be the neoplastic reticulum cell component of the disease.

- 3318 ULTRASTRUCTURE AND ENZYME ULTRACYTOCHEMISTRY OF HUMAN RENAL CELL CARCINOMA. (E.)

Yokoyama, M. (M. D. Anderson Hosp. Tumor Inst., Houston, Texas). *Cancer Bull* 23(5):91-92, 100, 1971.

The exact subcellular localization of various phosphatases was determined by ultracytochemical methods in renal cell carcinomas from five men and five women. Normal Chinese hamster, rat and human renal tissue was studied as a control. Carcinoma cells had pleomorphic nuclei with prominent nucleoli, large lipid droplets, and abundant cytoplasmic glycogen particles and organelles. Frequently, tumor cells were connected to one another and circumscribed by a basement membrane forming relatively differentiated tubular structures. In enzyme ultracytochemistry of the tumors, seven out of nine showed alkaline phosphatase activity located at microvilli on the luminal surface, as well as at the lateral cell surface in tumor cells forming tubules. Acid phosphatase (ACPase) activity was detected in all nine tumors studied and was localized mainly in lysosomes and the Golgi apparatus of both tumor and proximal tubular cells. The Golgi apparatus of tumor and proximal cells also contained thiamine pyrophosphatase (TPPase) and inosine diphosphatase (IDPase). Although IDPase was also seen in the endoplasmic reticulum of proximal cells, it was absent from that of tumor cells. Two of the four cases studied showed glucose-6-phosphatase (G6Pase) activity located mainly in the endoplasmic reticulum and nuclear envelope of tumor cells and proximal tubule cells. TPPase, IDPase and G6Pase activity was also detected on microvilli and lateral plasma membrane of tumor cells arranged in tubular formation. The similarities between tumor and normal renal cell enzyme patterns suggest that the renal cell carcinomas arose from proximal convoluted tubules. Presence of various enzyme activities at the lateral cell surface of the renal carcinoma cells suggests that functional dedifferentiation of the plasma membrane actually takes place in the tumor.

AGE AT MENARCHE AND BREAST CANCER. (E.) Staszewski, J. (Inst. Oncol., Gliwice, Poland). *J Nat Cancer Inst* 47(5):935-940, 1971.

Results of a case-control study in the Katowice pole Districts of Poland are presented. The distribution of females with "late" menarche (age ≥ 16), both cases and controls, was similar to the distribution reported for Tokyo and much higher than in Los Angeles or Boston, where breast cancer incidence is also low. Females reporting menarche at ages < 16 years had breast cancer risks 1.76 as high as those reporting "late" menarche. This differential in risk was more marked for women up to 44 years of age than for older women. Other sources indicate an increase in breast cancer risk in Poland and also a decrease in the proportion of late menarche. A relationship between geographic and secular variation in breast cancer occurrence and in menarche pattern is suggested. Age at menarche and breast cancer risk are probably indirectly associated, with nutrition being the possible common factor.

α -FETOPROTEIN IN RATS TRANSPLANTED WITH ASCITES HEPATOMA. (E.) Watabe, H. (Hokkai-Sch. Med., Japan), H. Hirai and H. Satoh. *Cancer* 33(2):189-199, 1972.

Change in the concentration of embryo-specific α -globulin (α -fetoprotein) was studied by immunoelectrophoresis and immunodiffusion in the serum of strain rats, in the serum of gestating female rats and in the serum and ascitic fluid of rats bearing transplantable ascites hepatomas. Serum α -fetoprotein concentration in fetuses decreased two weeks after birth to approximately one-half prenatal level and disappeared in five weeks. α -Fetoprotein was also present in serum of gestating rats in low concentrations which disappeared one week after delivery. α -Fetoprotein was also present in the serum and/or ascitic fluid of rats bearing transplantable ascites tumors. Twenty-six ascites hepatoma lines tested produced α -fetoprotein. One of five lines of Morris hepatoma produced α -fetoprotein as did four of seven sarcoma sublines. α -Fetoprotein was also present in extracts of α -fetoprotein-producing tumor

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AARONSON, S.A.	ANDERSON, J.	BAKER, H.W.
3096, 3126	3130	3410*
ABBREDERIS, K.	ANDERSON, S.A.	BAKER, M.B.
3507*	3135	3161
ABE, C.	ANDOH, T.	BAKER, R.E.
3223*	2936, 3005	3161
ABLASHI, D.V.	ANGELOPOULOS, A.P.	BALAKRISHNAN, V.
3099, 3104	3419*	3290*
ABLIN, R.J.	ANGLESIO, E.	BALDWIN, R.W.
3177, 3187	3267	3170
ADAMCZYK, B.	ANISIMOV, V.N.	BALINT, Z.
3217*	2943	3389*
ADAMS, K.	ANTHONY, P.P.	BANDLOW, G.
3303	3166	3056
ADKINS, P.C.	ANTONELLO, C.	BANERJEE, A.K.
3446*	2961	3105
ADLER, L.N.	ANTONIV, V.F.	BANI-HASHEMI, A.
3445*	3552*	3408*
ADLER, S.	AOKI, T.	BANKOWSKI, R.A.
3072	3144	3148*
ADZHIGITOV, F.I.	APATENKO, A.K.	BANNA, P.
3200	2917*	3567*
AHEARN, M.J.	ARAKI, M.	BARAJAS, L.
3360*	2983	3372*
AKAGI, T.	ARBENZ, U.	BARBIROLI, B.
3293	3346*	3504*
AKAO, M.	ARCEBITO, S.	BARDELL, D.
2946	3567*	3150*
AKSOY, M.	ARIMA, T.	BARKER, L.F.
2976	3502*	3166
ALBERTO, P.	ARMELI, G.	BARLOW, J.J.
3173	2987	3477*
ALEKSANDROWICZ, J.	ARMSTRONG, G.R.	BARNETT, J.M.
3018*	3099, 3104	3549*
ALETRAS, H.A.	ARSENI, C.	BARONI, C.D.
3577*	3600*	2970
ALEXANDER, P.A., JR.	ASAMER, H.	BASILICO, C.
3070	3507*	3055)
ALEXANDROV, K.	ASTRAKANTSEV, F.A.	BASS, L.R.
3012	3562*	0104
ALLDERDICE, P.W.	ATKIN, N.B.	BASSIN, R.H.
3473*	3338*	3058, 3098,
ALPERT, E.	ATTIA, Y.	3111, 3126
3401*	3255	BASSLEER, R.
ALTENKIRK, B.	AULISIO, C.G.	3536*
2959	3178	BAUCHART, J.
ALTER, M.	AULISIO, G.A.	3414*
3260	3565*	BAUER, H.
AMEMIYA, Y.	AULL, F.	3068
2982	3547*	BAUER, K.H.
AMES, B.N.	AUVERGNAT, J.CH.	2913*
2984	3561*	BAUMINGER, S.
ANDERSON, C.W.	AZARNOFF, D.L.	3224*
3140	3322*	BEARD, J.W.
ANDERSON, D.P.	BACCICHETTI, F.	3051, 3075
3527*	2961	BEATTIE, E.J., JR.

3031*
BECK, I.T.
3437*
BECKER, F.F.
3469*
BECKLER, V.
2916*
BEDA, B.
3255
BEDOYA, M.
3551*
BEKESI, J.G.
2989
BEKTERMIROV, T.A.
3418*
BELCHER, J.R.
3261
BELLONE, A.G.
3468*
BELOKHVOSTOV, A.S.
3463*
BENACERRAF, B.
3164
BENEKE, G.
3535*
BENITEZ, M.H.
3588*
BENNETT, N.B.
3452*
BENSAHEL, H.
3349*
BENSCH, K.
3424*
BEREZKIN, D.P.
3479*
BERGEON, J.J.
3174
BERGS, V.V.
3069
BERMAN, R.S.
3163
BERNARD, C.
3065
BERNARD, P.
3247
BERNS, A.J.M.
3495*
BERNS, K.I.
3072
BERTINO, J.R.
3325*
BERTRAND, E.
3255
BESKA, F.
3288*
BESSOT, M.

3305
BETTENS, G.
3517*
BHAGAT, B.
3357*
BHAMARAPRAVATI, N.
3008
BHARGAVA, P.M.
2988
BHIDE, S.V.
2988
BIBERFELD, P.
3435*
BIERNACKA, B.
3519*
BIGGS, P.M.
3152*
BILDER, J.
3496*
BIRD, E.S.
3082
BISERTE, G.
3348*
BISHOP, J.M.
3086, 3110,
3115
BISKUPSKA-WIECKO, J.
3576*
BISSELL, D.M.
3401*
BITTERSÖHL, G.
3284*
BLACK, P.H.
3063, 3088
BLAIR, C.D.
3129
BLAIR, D.G.R.
3992
BLAMEY, R.W.
3198
BLASKOVIC, D.
3114
BLAZEK, J.
3035
BLOEMENDAL, H.
3136, 3495*
BLOMGREN, H.
3226*
BLONDIN, J.
3433*
BLOOM, G.E.
3302
BOARD, J.A.
3393*
BOEHME, U.
3222*

BOERYD, B.
3300
BOGDEN, A.E.
3156
BOHUON, C.
3556*
BOIRON, M.
3065, 3091
BOJINOV, S.
3548*
BOLLA, M.
2912*
BONAR, R.A.
3051
BONNEAU, H.
3235, 3557*
BONNEAU, H.P.
3557*
BOOT, L.M.
2942
BORENSTEIN, C.
3470*
BORENSTEIN, D.
3182
BOS, C.J.
3450*
BOSE, H.R.
0127
BOSHKOV, A.N.
3484*
BOTS, G.T.A.M.
3436*
BOTTURA, C.
3317
BOULOS, B.M.
3322*
BOURALI-MAURY, C.
3341*
BOUREAU, M.
3349*
BOURGAUX-RAMOISY, D.
3139
BOURLIOUX, P.
3202
BRANDEN, C.I.
3057
BRAS, G.
3253
BRAUEROVA, J.
3101
BRAUNSTEINER, H.
3507*
BRENNAN, P.J.
3129
BRIENT, B.W.
3175

BRIGGS, G.M.
 2932
 BROWN, G.B.
 2972
 BROWN, H.D.
 3321*
 BROWN, W.J.
 3372*
 BROWNIE, A.C.
 3500*
 BROZMANOVA, E.
 3530*
 BRUCE, B.J.
 3359*
 BRUX, J.DE
 2918*, 2947
 BUNTSER, YA.M.
 3313
 BURATTI, C.
 3486*
 BURDETTE, W.J.
 3350*
 BURGHOUTS, J.TH.M.
 3136
 BUSCH, H.
 3358*
 CACHIN, Y.
 3344*, 3421*
 CAEN, J.-L.
 3344*, 3421*
 CALDWELL, I.C.
 3336*
 CANIVET, M.
 3091
 CAPP, A.P.M.
 3267
 CAPUTO, R.
 3468*
 CARBONELL, C.C.
 3596*
 CARCATZOULIS, S.
 3568*, 3569*
 CARLASSARE, F.
 2961
 CARMONA, A.
 3219*
 CARROLL, R.
 3205
 CARSTENS, P.H.B.
 3354*
 ASHMORE, A.R.
 3325*
 CASTILLO, J.R. DEL
 3596*
 CASTLEMAN, B.
 3383*

CASTRUP, H.J.
 3459*
 CAVALIERI, E.
 3025*
 CELER, V.
 3197
 CERNY, L.
 3197
 CESARINI, J.P.
 3235, 3557*
 CHABOT, J.
 3075
 CHAMEAUD, J.
 3028
 CHAMLOU, I.
 3349*
 CHAN, P.L.
 3227*
 CHANCE, B.
 3340*
 CHANG, D.C.
 3230
 CHAPMAN, W.H.
 3162
 CHAPPLE, M.F.
 3272
 CHARY, K.K.N.
 3210
 CHATTOPADHYAY, S.K.
 3321*
 CHELLO, P.L.
 3325*
 CHENG-MINODA, K.
 3352*
 CHERRY, C.P.
 2923, 2952,
 3007
 CHIECO-PIANCHI, L.
 3572*
 CHIRIGOS, M.A.
 3064, 3102,
 3119
 CHISCON, M.O.
 3188
 CHOI, N.W.
 3265
 CHONE, B.
 3573*
 CHOPRA, H.C.
 3099
 CHRISTINE, B.W.
 3272
 CHRISTOPHERSON, W.M.
 3467*
 CHU, S.Y.
 3336*

CHUAT, J.C.
 3065
 CHUMAKOVA, L.P.
 3538*
 CIHAK, R.W.
 3412*
 CITTADINI, A.
 3340*
 CLARK, H.F.
 3138
 CLAVIN, M.
 3025*
 CLEMENS, J.A.
 2929
 CLEVELAND, G.
 3230
 CLINE, M.J.
 3180
 COFFIN, J.M.
 3040
 COGGIN, J.H., JR.
 3204
 COHEN, G.H.
 3059
 COLE, P.
 3266
 COLEMAN, M.
 3394*
 COLIN, G.
 3414*
 COLLAVO, D.
 3572*
 COMBEMALE, B.
 3514*
 CONNER, R.
 3043
 CONRAD, E.
 2978
 CONSIGLI, R.A.
 3046
 CONSTANTINESCU, A.
 3472*
 COOK, P.
 3277
 COONEY, L.M., JR.
 3269
 COOPER, E.H.
 3326*
 COOPER, G.M.
 3540*
 COOPER, J.R.
 3324*
 COOPERMAN, J.M.
 3503*
 COPPEY, J.
 3092

CORBERAND, J.
3561*
CORK, A.
3360*
CORNELIUS, E.A.
3206, 3209
CORNELL, G.N.
3526*
CORTESE, A.F.
3526*
COSTIN, C.
3254
COTTIER, H.
3391*
COUTELLE, R.
3593*
COUTINHO, V.
3317
CRAIGE, B.
3035
CRAVIOTO, H.
3457*
CRILL, G., JR.
3191
CRISALLI, M.
3315
CROFT, C.J.
3097
CROIZAT, H.
3225*
CRONKITE, E.P.
3391*
CROUCH, N.A.
3141
CROVERI, G.
3376*
DACRE, J.C.
2986
DAGNA-BRICCARELLI, F.
3315
DAIBER, A.
3219*
DALHAMM, T.
2939
DAMJANOV, I.
3462*
D'ANGELO, E.
3564*, 3565*
DANIEL, R.W.
3034
DARDACHTI, D.
3379*
D'ARMIENTO, M.
3308
DAT-XUONG, N.
2957

DAVIE, J.
3521*
DAVIES, R.
3023*
DAVIS, K.D.
3449*
DAVREMONT, G.
3545*
DEAN, G.
3335*
DEASY, P.F.
3205
DECKERS, P.J.
3160
DEELEY, T.J.
2902
DEFENDI, V.
3124, 3138
DEGTYARENKO, V.I.
3167, 3200
DEINGS, P.
3505*
DEINHARDT, F.
3153*
DELAIN, E.
3100, 3117
DELBEKE, M.J.
3545*
DELFS, E.
3307
DELSOL, G.
3561*
DEMAILLE, A.
3241*
DENT, P.B.
3120
DEODHAR, S.D.
3191
DEPIEDS, R.
3218*
DEPLANO, A.
3285*
DEROUT, J.
2947
DESAIVE, C.
3536*
DESCHNER, E.E.
3239
DE-THE, G.
3402*
DEV, V.G.
3473*
DE WYS, W.
3306
DIAMOND, L.
2991

DIEBOLT, G.
3157
DINCOL, G.
2976
DINCOL, K.
2976
DIOT, M.-N.
3556*
DIYACHKOVA, L.V.
3597*
DMOCHOWSKI, L.
2909
DOBOS, M.
3417*
DOMAGALA, W.
3497*
DOMMASCH, M.
2992
DON, M.
3472*
DONNER, L.
3093
DONOSO, S.
3017*
DORE, J.-F.
3201
DOTSENKO, A.P.
3553*
DOYLE, M.
3041
DRAGOMERETSKII, V.D.
3167
DRAGONI, G.
3592*
DRAMPYAN, F.S.
3482*
DREWINKO, B.
3360*, 3492*
DREWS, J.
3534*
DRIESSENS, J.
3241*
DROBNIK, J.
3101
DUBARRY, J.-J.
3287*
DUBBS, D.R.
3060
DUBEN, J.
3042
DUFF, R.
3043
DUNN, A.R.
3108
DUNNING, W.F.
3540*

DUPREZ, A.
 3305
 DUQUESNOY, R.J.
 3229*
 DURAN-REYNALS, M.L.
 3121
 DUUREN, B.L. VAN
 2981, 3002
 DYADKOVA, A.M.
 3044
 DYSHLEVAYA, L.N.
 3313
 YUMIN, O.V.
 3107
 EBERT, P.
 3102
 EBERT, P.S.
 3119
 EBY, L.S.
 3410*
 EDLAND, R.W.
 3386*
 EGBRING, R.
 3506*
 EGMOND, H. VAN
 3517*
 EISEN, H.N.
 3158
 EL-DOMEIRI, A.A.
 3031*
 ELEKES, E.
 3212
 ELLIS, V.L.
 3061
 ELLMAN, L.
 3164
 ELQUEZABAL, A.
 3333*
 EMMELOT, P.
 3450*
 ENEROTH, C.-M.
 3529*
 ENGELBRECHT, J.C.
 2959
 ENGELSE, L.DEN
 2997
 ENTWISTLE, D.W.
 3265
 EPSTEIN, M.A.
 3107
 ERODEM, S.
 2976
 ERLANDSON, R.A.
 3323*, 3354*
 3385*
 ERTL, N.

3589*
 ESBER, H.J.
 3156
 ESCALONA ZAPATA, G.
 3570*
 ESIRI, M.M.
 3123
 ESSELSTYN, C.B., JR.
 3191
 ESSEX, M.
 3036
 ESTENSEN, R.D.
 3510*
 ETCHEVERRY, R.B.
 3017*
 EVANS, D.M.D.
 3198
 EWEN, S.W.B.
 3396*
 FABER, A.J.
 3480*
 FABIANI, A.
 3014*, 3376*
 FADEI, L.
 3475*, 3563*
 FALCAO, R.P.
 3317
 FANSHIER, L.
 3115
 FARAS, A.J.
 3110
 FARBISZEWSKI, R.
 3471*
 FARRER-BROWN, B.
 2948
 FASTOVSKIY, V.L.
 3369*
 FEBVRE, H.
 3085
 FEDOROVA, YU.B.
 3418*
 FEGERTY, P.
 2948
 FELSENFELD, H.W.
 3424*
 FERENCZY, A.
 3413*
 FERNANDEZ-CRUZ, L.
 3361*
 FERRERA, S.
 3567*
 FEURER, F.
 3453*
 FINE, D.L.
 3134
 FINLAYSON, A.

3270
 FISCHER, E.R.
 3533*
 FISCHER, H.
 3038
 FISCHINGER, P.J.
 3058, 3111
 FISHER, M.YE.
 3369*
 FISHZON-RYSS, YU.I.
 3297
 FJELDE, A.
 3122
 FLAXMAN, B.A.
 3234
 FLEISCHMANN, T.
 3309
 FLEISSNER, E.
 3144
 FLUEGEL, R.M.
 3073
 FOLDS, J.D.
 3478*
 FONSECA, N.M.
 3347*
 FONTANA, L.
 3016*
 FORD, L.
 3268
 FORNATTO, L.
 3376*
 FORNI, A.
 2987
 FOURCADE, A.
 3081
 FOWLER, M.
 3454*
 FOX, J.A.E.
 3437*
 FRANCES, J.
 3371*
 FRANCOIS, D.
 3085
 FRANK, A.L.
 3382*
 FRANK, M.M.
 3184
 FRANKLIN, R.M.
 3057
 FRAUMENI, J.F., JR.
 2998, 3251
 FRAZIER, J.A.
 3152*
 FREDERICQ, E.
 3481*
 FREDRICKSON, T.N.

3070
 FREEMAN, A.E.
 3080
 FREI, J.V.
 2934
 FREISKORN, R.
 3444*
 FRENKEL, K.
 3002
 FRICK, T.
 3149*
 FRIEDMAN, N.B.
 3328*
 FRIEDRICH, E.G., JR.
 3329*
 FRIEDRICHS, K.H.
 3586*
 FRINDEL, E.
 3225*
 FROEHLICH, K.H.
 3362*
 FU, Y.-S.
 3381*
 FUJII, S.
 3502*
 FUJINO, H.
 3522*
 FUJITA, SH.
 3575*
 FUNSHTEYN, L.V.
 3585*
 GABRIELIDIS, C.G.
 3577*
 GADRAT, J.
 3561*
 GALANKIN, V.N.
 3554*
 GALASKO, C.S.B.
 3489*
 GALEOTTI, T.
 3340*, 3423*
 GALLMEIER, W.M.
 3222*
 GANGAHDARAN, P.
 3264
 GANTT, R.
 3106
 GARAPIN, A.-C.
 3086, 3115
 GARCIA, H.
 2969
 GARDE, A.
 3558*
 GARDNER, M.B.
 3076
 GAZDAR, A.F.

3098, 3132
 GAZZERA, G.
 2903
 GAZZOLO, L.
 3402*
 GEBHART, W.
 3370*
 GELBOIN, H.V.
 2928, 2991
 GELFON, I.A.
 3367*
 GENDRE, P.
 3174
 GENIN, J.
 3214, 3344*
 GENTRY, G.A.
 3087
 GERALD, M.D.
 3276
 GERARD-MARCHANT, R.
 3344*, 3421*
 GERMAN, A.
 3202
 GERSTON, K.
 3409*
 GESTELAND, R.F.
 3140
 GHETTI, G.
 2987
 GIBSON, A.A.M.
 3270
 GIELKENS, A.L.J.
 3136
 GIGNOUX, B.
 3247
 GIGNOUX, M.
 3247
 GILBERT, S.
 3334*
 GILL, D.
 3154*
 GILLESPIE, C.
 3161
 GILLISSEN, G.
 2938
 GITHENS, J.H.
 3232
 GLASER, R.
 3043, 3053
 GLASS, D.N.
 3023*
 GLATSTEIN, E.J.
 3208
 GLAUDEMANS, C.P.J.
 3190
 GLAVES, D.

3170
 GLINSKA, H.
 3217*
 GLOVER, E.L.
 2967
 GLUCKSMANN, A.
 2923, 2952,
 3007
 GOEBEL, D.
 3364*
 GOEBEL, H.H.
 3457*
 GOESSENS, G.
 3536*
 GOFFINET, D.R.
 3208
 GOLDBERG, R.J.
 3033
 GOLDENBERG, D.M.
 3407*
 GOLDSCHMIDT, B.M.
 3002
 GOLOSOVA, T.V.
 3538*
 GOLSTEIN, P.
 3226*
 GOLUB, E.S.
 3188
 GOMARD, E.
 3196
 GOMEZ, S.C.
 3560*
 GONDER, M.J.
 3177
 GONZALEZ-CRUSSI, F.
 3332*
 GOOD, R.A.
 3120
 GOODMAN, J.I.
 2979
 GORCZYNSKI, R.M.
 3176
 GORDON, A.S.
 3070
 GORDON, E.D., JR.
 3447*
 GORDON, J.E.
 3008
 GOSALVEZ, M.
 3423*
 GOTTLIEB, A.A.
 3074
 GOULD, V.E.
 2973
 GOUTAREL, R.
 2957

GOVORCHENKO, V.I.
2944
GOWIN, R.L. DE
3515*
GRAHAM, J.B.
3268
GRAHAM, S.
3268
GRANBERG, I.
3546*
GRASMUK, H.
3534*
GREEN, I.
3164, 3179,
3184
GREENBLATT, M.
2951, 2966,
2978
GREER, S.
3540*
HESSER, I.
3341*
HEWAL, M.S.
3473*
HIEFFIN, A.C.
3359*
HIGORYAN, E.G.
3482*
HOFF, W.H.
3272
ROSSI-PAOLETTI, E.
3014*
HOTE, J.
3581*
HOULS, V.
3584*
HOVER, P.L.
2984
HUBE, F.O.
3598*
HUNDMANN, E.
2914*
RZEBIELUCH, M.
3438*, 3439*
HABELADZE, D.A.
3200
HABETTA, L.
3566*
HENTHER, H.
3581*
HIGLIA, S.F.
2904
HINTHER, H.
3582*
STAFSSON, T.
3309

GUTTERMAN, J.
3384*
GYORKEY, F.
3358*
GYORKEY, P.
3358*
HAAPALA, D.K.
3058, 3111,
3132
HACKER, B.
3155*
HACKETT, A.J.
3137
HADJIOLOV, D.
2996
HADJIYANNAKIS, M.J.
3201
HAGUENAU, F.
3085
HAIMOVICH, J.
3175
HAINES, M.
3499*
HAJDU, S.I.
3323*
HAKANSSON, C.H.
3309
HAMEED, K.
3330*
HAMEL, S.
3421*
HAMLIN, J.A.
3328*
HAN, T.
3165
HANDLER, E.E.
3541*
HANDLER, E.S.
3541*
HANNA, M.G., JR.
3204
HARIDAS, K.P.
3398*
HARRIS, J.R.
3170
HARRISON, S.C.
3057
HARTING, M.C.
3216*
HARVEN, E.DE
3142
HASHIMOTO, K.
3531*
HASHIMOTO, T.
3502*
HASSAR, S. EL

3514*
HASUE, M.
3429*
HATHAWAY, W.E.
3232
HAVEMANN, K.
3506*
HAWTREY, A.O.
2953
HAYASAKI, N.
2945
HAZLEWOOD, C.F.
3230
HECKER, E.
2927
HEHLMANN, R.
3131
HEINE, U.
3151*
HEINE, W.-D.
3242*
HEINZ, E.
3432*
HELLER, A.
3508*
HELLMAN, S.
3237
HELLSTROEM, I.
3162
HELLSTROEM, K.E.
3162
HELPA, B.
3584*
HELTIANU, C.
3472*
HENDERSON, J.F.
3336*
HERBERMAN, R.
3184
HEROLD, H.J.
3286*
HESHMAT, M.Y.
3276
HESSEK, F.
3573*
HEUCHERT, M.D.
2992
HEUSON, J.-C.
2993
HEWETT, W.J.
3477*
HIGA, E.
3521*, 3525*
HIGASHI, T.
3491*
HIGGINS, I.T.T.

3246
 HILGARD, P.
 3427*
 HILSCHER, W.
 3586*
 HINKLE, P.M.
 3351*
 HINUMA, Y.
 3062
 HINZE, H.C.
 3143, 3151*
 HIRAI, H.
 3320
 HIRAI, K.
 3124
 HIRAKI, S.
 2974
 HITCHENS, E.M.
 3327*
 HUERTMAN, L.
 3529*
 HO, H.C.
 3402*
 HOAK, J.C.
 3515*
 HOCHHOLZER, L.
 3383*
 HODGETT, J.
 3303
 HOFFMANN, D.
 2901
 HOFSCHEIDER, P.H.
 3068
 HOKARI, S.
 2945
 HOLCZINGER, L.
 3389*
 HOLLAND, J.J.
 3041
 HOLYOKE, E.D.
 3382*
 HOMBURGER, F.
 2921*, 2925
 HOOPER, S.B.
 3441*
 HOOVER, R.
 3266
 HORIO, T.
 2949
 HORNOVA, J.
 3496*
 HORTON, B.J.
 2963
 HOU-JENSEN, K.
 3244*
 HOWES, A.E.

3492*
 HROMADA, J.
 3288*
 HRUBAN, Z.
 3403*
 HSU, C.C.S.
 3181
 HSUEH, S.-S.
 2925
 HUANG, G.-F.
 2983
 HUANG, H.L.
 3087
 HUANG, W.Y.
 3307
 HUBER, H.
 3507*
 HUDSON, J.B.
 3109
 HUEBNER, R.J.
 2964
 HUGGINS, C.
 3375*
 HUHN, D.
 3507*
 HUI, Y.H.
 2932
 HULU, N.
 3231
 HUMBERT, J.R.
 3232
 HUMPHREY, G.B.
 3210
 HUOT, J.
 3366*
 HURST, L.
 2956, 2957
 HURWITZ, J.
 3047
 HUSSA, R.O.
 3307
 HUVOS, A.G.
 3031*, 3385*
 HUYNH, TH.
 3081
 IDE, T.
 2936, 3005
 IKEMURA, K.
 3522*
 ILLUECA, E.
 3371*
 IMAIZUMI, T.
 3013
 INGLETON, P.M.
 2930
 IRLIN, I.S.

3090, 3146*
 IRVING, C.C.
 2941
 ISHIBE, T.
 3544*
 ISHIZAKI, R.
 3051, 3075
 ISLAM, M.N.
 3353*
 ISSENBERG, H.J.
 3252
 ITO, M.
 2960, 2965
 ITO, N.
 2945
 IVANOVA, A.
 3548*
 JACKSON, N.
 3115
 JACOBS, S.A.
 3325*
 JACQUOT, F.
 2912*
 JAEMES, D.
 3411*
 JAENISCH, R.
 3060
 JAERVINEN, M.
 2926
 JAGODZINSKI, Z.
 3599*
 JAHNES, W.G.
 3178
 JANCZEWSKI, G.
 3575*
 JANIK, P.
 3303
 JANKU, O.
 3215
 JANOFF, A.
 3433*
 JAO, J.
 3334*
 JASMIN, G.
 3019*
 JASTY, V.
 3130
 JAYANT, K.
 3290*
 JAYLE, M.-F.
 2956
 JEANNET, M.
 3173
 JELACIC, O.
 3283*
 JELINKOVA, E.

3197
 JENSEN, F.
 3138
 JOHANSSON, B.
 3296
 JOHNSON, D.E.
 2954, 2955
 JOHNSON, D.S.
 3410*
 JOHNSON, G.S.
 3308, 3314
 JONES, D.B.
 3071
 JONES, K.W.
 3108
 JONES, P.A.
 2953
 JORDAN, E.
 3594*
 JUDKIEWICZ, L.
 3587*
 JULIAN, B.
 3106
 JURIN, M.
 3492*
 KABAKCI, T.
 3456*
 KAGAN, A.
 3263
 KAGAN, A.R.
 3328*
 KAGAN, G.YA.
 3538*
 KAHN, L.B.
 3523*
 KALASHINIKOVA, G.V.
 3590*
 KALETA, E.F.
 3148*
 KALISS, N.
 3182
 KALLMAN, R.F.
 3464*
 KALLNER, H.
 3258
 KAMPSCHMIDT, R.F.
 3192, 3374*
 KANNAN, Y.
 2949
 KAPLAN, J.C.
 3063, 3088
 KAPULER, A.M.
 2994
 KARACA, M.
 3456*
 KARK, A.E.

3189
 KARNICKA-MLODKOWSKA, H.
 3594*
 KARPAS, A.
 3079
 KASHIWAGI, K.
 3491*
 KASYANENKO, I.V.
 3574*
 KATONA, F.
 3443*
 KATZ, C.
 2981, 3002
 KATZ, D.H.
 3164
 KATZ, R.U.
 3017*
 KAWAKAMI, T.G.
 3036
 KAWAMURA, Y.
 3440*
 KAWASHIMA, T.
 3412*
 KAWAZOE, Y.
 2983
 KAY, E.R.M.
 3353*
 KAZ'MIN, S.D.
 3312
 KELLER, A.R.
 3383*
 KELLERER, A.M.
 3029
 KELLIE, A.E.
 2948
 KEMPSON, R.L.
 3355*
 KENNEY, F.T.
 3295
 KERAENEN, A.J.A.
 3501*
 KERR, C.S.
 2925
 KETTNER, M.
 3444*
 KHANDEKAR, J.D.
 3379*
 KHUONG-HUU, Q.
 2957
 KIDD, R.L.
 3370*
 KILLMANN, S.-A.
 3448*
 KIMOTO, T.
 3094, 3133
 KINOSHITA, N.

2928
 KIREEVA, I.S.
 3021*
 KISELEV, F.L.
 3090
 KISIELOW, P.
 3193
 KIT, S.
 3060
 KITAMURA, T.
 3037
 KIZER, D.E.
 2990
 KLAVINS, J.V.
 3207
 KLEHR, H.U.
 3579*
 KLINE, I.K.
 3388*
 KLINGER, M.E.
 3333*
 KLINGMUELLER, G.
 3579*
 KNUDSON, A.G., JR.
 3238
 KOCABAS, A.
 3456*
 KOGA, C.
 2983
 KOH, Y.-C.
 3446*
 KOJIMA, K.
 3404*, 3455*
 KOJIRO, M.
 3337*
 KOLESNICHENKO, T.S.
 2995
 KOMITOWSKI, D.
 3576*
 KOMMINENI, V.
 2978
 KOMMINENI, V.R.C.
 2966
 KONICKOVA, Z.
 3215
 KONINGS, R.N.H.
 3068
 KONOVALOVA, N.P.
 3147*
 KOPSU-HAVU, V.K.
 2926
 KOPELOVA, YE.I.
 3538*
 KOROSTELEVA, T.A.
 3463*
 KOSYAKOV, P.N.

3194
 KOTLAREK-HAUS, S.
 3550*
 KOTSCHY, M.
 3438*, 3439*
 KOUBA, K.
 3042
 KOVACS, K.
 3579*
 KOVALENKO, L.A.
 3539*
 KOVI, J.
 3276
 KOZLOWSKI, J.W.
 3587*
 KRAMARSKY, B.
 3049, 3116
 KRAUSE, H.P.
 3428*
 KRAUSE, S.
 3445*
 KRAUZE-JAWORSKA, H.
 3567*
 KRAWCZYNSKI, K.
 3193
 KREIBICH, G.
 2927
 KRIVIT, W.
 3210
 KRUEGER, W.
 3509*
 KRYKOWSKI, E.
 3587*
 KUBICEK, M.T.
 3134
 KUBOTA, Y.
 3512*
 KUFF, D.
 3131
 KUFF, E.L.
 3103
 KULPA, J.
 3217*
 KUMAGAMI, H.
 3542*
 KUMAR, K.M.
 3398*
 KURATA, K.
 3036
 KURODA, K.
 2946
 KUROSUMI, S.
 3373*
 KURYLEV, V.N.
 2944
 KUTINOVA, L.

3101
 KUWANO, A.
 3430*
 KUWERT, E.
 3222*
 KUZMIN, V.I.
 3236
 KUZNETSOV, O.K.
 3044
 KYALWAZI, S.K.
 2906
 KYRIAKOS, M.
 3355*
 KYRIAZIS, A.P.
 3211
 LACASSAGNE, A.
 2919*, 2956,
 2957
 LACOUR, F.
 3081, 3100,
 3214
 LACOUR, J.
 3214
 LA FIANDRA, A.
 3105
 LAFUMA, J.
 3028
 LAGACHE, G.
 3514*
 LAMBERTENGHI, G.
 3142
 LANDON, J.C.
 3134
 LANGLOIS, A.J.
 3075
 LARSON, C.L.
 3161
 LARSON, J.E.
 3073
 LASFARGUES, E.Y.
 3049
 LASFARGUES, J.C.
 3049
 LASKINA, A.V.
 3310
 LASQUELLEC, B.F.
 3065
 LATARJET, R.
 2905
 LATTI, J.
 3500*
 LATTES, R.
 3524*
 LAUGHLIN, J.
 3441*
 LAUZON, S.DE

2956
 LAWINSKI, M.
 3438*, 3439*
 LAWLEY, P.D.
 2971
 LAWSON, T.A.
 2933
 LAZO, A.
 3551*
 LAZOVSKA, J.
 3042
 LEBRAS, M.
 3255
 LECLERC, J.-C.
 3196
 LEE, J.A.H.
 3252
 LEE, K.-L.
 3295
 LEE, P.N.
 2935
 LEE, T.-C.
 2972
 LEGROS, N.
 2993
 LEIBOWITZ, U.
 3260
 LEINIKKI, P.
 3171
 LEIS, J.P.
 3047
 LEIVA, S.
 2969
 LELIKOVA, G.P.
 3310
 LE MEVEL, B.
 3201
 LENNARTZ, K.J.
 3459*
 LEONARD, J.W., JR.
 3311
 LEONG, J.-A.
 3115
 LEPAGE, R.
 3022*
 LEPOINT, A.
 3536*
 LEVAN, A.
 3309
 LEVER, W.F.
 3461*
 LEVINE, A.J.
 3060
 LEVINE, L.
 3351*
 LEVINSON, C.

3447*
 LEVINSON, W.
 3115
 LEVINSON, W.E.
 3086, 3110
 LEVY, J.-P.
 3196
 LEWAN, L.
 3390*
 LEWIS, P.
 3291
 LI, F.P.
 3251
 LICHTIGER, B.
 3360*
 LIEBERMAN, R.
 3184
 LIJINSKY, W.
 2951, 2978
 LILLY, F.
 3121
 LIN, J.T.
 3301
 LINDER, F.
 3282*
 LINE, D.H.
 2902
 LINHARD, J.
 3157
 LINNIK, A.B.
 3000
 LIPKIN, M.
 3239
 LIPMAN, M.
 3118
 LISCO, H.
 3118
 LISIEWICZ, J.
 3018*, 3518*,
 3519*
 LITVINOV, N.N.
 2944
 LEDO, S.M.
 3596*
 LOYD, B.J., JR.
 3099
 LOBUE, J.
 3070
 LODDO, S.
 3285*
 LONGERFO, P.
 3181
 LOLOVA, I.
 3548*
 LOPES CARDOZO, E.
 3216*

LUEDERS, G.
 3580*
 LUGER, A.
 3026
 LUNDGREN, G.
 2968
 LUNDIN, P.M.
 3300
 LUYENDIJK, W.
 3436*
 LUZZI, M.
 3218*
 MAC DONALD, J.S.
 3490*
 MAC DONALD, W.C.
 3380*
 MAC DONELL, J.D.
 3205
 MAC DOUGALL, M.
 3322*
 MACHACEK, J.
 3288*
 MACHALA, O.
 3093
 MACKENZIE, D.H.
 3399*, 3422*
 MACKIEWICZ, J.
 3599*
 MADISON, R.M.
 3001
 MAEKAWA, A.
 3404*
 MAESTRI, N.E.
 3119
 MAGOVERN, G.J.
 3445*
 MAHNOVSKI, V.
 3283*
 MAICANESCO-GEORGESCU, M.
 3365*
 MAIR, A.
 3270
 MALDONADO, R.L.
 3127
 MALFER, P.
 2961
 MALKIEWICZ, B.
 3018*, 3518*,
 3519*
 MALLAFRE, M.S.
 3368*
 MANCINI, L.O.
 3130
 MANN, J.R.
 3493*
 MANNING, J.S.

3137
 MANZ, H.J.
 3332*
 MARCOVE, R.C.
 3385*
 MARETSIS, M.
 3600*
 MARIANI, T.
 3120
 MARJANOVIC, A.
 3289*
 MARTIN, G.S.
 3128
 MARTIN-LALANDE, J.
 3363*
 MARTYNOVA, V.A.
 3538*
 MASEK, K.
 3424*
 MASHELKAR, B.N.
 3474*
 MATES, J.
 3215
 MATHEWS, M.B.
 3495*
 MATSUNAGA, H.
 3451*
 MATSUO, Y.
 3233
 MATSUYAMA, M.
 2965, 3442*
 MATTINGLY, R.F.
 3307
 MATUO, Y.
 2949
 MAUGEL, T.K.
 3449*
 MAY, G.
 3444*
 MAZZARELLA, P.
 3543*
 MC ALLISTER, R.M.
 3076
 MC CALL, M.G.
 3274
 MC COY, M.M. II
 3533*
 MC CRUMB, F.R., JR.
 3034
 MC CULLOUGH, B.
 3066
 MC DIVITT, R.M.
 2920*
 MC DONNELL, J.P.
 3110
 MC DOUGHAL, J.K.

3108
 MC EWEN, J.
 3270
 MC FALL, R.
 2991
 MC FEELY, A.E.
 3449*
 MC GRATH, C.M.
 3067
 MC KINNELL, R.G.
 3061
 MC MULLAN, G.
 3384*
 MEDINA, D.
 3003, 3004,
 3230
 MEL'NIKOVA, N.N.
 3312
 MENEZO, J.L.
 3371*
 MENNINGER, F.F., JR.
 3156
 MENYE, P.-A.
 3280*
 MERETAY, K.
 3212
 MERIGAN, T.C.
 3208
 MERKOV, A.M.
 3279*
 MERLIN, E.
 3081
 MESA-TEJADA, R.
 3207
 MESSER, R.
 3334*
 METCALF, T.G.
 3150*
 METZGER, H.
 3582*
 MEUNIER, J.
 3174
 MICHAELS, L.
 3082
 MICHALUK, W.
 3265
 MICHEAU, C.
 3344*, 3421*
 MICHELSON, A.M.
 2994
 MIGLIAVACCA, F.
 3486*
 MIKE, V.
 3385*
 MIKOSHIBA, A.
 3336*

MILAM, D.F.
 3203
 MILCU, ST.-M.
 3365*
 MILLARD, M.
 3409*
 MILLER, D.A.
 3473*
 MILLER, G.
 3118
 MILLER, J.
 2991
 MILLER, J.M.
 3113
 MILLER, L.D.
 3113
 MILLER, O.J.
 3473*
 MILLER, R.G.
 3176
 MILLER, R.W.
 2998
 MILLER, S.H.
 3515*
 MILOSLAVSKII, I.M.
 3313
 MINAYEVA, M.N.
 3343*
 MINGAZZINI, P.C.
 2970
 MIRAND, E.A.
 3077, 3122
 MIRVISH, S.S.
 2966
 MISHIMA, Y.
 3528*
 MITCHELL, M.S.
 3159
 MIWA, T.
 3429*
 MIYAKI, K.
 2946
 MIZELL, M.
 3035
 MOBERGER, G.
 3529*
 MOCHIZUKI, Y.
 3403*
 MODAN, B.
 3258
 MOEPERT, S.
 3286*
 MOGENSEN, B.
 3250
 MOGILEVSKAYA, I.A.
 3327

MOHIT, B.
 3168
 MOHR, M.
 3535*
 MOLNAR, Z.
 2989
 MOLONEY, W.C.
 3233
 MOLTENI, A.
 3500*
 MONNIER, J.
 3561*
 MONTEVERDE, R.
 3315
 MOON, R.C.
 3006
 MOORE, D.H.
 3049, 3116
 MOORE, M.
 3071
 MORAX, S.
 3174
 MORGAN, D.A.
 3330*
 MORGAN, J.F.
 2992
 MORIWAKI, K.
 3133
 MOROSOVA, V.T.
 3418*
 MORRIS, H.P.
 3321*, 3403*,
 3423*, 3504*
 MORTAZAVI, S.H.
 3408*
 MOSCHETTO, Y.
 3348*
 MOTOI, M.
 3078
 MOTTET, N.K.
 2973
 MOUTON, Y.
 3241*
 MOZAFARI, M.
 3408*
 MUENTZING, J.
 3476*
 MUNK, K.
 3149*
 MUNKLEY, R.M.
 3493*
 MUNOZ, M.C.
 3371*
 MUNOZ, N.
 3248
 MURPHY, G.P.

3054
 MUSHINSKI, E.B.
 3190
 MYLES, A.
 2972
 NACHMAN, R.L.
 3394*
 NADLER, J.V.
 3324*
 NAGASAWA, H.
 2975
 NAGOYA, T.
 2960, 2965,
 3062
 NAGY, A.
 3443*
 NAIDE, Y.
 3431*
 NAKAJIMA, K.
 3522*
 NAKAMURA, Y.
 3516*
 NAKANISHI, K.
 3440*
 NAKASHIMA, S.
 2977
 NANDI, S.
 3067
 NARUO, G.L., DE
 3464*
 NASKALSKI, J.
 3518*
 NASYROV, R.L.
 3015*
 NAVONE, R.
 3566*, 3571*
 NEBORAK, YU.T.
 3585*
 NECHAYEVA, T.I.
 3562*
 NEDBAL, P.
 3197
 NEGOCESCU, I.
 3472*
 NELSON, N.
 3265
 NELSON-REES, W.A.
 3076
 NES, W.R.
 3301
 NESBIT, M.E., JR.
 3210
 NETTESHEIM, P.
 3405*
 NEVILLE, A.M.
 3400*

NEWMAN, M.W.
 3397*
 NICHOLS, B.L.
 3230
 NICIOKA, CH.K.
 3347*
 NICKERSON, P.A.
 3500*
 NIIMURA, K.
 3431*
 NIKONOVA, T.V.
 2995
 NILSSON, T.
 3476*
 NISHIKAWA, K.
 2949
 NISHIO, Y.
 3278*
 NISONOFF, A.
 3175
 NKRUH, F.K.
 3257
 NOMURA, S.
 3058, 3111
 NORRBY, K.
 3300
 NOSAL, G.
 3366*
 NOWINSKI, R.C.
 3144
 OCKEY, C.H.
 3494*
 ODA, K.-I.
 3089
 ODA, T.
 3487*
 OGINO, T.
 3083
 OGSTON, C.M.
 3452*
 OGSTON, D.
 3452*
 OGURA, H.
 3487*
 OHBU, D.
 3522*
 OHIRA, I.
 3013
 OKA, H.
 3375*
 OKADA, T.
 3223*
 OKAGAKI, T.
 3543*
 OKUDA, H.
 3502*

OLIVER, J.
 2934
 OLIVIE, M.
 3091
 OLSEN, S.
 3250
 OLSON, C.
 3113
 OLSZEWSKI, W.
 3497*
 OME, K.B., DE
 2932
 O'NEILL, F.J.
 3033, 3053
 O'NEILL, J.A.
 2935
 ONO, S.
 2977
 ONO, T.
 3511*
 ONODERA, Y.
 3429*
 OPPER, A.W.
 3311
 ORBAN, E.
 3259
 ORDER, S.E.
 3237
 ORENSTEIN, M.M.
 3527*
 ORLOV, YU.A.
 3416*
 ORR, D.J.
 2971
 OSBORN, M.
 3495*
 OSSERMAN, K.E.
 3189
 OTERO, G.O.
 3560*
 OZER, H.L.
 3034, 3048
 PAGLIA, M.A.
 3323*
 PALMA, L.D.
 3054
 PANERO, M.
 3267
 PAOLETTI, P.
 3014*
 PAPAMICHAIL, M.
 3568*, 3569*
 PAPATESTAS, A.E.
 3189
 PAPIERZ, W.
 3599*

PARASKEVAS, F. 3185	PERKINS, I.V. 3257	POGOSYANTS, E.E. 3510
PARDO, V. 3409*	PERRAUD, R. 3028	POIRIER, L.A. 3022*
PARK, J.K. 3231	PERTAYA, A.V. 3200	POIRIER, M.C. 3022*
PARKHOMENKO, I.I. 3147*	PERZADAEV, R.O. 3488*	POLAK, J.M. 3396*
PARRILLA, P.P. 3596*	PERZIN, K.H. 3381*, 3524*	POLKOWSKA-KULESZA, E. 3587*
PARSHIN, A.N. 3292	PESCATORE, S. 3345*	POLL-GOUATER, A. 3157
PARTLEVYAN, A.G. 3482*	PETERS, N. 3362*	POLLIAK, A. 3112
PASQUALINI, C.D. 3299	PETERSON, M.R. 3166	POMERANZ, J.R. 2937
PASTAN, I. 3314	PETERSON, N.P. 3549*	POPOVA, YU.N. 3483*
PATRICK, A.L. 3253	PETITO, C.K. 3392*	PORIES, W. 3306
PATTILLO, R.A. 3307	PETRAKIS, N.L. 3273	PORRO, R.S. 3392*
PAUL, S.M. 3035	PETTENGILL, O.S. 3498*	POTAPENKOVA, L.S. 3463*
PAUL, W.E. 3164	PETTERSSON, U. 3057, 3095	POTTER, M. 3190
PAVIE, J. 3196	PHILIPSON, L. 3057	POTTER, V.R. 2979, 3504*
PAVLYUCHENKOVA, R.P. 3194	PHILLIPS, R.A. 3176	POUND, A.W. 2933
PAVLYUSHCHIK, A.V. 3369*	PHILLIPS, T.F. 3469*	PRAGE, L. 3095
PAYMASTER, J.C. 3264	PICKREN, J.W. 3477*	PRASAD, K.N. 2924, 3465*
PEAKMAN, D.C. 3232	PIETROJUSTI, M. 3267	PRAT, G.A. 3017*
PEARSE, A.G.E. 3396*	PILCH, Y.H. 3160	PREMKUMAR, E. 2988
PEARSON, J.W. 3102	PILLINGER, D.J. 3009	PREUSSMANN, R. 2915*
PEDERSEN, B. 3448*	PITT, T.H. 3272	PRICE, C.H.G. 3071
PEDRAZZI, J.J. 3470*	PIZER, L.I. 3316	PRICE, F.W. 3077
PEEBLES, P.T. 3058, 3132	PIZON, P. 3249	PRICE, M.R. 3170
PEESKER, S.J. 2992	PLAGEMANN, P.G.W. 3510*	PRICE, P.J. 3080
PENNELLI, N. 3572*	PLATONOVA, G.N. 3597*	PRIS, J. 3561*
PEPE, FR. 3470*	PLATT, D.S. 3327*	PROBERT, M. 3107
PERA, C. 3361*	PLOCINIK, B.A. 3183	PROBST, H. 3428*
PERIES, J. 3091	POCHON, F. 2994	PRUYN, F.H.A.M. 3024*

PRYUZ, H.	3213	3443*
3296	REGAN, J.D.	ROSAI, J.
PUDOV, V.I.	3316	3521*, 3525*
3342*	REIJNIERSE, K.	ROSAS-URIBE, A.
PULLIAM, L.A.	3024*	3356*
3192	REINA, A.	ROSENBERG, S.A.
PYLEV, L.N.	3567*	3183
3015*	REINHARD, M.	ROSENFELD, C.
QUATTRO, V.DE	3580*	3537*
3372*	REIS, H.E.	ROSENSTEIN, R.W.
QUINTON, A.	3222*	3532*
3287*	RENGER, H.C.	ROSSI, H.H.
KABASA, S.L.	3055	3029
3299	RENNKE, H.	ROSSUM, G.D.V. VAN
RABINOWITZ, Z.	3017*	3423*
3045	REUBER, M.D.	ROUESSE, J.
RADOUCO-THOMAS, C.	2967	3556*
3366*	REVANKAR, S.N.	ROWSON, K.E.K.
RADZIKOWSKI, C.	3474*	3082
3193	RHOADES, J.W.	RUBETSKOI, L.S.
RAFALOVICH, M.B.	2954, 2955	3000, 3554*
3578*	RICE, J.M.	RUBIN, H.
KAFFI, A.	3001	3128
3408*	RICHARDS, F.F.	RUDOLPH, R.H.
KAMACHANDRAN, P.	3532*	3172
3398*	RICHART, R.M.	RUGSTAD, H.E.
KAMOS, C.V.	3413*, 3543*	3296
3331*	RICHMAN, A.V.	RUMI, L.
KAMOT, B.	3178	3299
3231, 3271	RIECHERS, L.	RUSSELL, A.S.
KANA, M.W.	3102	3023*
3357*	RIEPER, J.P.	RUSSEFIELD, A.B.
3474*	3347*	2925
RANDALL, C.C.	KIMAI, L.	RUSTIA, M.
3087	3154*	2999
KANSBERGER, K.	RIOPELLE, J.L.	RYBAKOVA, T.M.
3588*	3019*	3167
KAPP, F.	RIOS, A.	RYTTER, M.
3033, 3043,	2968, 3199	3559*
3083, 3141	RIOU, G.	RZECZYCKI, W.
KAPPAPORT, H.	3117	3471*
3231, 3356*	RIOULT, J.	SABINE, J.R.
KASCHKE, E.	3414*	2963
3583*	ROBINSON, A.	SACHS, L.
KASKOVA, T.M.	3232	3045
3538*	RODRIGUEZ, V.	SADIKALI, F.
KAVITZ, G.	3384*	3166
3203	ROEPCKE, G.	SADOFF, L.
KAY, P.K.	2950	2907
2968	ROGENTINE, G.N., JR.	SAEGESSER, F.
KEDDY, P.S.	3183	3411*
3445*	ROGERS, Q.R.	SAIM, A.
KEN, D.J.	3046	3365*
3205	ROIZMAN, B.	SAITO, K.
KES, J.A.	3050	3455*
	RONA, E.	SAKAI, K.

2982
 SAKAMOTO, A.
 3465*
 SAKURADA, T.
 3431*
 SALMEEN, I.
 3154*
 SAMSO, A.
 3079
 SANCHO, H.
 3344*, 3421*
 SANFORD, R.S.
 3333*
 SANGHVI, L.D.
 3290*
 SANKALE, M.
 3157
 SANOU, A.
 3280*
 SANTTI, R.S.S.
 2926
 SARKAR, N.H.
 3049, 3116,
 3144
 SARMA, P.S.
 3098
 SASSE, D.
 3580*
 SASSON, Z.B.
 3112
 SATO, T.
 3142
 SATOH, H.
 3320
 SAUER, G.
 3038
 SAUTIERE, P.
 3348*
 SAVENKO, M.I.
 3554*
 SAVET, J.-F.
 3558*
 SAVIC, B.
 3583*
 SAVICH, K.V.
 3591*
 SAVITSKY, I.G.
 3574*
 SCELSI, R.
 2970
 SCHAFER, J.A.
 3432*
 SCHALLER, J.
 3066
 SCHANDL, E.K.
 3406*

SCHENDEL, P.F.
 3073
 SCHIFFER, D.
 3014*, 3376*
 SCHINK, W.
 3256
 SCHMAEHL, D.
 3020*
 SCHMAHL, D.
 3281*
 SCHMALZL, F.
 3507*
 SCHMIDT, C.G.
 3222*
 SCHNEIDER, F.
 3428*
 SCHRAMM-THIEL, N.
 3444*
 SCHREIBER, H.
 3405*
 SCHREK, R.
 3339*
 SCHRIJVER, F. DE
 3517*
 SCHULER, D.
 3417*
 SCHULTZ, E.F.
 3070
 SCHULZ, D.
 3583*
 SCHUMACHER, H.R.
 3449*
 SCHWEIZER, K.
 2938, 3220*
 SCOLNICK, E.M.
 3096
 SEALY, R.
 3523*
 SECK, I.
 3157
 SEDAGHATIAN, M.R.
 3387*
 SEGALL, A.
 3214
 SEIDEL, H.-J.
 3145*
 SEIDMAN, H.
 3262
 SEKIYA, T.
 3089
 SEKKAT, A.
 3174
 SELLAKUMAR, A.
 2940
 SELZER, G.
 3523*

SEMEANOVA, L.A.
 3090
 SENDOV, B.
 2910
 SENO, S.
 3094
 SERGEL, O.S.
 3221*
 SETHI, S.
 3586*
 SFORZA, C.
 3470*
 SHAAR, C.J.
 2929
 SHABAD, L.M.
 2995, 3000,
 3011, 3015*
 SHADDOCK, J.A.
 3066
 SHAH, K.V.
 3034, 3054
 SHAH, S.A.
 2971
 SHALL, S.
 3434*
 SHAMAYEVA, YE.M.
 3597*
 SHAMBERGER, R.J.
 3245*
 SHANK, R.C.
 3008
 SHARMA, R.K.
 3531*
 SHATKIN, A.J.
 3105
 SHCHERBAKOVA, M.G.
 3243*
 SHEDD, D.P.
 3395*
 SHEVACH, E.
 3179, 3184
 SHEVCHENKO, N.G.
 3418*
 SHIGEMATSU, H.
 3512*
 SHIMIKIN, M.B.
 2981
 SHIMIZU, Y.
 3094
 SHIN, H.S.
 3182
 SHIOKAWA, Y.
 3223*
 SHOEMAN, D.W.
 3322*
 SHOPE, R.E.

3163
 SHOPE, T.
 3118
 SHUBIK, P.
 2940, 2999
 SIDDHICHAJ, P.
 3008
 SIDDIQUI, M.A.
 2988
 SIEGERT, W.
 3068
 SILFVERSWAERD, C.
 3546*
 SILVA, N.
 3395*
 SILVERBERG, S.G.
 3393*
 SIMAGA, D.
 3280*
 SIMMONS, R.L.
 3199
 SIMONS, R.L.
 2968
 SIMPSON, J.S.
 3493*
 SIMS, P.
 2984
 SINCLARI, N.R.ST.C.
 3227*
 SINGER, D.B.
 3387*
 SIRISHINHA, S.
 3158
 SKEN, J.E.
 3458*
 IVAK, A.
 3002
 KALBA, P.
 3595*
 KARIN, A.T.
 3233
 KINNER, M.
 3035
 KREB, N.
 3462*
 KROVINA, B.
 3530*
 LESERS, A.
 3403*
 LOMSKA, J.
 3415*
 METANA, K.
 3358*
 MIRNOV, G.A.
 3011
 MIRNOV, N.M.

3479*
 SMIRNOVA, N.B.
 3294
 SMITH, L.D.
 2990
 SMITH, R.K.
 3153*
 SNELL, L.M.
 3268
 SO, B.T.
 2958
 SOANES, W.A.
 3177
 SOEDERBERG, G.
 3529*
 SOERENSEN, R.
 3219*
 SOIHET, S.
 3551*
 SOLAO, P.B.
 3434*
 SOLITARE, G.B.
 3269
 SOLTER, D.
 3462*
 SORENSON, G.D.
 3498*
 SOVOSTJYANO, G.A.
 3044
 SOVOVA, V.
 3093
 SPAHN, G.J.
 3080
 SPEAR, P.G.
 3050
 SPIEGELMAN, S.
 3131
 SPIERS, P.S.
 3275
 SPIRCHEV, V.B.
 3597*
 SPITZNAGEL, J.K.
 3478*
 SPOONER, M.E.
 3326*
 STAMBROOK, P.J.
 3458*
 STANKOVIC, P.
 3056
 STASCH, M.J.
 3464*
 STASTNY, B.
 3114
 STASZEWSKI, J.
 3274, 3319
 STEEL, G.G.

3303
 STEENBECK, L.
 3426*
 STEER, A.
 3027, 3412*
 STEEVES, R.A.
 3122
 STEIN, J.J.
 3527*
 STEINER, G.M.
 3490*
 STEINITZ, R.
 3248, 3254
 STELL, P.M.
 2962
 STENHOUSE, N.S.
 3274
 STEPHENSON, J.R.
 3096, 3135
 STEUDEN, J.
 3193
 STEWART, A.M.
 3032*
 STEWART, F.W.
 3419*
 STIRLING, G.A.
 3441*
 STITT, D.
 3118
 STOBO, D.
 3179
 STOECKER, E.
 3242*
 STOEHRER, G.
 2972
 STROBEL, E.
 3598*
 STROMBERG, K.
 2967, 3106
 STRONG, L.C.
 3238, 3451*
 STUART, J.
 3493*
 SUBHAMANI, B.
 3008
 SUGA, S.
 3378*
 SUGIYAMA, T.
 3010
 SUK, W.A.
 3080
 SURIKOVA, N.I.
 3147*
 SUTHERLAND, R.M.
 3186
 SUZUKI, H.

2965, 3442*
SVEDMYR, E.A.J.

3226*
SVOBODA, J.
3093

SVOBODOVA, J.
3114

SWEET, R.W.
3073

SWERIN, D.
2901

SYMES, M.O.
3213

SZABOCSIK, J.M.
3087

SZACKI, J.
3438*, 3439*

SZKUDLAREK, J.
3193

SZNAJD, J.
3518*

TAGLIAVINI, R.
3468*

TAKASUGI, N.
3298

TAKENOSHITA, M.
3440*

TALAGERI, V.R.
3474*

TAMAOKI, T.
3480*

TAMURA, Z.
3378*

TANAKA, K.
3223*

TANENBAUM, B.
3333*

TARANGER, L.A.
3162

TARTAROGLU, N.
3456*

TASHIRO, H.
3522*

TASHJIAN, A.H., JR.
3351*

TAURASO, N.M.
3178

TAYLOR, D.J.
3156

TAYLOR, H.B.
3240, 3331*

TAYLOR, J.M.
3110

TCHEN, P.
3065

TELLER, M.N.

2972
TEMIN, H.M.

3040
TENNANT, J.R.

3142
TENNANT, R.W.

3204
TENNEY, D.N.

3074
THAMPI, N.S.

3301
THEWS, G.

3582*
THIAM, A.-A.

3157
THIERIOT-PREVOST, G.

2947
THOMAS, E.D.

0172
THOMSEN, R.

3056
THORBJARNARSON, B.

2920*
THORNES, R.D.

3205
TIDWELL, T.

3359*
TIEDEMANN, R.N.

2920*
TIGERSTROM, R.G. VON

2980
TIGGELBECK, D.

2922*
TILCH, G.

3256
TILSON, H.B.

3419*
TIMPERLEY, W.R.

3425*
TOBE, T.

3491*
TOLEN, S.J.

3466*
TOMLINSON, A.H.

3123
TORTA, R.

3376*
TOYOSHIMA, K.

2985
TRANEUS, A.

3546*
TREICHEL, R.

3256
TRISKA, J.

2911*
TROUILLAS, P.

3558*
TRUJILLO, J.M.

3360*
TRUSOVA, N.F.

3418*
TSAHEV, R.

2910
TSUBURA, Y.

2985
TSUJI, H.

2985
TSUKADA, K.

2945
TSUKADA, Y.

2931, 3477*
TSYSINA, E.N.

3146*
TUCHWEBER, B.

3379*
TUMANOV, V.P.

3000
TUNELL, W.P.

3446*
TURNER, W.

3064, 3102,
3104, 3111

TUYEN, V.VAN
3085

TYROU, D.
3348*

UBERTINI, T.R.
3125

UCCINI, S.
2970

UEKI, H.
3512*

UENOYAMA, K.
3511*

UNGER, F.
3256

UPCHURCH, H.F.
3374*

UPHOFF, D.E.
3228*

URASINSKI, I.
3018*

USHIJIMA, R.N.
3161

VAAGE, J.
3169

VALDIVIA, E.
3551*

VALERIOTE, F.A.
3466*

VANDENBROUCK, C.
3344*

VARMUS, H.E.
 3086
 VARTERESZ, V.
 3212
 VASYUTINSKAYA, L.A.
 3167
 VAUPEL, P.
 3581*, 3582*
 VEAZEY, R.A.
 2941
 VENDERLY, C.
 3012
 VENUAT, A.-M.
 3537*
 VENUTA, S.
 3128
 VERESHCHAGINA, G.V.
 3418*, 3485*
 VERIN, P.
 3174
 VERNADAKIS, A.
 2924
 VERNARELLI, A.
 3564*
 VIDINS, E.I.
 3437*
 VIGANOTTI, G.
 3592*
 VIGLIANO, E.M.
 3394*
 VILDE, F.
 3555*
 VILKOVA, I.
 3042
 VILKEL, E.F.
 3351*
 VOGEL, C.L.
 3166
 VOGT, P.K.
 3052
 VOLEGOV, A.I.
 3195
 VOLM, M.
 3589*
 VONKA, V.
 3042, 3101
 VORONOVA, L.A.
 3292
 VOUSOS, C.
 2912*
 VILLAUME, M.
 3402*
 VILLEMEN, P.
 2912*
 VICKER, A.
 3444*

WAGNER, H.P.
 3391*
 WAGNER, V.
 3215
 WAGNEROVA, M.
 3215
 WAISMAN, J.
 3372*
 WALLCAVE, L.
 2978
 WANE, A.-B.
 3157
 WARABIOKA, K.
 3491*
 WARD, R.
 3105
 WARNER, N.L.
 3180
 WASHINGTON, S.L.A.
 3441*
 WATABE, H.
 3320
 WATNE, A.L.
 3203
 WATRAS, J.
 3030
 WAYSS, K.
 3589*
 WEAVER, C.
 3126
 WEBER, J.
 3039
 WEBER, M.
 3128
 WEBNER, D.L.
 3143
 WECHSLER, H.L.
 3533*
 WEHNER, H.
 3453*
 WEHNER, I.
 3453*
 WEIDER, R.
 2981
 WEIDNEROVA, K.
 3114
 WEIL, R.
 3534*
 WEILER, O.
 3100, 3214
 WEINBRENN, K.
 3441*
 WEINERMAN, B.
 3185
 WEISS, L.
 3382*

WEISS, M.
 3207
 WEKSLER, M.E.
 3394*
 WELLS, R.D.
 3073
 WELSH, I.R.H.
 3478*
 WENZEL, G.
 3242*
 WERNER, P.-E.
 3057
 WESTERMARK, B.
 3420*
 WETLI, C.V.
 3409*
 WETTER, O.
 3222*
 WHIMSTER, W.F.
 3253
 WHITMIRE, C.E.
 2964
 WHITNEY, R.B.
 3186
 WICKER, R.
 3092
 WIDEL, M.
 3030
 WIGZELL, H.
 3226*
 WILBERT, S.M.
 3063, 3088
 WILDE, R.A. DE
 3517*
 WILKINSON, R.
 3009
 WILLIAMS, D.E.
 3198
 WILLIAMSON, E.O.
 3467*
 WILLSON, M.A.
 3393*
 WILSON, S.H.
 3103
 WINAWER, S.J.
 3239
 WINTERS, A.L.
 3046
 WISSLER, R.W.
 3211
 WITTE, I.
 2927
 WITTE, S.
 3364*
 WOGAN, G.N.
 3008

WOLF, M.
 3588*
 WOLFE, L.G.
 3153*
 WOLFF, G.
 3426*
 WOLFF, M.
 2973
 WOLLEMAN, M.
 3443*
 WOLMAN, S.R.
 3469*
 WOLTER, J.R.
 3549*
 WOOD, S., JR.
 2908
 WOODKOFFE, A.J.
 3520*
 WOODS, W.A.
 3064
 WOO-MING, M.
 3253
 WOROWSKI, K.
 3471*
 WOSORNU, J.L.
 3257
 WUYKE, S.
 3497*
 WOZNIAKOWSKA, Z.
 3415*
 WYNDER, E.L.
 2901, 2958
 WYS, W.D.DE
 3377*
 WYSS, M.
 3173
 YABLONSKI, M.
 3260
 YACHNIN, S.
 3224*
 YAMADA, S.
 2960, 2965
 YAMAKAWA, M.
 3094, 3133
 YAMAMOTO, Y.
 3429*
 YAMANE, Y.
 2982
 YAMANISHI, Y.
 3528*
 YAMASHITA, J.
 3304
 YANAI, R.
 2975
 YANYSHEVA, N.YA.
 3021*

YATES, V.J.
 3130
 YAVUZGIL, C.
 3456*
 YOHN, D.S.
 3039, 3066
 YOKOMURA, E.
 3094, 3133
 YOKOYAMA, M.
 3318
 YOSHIDA, H.
 3460*
 YOUNG, L.
 3067
 YOUNG, S.
 3006
 ZAKHAROV, A.F.
 3310
 ZANARDI, S.
 3016*
 ZANELLA, A.
 3084
 ZATSEPIN, N.I.
 3167, 3200
 ZAVADOVA, H.
 3042
 ZIEGLER, J.L.
 2906
 ZILBERT, N.I.
 3578*
 ZIPPIN, C.
 3273
 ZISSIADIS, A.G.
 3577*
 ZORINA, L.A.
 3367*
 ZWAN, A. VAN DER
 3436*
 ZWART, P.
 3513*

2-ACETYLAMINOFLUORENE
 HEPATIC ACTIVITIES OF 1-CARBON ENZYMES
 RAT (3022)*
 LIVER, DNA-BINDING, RNA-BINDING,
 CARCINOGENESIS, 3-METHYLCHOL-
 ANTHRENE, RAT (2941)
 N-ACETYLNEURAMINIC ACID
 PROTEOLYTIC PRODUCTS, TUMOR CELL
 MEMBRANES (3509)*
 ACTINOMYCIN D
 NEOPLASTIC CELLS, PROLIFERATION,
 DEVELOPMENT (3366)*
 RNA DEGRADING ENZYMES, ACTIVITY
 CHANGES, EHRlich ASCITES CELLS,
 MOUSE (2980)
 ADENOACANTHOMA
 PANCREAS, HUMAN (3412)*
 ADENOCARCINOMA
 CERUMINOUS GLANDS, ULTRASTRUCTURE,
 CASE REPORT, HUMAN (3409)*
 ENDOMETRIUM, PSAMMONA BODIES,
 HISTOLOGY, ULTRASTRUCTURE, CASE
 REPORT (3330)*
 GASTRIC CARDIA, CLINICAL AND PATHO-
 LOGIC FEATURES, HUMAN (3380)*
 GLANDULAR STOMACH,
 N,N'-2,7-FLUORENYLENEBISACETAMIDE,
 X-RAY, RAT (2960)
 LUCKE, KIDNEY, HERPESVIRUS ANTIGEN
 DETECTION, INDIRECT IMMUNO-
 FLUORESCENCE, FROG (3035)
 RENAL, HERPESVIRUS CONTENT, FROG
 (3061)
 VAGINA, MATERNAL SYNTHETIC ESTROGEN
 THERAPY, CASE REPORTS (3477)*
 ADENOMA
 PAPILLARY, HUMAN (3524)*
 SEBACEOUS GLANDS, REVILW (2917)*
 ADENOMATOSIS
 MEDIASTINAL ENDOCRINE NEOPLASM, CASE
 REPORTS (3521)*
 PAPILLARY ADENOMA, CLINICOPATHOLOGIC
 STUDY, HUMAN (3524)*
 ADENOSINE MONOPHOSPHATE
 REGULATION OF MORPHOLOGY AND GROWTH,
 FIBROBLASTS, MOUSE, HAMSTER (3314)
 ADRENAL GLAND
 ADRENOCORTICAL CARCINOMA, METABOLIC
 REGULATION, ULTRASTRUCTURE, CELLS,
 RAT (3531)*
 MYELOLIPOMA, CASE REPORTS (3335)*
 TUMORS, ANDROGEN BIOSYNTHESIS, HUMAN
 (3294)
 FLATOXIN
 B1, CYTOTOXIC ACTION, LYMPHOCYTES,
 PHYTOHEMAGGLUTININ CULTURE (3018)*
 DIETARY, HUMAN LIVER CANCER,
 HEPATOMEGALY, INCIDENCE, THAILAND
 (3008)
 STERIGMATOCYSTIN, EFFECT ON PRIMARY
 CELL CULTURES (2959)
 AGE
 MATERNAL, CHILDHOOD LEUKEMIA,
 RELATIONSHIP (3275)
 ALBUMIN
 HYPOALBUMINEMIC SUBSTANCE, EHRlich
 SOLID CARCINOMA (3512)*
 ALKYLATING AGENT
 HEMATOPOIETIC AND LYMPHOMA CELL
 COLONIES, SURVIVAL, MOUSE (3466)*
 ALPHA FETOPROTEIN
 ASCITES HEPATOMA, RAT (3320)
 ALPHA GLOBULIN
 PLASMA, LYMPHOCYTE INHIBITION, COLON
 CANCER, HUMAN (3181)
 ALVEOLAR CELL
 LUNG CARCINOMA, ULTRASTRUCTURE, HUMAN
 (3497)*
 AMELOBLASTOMA
 MANDIBLE, METASTASIS, LUNGS, LYMPH
 NODES, CASE REPORTS (3522)*
 AMINO ACID
 DEPRIVATION, SV40 TRANSFORMATION,
 DNA SYNTHESIS, KIDNEY CELLS, HAMSTER
 (3063)
 AMINOAZO DYE
 HEPATOMA, ANTIGENS, RAT (3170)
 ANGIOMA
 PAROTID, CASE REPORTS (3565)*
 ANTIBODY
 ACUTE BOVINE LYMPHOCYTIC LEUKEMIA,
 PRIMARY IMMUNE RESPONSE, E. COLI, COW
 (3197)
 ANTI-EMBRYONIC, HUMAN CARCINOMA
 ANTIGEN CROSS REACTIONS, RABBIT
 (3207)
 T-ANTIGENS, SERA, ROUS SARCOMA,
 ADENOVIRUS TYPE 12, MONKEY (3200)
 ANTI-LYMPHOMA, GRAFT REJECTION,
 COMPLEMENT, MOUSE (3182)
 AUTOANTIBODIES, RENAL CELL CARCINOMA,
 HUMAN (3203)
 AUTOIMMUNE-LIKE, LIGAND-BINDING SITES,
 MYELOMA PROTEINS, MOUSE (3158)
 CARCINOEMBRYONIC ANTISERA, COLON TUMOR
 TISSUES, PREPARATION (3218)*
 COMPLEMENT FIXING, SARCOMA 180, MOUSE
 BRAIN CELL (3163)
 ENHANCED RESPONSE, TUMOR-ASSOCIATED
 IMMUNITY, BYCOBACTERIUM BUTYRICUM,

- RAT (3156)
 EPSTEIN-BARR VIRUS, CAPSID ANTIGEN,
 SOLUBLE ANTIGEN, INFECTIOUS
 MONONUCLEOSIS, HUMAN (3042)
 FORMATION, COMPLETE AND INCOMPLETE,
 NEOPLASTIC DISEASE, HUMAN (3215)
 GROUP-SPECIFIC, AVIAN LEUKOSIS GROUP,
 DETECTION (3039)
 HEPATITIS-ASSOCIATED, HEPATOCELLULAR
 CARCINOMA, HUMAN (3166)
 PRIMARY, FORMATION, ADJUVANT EFFECT
 OF ENDOTOXIN, IRRADIATED RATS (3212)
 SERUM, AVIAN LEUKOSIS VIRUS, HUMAN
 (3178)
 SV40 INFECTION, HUMAN (3034)
 SV40-NEUTRALIZING, SERUM,
 GENITOURINARY CARCINOMA, HUMAN
 (3054)
- Antigen
 ADENOVIRUS TYPES 2 AND 3, STRUCTURAL
 CORE PROTEINS (3095)
 AUSTRALIAN, LIVER CANCER, INCIDENCE,
 AFRICA (3157)
 CAPSID, SOLUBLE, EPSTEIN-BARR VIRUS,
 ANTIBODY, INFECTIOUS MONONUCLEOSIS,
 HUMAN (3042)
 ENVIRONMENTAL, MYELOMA PROTEIN, MOUSE
 (3190)
 FELINE LEUKEMIA-SARCOMA GROUP-SPECIFIC
 PRESENCE IN TISSUE CULTURE CELLS,
 ULTRASTRUCTURE, HUMAN (3125)
 FETAL CELL, RAUSCHER LEUKEMIA VIRUS,
 RECOVERY, SPLENOMEGALY, SUPPRESSION,
 MOUSE (3204)
 GROUP-SPECIFIC
 AVIAN LEUKOSIS VIRUS, DETECTION
 (3039)
 AVIAN TUMOR VIRUS, IMMUNO-
 ELECTROPHORESIS (3051)
 HEPATITIS-ASSOCIATED, HEPATOCELLULAR
 CARCINOMA, HUMAN (3166)
 HERPESVIRUS, DETECTION BY INDIRECT
 IMMUNOFLUORESCENCE, LUCKE RENAL
 ADENOCARCINOMA, FROG (3035)
 HL-A
 CHORIOCARCINOMA, HUMAN (3172)
 HODGKIN'S DISEASE, MULTIPLE
 MYELOMA, ANALYSIS (3222)*
 MALIGNANT BLOOD DISEASES, HUMAN
 (3173)
 HUMAN CARCINOMA, CROSS REACTIONS,
 ANTI-EMBRYONIC ANTIBODIES, RABBIT
 (3207)
 LIVER MICROSOMES,
 2',3-DIMETHYL-4-AMINOAZOBENZENE,
 MOUSE (2930)
 MORRIS HEPATOMA 5123, PURIFICATION,
 DEMONSTRATION (3211)
 NON-VIRION, EPSTEIN-BARR VIRUS
 PRODUCTION, BURKITT LYMPHOMA
 (3062)
 PROSTATE, MALIGNANT, BENIGN, HUMAN
 (3187)
 ROUS SARCOMA VIRUS, EARLY INFECTION
 (3044)
 SURFACE, LYMPHOID CELL, NEURAMINIDASE,
 HUMAN (3183)
 SYNTHESIS
 MURINE SARCOMA VIRUS, MOUSE,
 RAT, HAMSTER, CHICKEN, HUMAN
 (3065)
 ONCORNAVIRUSES, CHROMATOGRAPHY,
 CHICKEN, HAMSTER, MOUSE, CAT
 (3144)
 TISSUE TYPE SPECIFIC, BLADDER TUMOR,
 3-METHYLCHOLANTHRENE, MOUSE, RAT
 (3162)
 TUMOR, DETECTION, REGIONAL LYMPH
 NODES, METASTASIS, HUMAN (3194)
 TUMOR-SPECIFIC, EMBRYONIC, AMINOAZO
 DYE, HEPATOMA, RAT (3170)
 TUMOR-SPECIFIC TRANSPLANTATION,
 ISOGRAFT GROWTH, RNA, SPLEEN CELL,
 RAT (3160)
 ANTIGENICITY
 MAMMARY TUMOR VIRUS-ASSOCIATED,
 LEUKEMIA CELLS, MOUSE (3193)
 ANTISERUM
 NERVE GROWTH FACTOR, ANTITUMOR
 ACTIVITY, MOUSE (3357)*
 ARGININE
 BIOSYNTHESIS, POLYOMA VIRUS, CELL
 INFECTION, MOUSE (3046)
 ASBESTOS
 MESOTHELIOMA, INCIDENCE, SCOTLAND
 (3270)
 PLEURAL-PULMONARY MALIGNANCY,
 RELATIONSHIP, LIGURIA (3016)*
 TISSUE REACTION, FIBER DISTRIBUTION,
 ABDOMINAL GRANULOMAS, LYMPH NODES,
 RAT (3586)*
 ASCITES
 EHRLICH CARCINOMA CELLS, AGGREGATION
 EFFECT, CHEMICAL (3427)*
 EHRLICH CELLS, RNA DEGRADING ENZYMES,
 ACTIVITY CHANGES, ACTINOMYCIN D,
 MOUSE (2980)
 EHRLICH-LETTRE CARCINOMA, NUCLEOTIDE-
 PEPTIDE ISOLATION, CHROMATOGRAPHY,
 CELLS (3353)*

EARLY TUMOR
 ADENINE PHOSPHORIBOSYLTRANSFERASE ACTIVITIES, MOUSE (2992)
 CYTOLOGY, MORPHOLOGY, ULTRASTRUCTURE, MOUSE (3536)*
 METAL METABOLISM, MOUSE (3431)*
 EARLY TUMOR CELLS
 ADENOSINE KINASE, KINETIC STUDIES (3336)*
 ENERGY METABOLISM CELL DIVISION INTERRELATIONS, AEROBIC-ANAEROBIC CONDITIONS (3428)*
 NA⁺ AND K⁺ POTENTIAL, ACTIVE TRANSPORT, AMINO ACIDS (3432)*
 NAD(P)⁺ REDOX COMPARTMENTATION, MOUSE (3340)*
 NK/LY LYMPHOMAS, GROWTH, ENERGY EXCHANGE (3312)
 PHOSPHORUS INCORPORATION (3447)*
 HEPATOMA
 ALPHA FETOPROTEIN, RAT (3320)
 SURFACE MEMBRANE, RAT (3404)*
 TUMOR CELLS, EXTERNAL ANIONS EFFECT, STEADY-STATE CHLORIDE EXCHANGE (3547)*
 AUTOIMMUNE DISEASE
 IMMUNOGLOBULIN-CARRYING CELLS, GAMMA GLOBULIN, NZB MICE (3155)
 VACCILLUS CALMETTE-GUÉRIN
 IMMUNOTHERAPY, FRIEND DISEASE, MOUSE (3161)
 NEURAMINIDASE, 3-METHYLCHOLANTHRENE, TUMOR REGRESSION, MOUSE (3199)
 TUMOR INDUCTION, RESISTANCE, RAT (3195)
 ADJAL CELL
 CARCINOMA, SYNDROME, CASE REPORT (3517)*
 BASAL CELL CARCINOMA
 CULTURE, KERATINIZATION, HUMAN (3134)
 BENZ(A)ANTHRACENE
 EPOXIDES, FRAME SHIFT MUTAGENS, SALMONELLA (2984)
 ENZYME
 OCCUPATIONAL HAZARD, ACUTE LEUKEMIA, CASE REPORTS (2976)
 BENZOFLAVONE
 ARYL HYDROCARBON HYDROXYLASE ACTIVITY, DBMA-INDUCED ADRENAL NECROSIS, LUNG TUMORIGENESIS, POLYCYCLIC HYDROCARBONS TOXICITY, HAMSTER, RAT (3941)
 7,8-BENZOFLAVONE
 TUMORIGENESIS INHIBITION, 7,12-DIMETHYLBENZ(A)ANTHRACENE, BENZO(A)PYRENE, MOUSE (2928)
 BENZO(A)PYRENE
 CARBON BLACK, PHYSICAL PROPERTIES (3015)*
 CARCINOGENICITY, OINTMENTS, COAL-TAR (3000)
 CONTACT SENSITIVITY INDUCTION, TOLERANCE, GUINEA PIG (2937)
 DNA BINDING, MOUSE (2961)
 ENVIRONMENTAL HAZARD, AIRPLANE ENGINE SOOT, MOUSE (3011)
 GASTRIC CANCER, ICELANDERS, INCIDENCE, MANITOBA (3265)
 1-METHYLCYTOSINE, PHOTOCHEMICAL COUPLING, PHOTOENHANCEMENT OF CARCINOGENICITY (3025)*
 TUMORIGENESIS, TIME AND DOSE, MOUSE (2935)
 TUMORIGENESIS INHIBITION, 7,8-BENZOFLAVONE, MOUSE (2928)
 BILE DUCT
 MALIGNANT TUMORS, HUMAN (3361)*
 BIOTIN
 SYNTHESIS, HELA CELLS (3501)*
 BIS(CHLOROMETHYL)ETHER
 ANALOGS, CARCINOGENESIS, STRUCTURE ACTIVITY RELATIONSHIP, MOUSE (3002)
 BLADDER
 CANCER, CIGARETTE SMOKING, POPULATION TRENDS, UNITED STATES, ENGLAND, DENMARK (3266)
 CARCINOMA, CHROMOSOMES, HUMAN (3326)*
 TUMOR, TISSUE TYPE SPECIFIC ANTIGENS, 3-METHYLCHOLANTHRENE, MOUSE, RAT (3142)
 URINARY, TUMOR, 3,2'-DIMETHYL-4-AMINOBIPHENYL, HAMSTER (2958)
 BLOOD
 ANTICOAGULATION SYSTEM, LEUKEMIA, HUMAN (3343)*
 CLOTTING SYSTEM
 UTERINE MYOMA, ANEMIA, HUMAN (3539)*
 YOSHIDA SARCOMA, L-AMINOCAPROIC ACID, SINTROM, RAT (3438)*
 COAGULATION FACTORS, SYNTHESIS, ACTINOMYCIN D INHIBITION, HEPATOMA, RAT (3296)
 FIBRINOLYTIC ENZYME SYSTEM, HEPATIC CIRRHOSIS, MALIGNANT METASTASES, HUMAN (3452)*
 FLOW DETERMINATION, IRRADIATED SARCOMA CLEARANCE OF XENON-133, MOUSE (3464)*
 LEUKOCYTE, ADENOSINE DEAMINASE,

- LEUKEMIA, HUMAN (3302)
 MALIGNANT DISEASES, HL-A ANTIGENS, HUMAN (3173)
 MICROBIAL AGENTS, ISOLATION AND IDENTIFICATION, ACUTE LEUKEMIA, HUMAN (3538)*
 SERUM COPPER MEASUREMENT, LYMPHOMAS, HUMAN (3408)*
 SERUM PROTEIN FRACTIONS, PROPERDIN TITER, GASTRO-INTESTINAL CANCER, HUMAN (3553)*
 TRANSFUSION, HEPATOMA, INDUCTION RESISTANCE, 4-DIMETHYLAMINOAZOBENZENE, RAT (2931)
- BONE
 ANGIOFIBROMA, HUMAN (3486)*
 CHONDROBLASTOMA, CLINICOPATHOLOGIC STUDY, ULTRASTRUCTURE, HUMAN (3385)*
 GRANULOMA, MALIGNANT RETICULOENDOTHELIOSIS, CASE REPORT (3484)*
 MANDIBLE, METASTATIC NEUROBLASTOMA, CASE REPORT (3419)*
 METASTASES
 MAMMARY CANCER, HUMAN (3489)*
 UTERINE CERVIX CANCER, ASSOCIATION (3594)*
 TUMOR
 ANGIOFIBROMA, HUMAN (3486)*
 SIALIC ACID, HUMAN (3530)*
- BONE MARROW
 MICROBIAL AGENTS, ISOLATION AND IDENTIFICATION, ACUTE LEUKEMIA, HUMAN (3538)*
 STEM CELL RESPONSE, TUMOR GRAFTS, MOUSE (3225)*
 TELOCENTRIC CHROMOSOME, ABERRATION VULNERABILITY, 7,12-DIMETHYLBENZ(A)-ANTHRACENE, RAT (3010)
 TRANSPLANTATION, GRAFT VS HOST REACTION, RESPONSIVENESS TO ALLO-ANTIGENS, MOUSE (3228)*
- BRAIN
 CEREBRAL LEPTOMENINGES, PRIMARY MELANOBLASTOMA, REVIEW (2911)*
 COMPLEMENT FIXING ANTIBODY, SARCOMA 180, MOUSE (3163)
 EPENDYMOMA, ULTRASTRUCTURE, HUMAN (3457)*
 TUMOR
 LACTATE DEHYDROGENASE ISOENZYMES, HUMAN (3443)*
 LIPID AND FATTY ACID COMPOSITION, HUMAN (3429)*
 NITROSOUREA-INDUCED, GLIOMAS, PATHOGENESIS, RAT (3014)*
- TRITON X-100 IRRADIATION, ACID PHOSPHATASE, RAT (3376)*
- BREAST
 CANCER
 AGE AT MENARCHE, CASE-CONTROL STUDY, POLAND (3319)
 GENETIC, SOCIOECONOMIC, VIRAL ASSOCIATIONS, IDENTIFICATION OF HIGH RISK GROUPS (3273)
 HORMONE DISTURBANCES, WOMEN (3236)
 CARCINOMA, BENIGN DISEASE, ESTRADIOL RECEPTOR, MENOPAUSE, HUMAN (2948)
 TUBULAR CARCINOMA, ULTRASTRUCTURE, CASE REPORTS (3354)*
 TUMOR, ATOMIC BOMB RADIATION, INCIDENCE, HUMAN, REVIEW (3027)
- BREAST CANCER
 VIRAL ETIOLOGY, MOUSE, REVIEW (2909)
- BROWN-PIERCE CARCINOMA
 METASTASIZATION, INTERFERON INFLUENCE, RABBIT (3342)*
- BURKITT'S LYMPHOMA
 CLINICAL FEATURES, THERAPY, REVIEW (2906)
 INDUCTION OF ACUTE LEUKEMIA, CASE REPORT (3384)*
 LYMPHOBLASTOID CELLS, HYBRIDIZATION, INACTIVATED SENDAI VIRUS, CHROMOSOME ANALYSIS, MOUSE AND HUMAN CELL LINES (3053)
 SURVIVAL, GHANA (3257)
- CANCER
 CELL DIFFUSION, CHICKEN EGG (3241)*
 DISTRIBUTION, INCIDENCE, ENDOGAMOUS GROUPS, INDIA (3290)*
 EPIDEMIOLOGY PROBLEMS, SMALL POPULATION, GERMANY (3286)*
 ETIOLOGY, PATHOGENIC FACTORS (3281)*
 HUMAN, REVIEW (2913)*
 IMMUNOLOGY, MOUSE, REVIEW (2914)*
 INCIDENCE, YUGOSLAVIA (3289)
 LEUKEMIA, MORTALITY, FRANCE (3249)
 METASTASES, VERTEBRAL BODY, POSTMORTEM EXAMINATION, X-RAY STUDY (3585)*
 MORTALITY
 ETHNIC GROUPS, INCIDENCE, HAWAII (3263)
 NEW YORK CITY (3262)
 POLISH MIGRANTS TO AUSTRALIA (3274)
 RECTUM, TNM-CLASSIFICATION, CLINIC, THERAPY (3583)*
 CANCEROGENESIS
 CYTODIFFERENTIATION, EPIGENETIC

MECHANISM, REVIEW (2910)
MOLECULAR ASPECTS, REVIEW (2915)*
CANNABINOIDS
ONCOGENIC POTENTIAL, MURINE LEUKEMIA
VIRUS, FISCHER RAT EMBRYO CELLS,
TRANSFORMATION (3080)
CARBOHYDRATE
METABOLISM
CHRONIC LEUKOSIS, HUMAN (3485)*
NEOPLASTIC PROCESS, HUMAN (3313)
CARCINOEMBRYONIC ANTIGEN
SERUM, PLASMA, LYMPHOCYTE INHIBITION,
COLON CANCER, HUMAN (3181)
CARCINOGENESIS
7H-DIBENZO(C,G)CARBAZOLE, RESPIRATORY
TRACT, EPITHELIUM, HAMSTER (2940)
DRUG-INDUCED CANCER, HUMAN (2998)
CARCINOGENS
DYES, MEAT MARKING COLORS,
NEW ZEALAND (2986)
CARCINOMA
BRONCHIOLO-ALVEOLAR, NODULAR DIS-
SEMINATED TYPE, NODULAR PNEUMONIC
MIXED TYPE, ALVEOLAR CELL CARCINOMA
(3584)*
BRONCHUS, NECROPSY FINDINGS, HUMAN,
REVIEW (2902)
LEUKEMIC REACTIONS (3587)*
VAGINAL-CERVIX-INNervation, RELATION-
SHIP, HUMAN (3347)*
CARCINOSARCOMA
WALKER 256, TUMOR GROWTH, LIVER
REGENERATION, RATS (3589)*
CASTRATION
CARCINOGENESIS, DIMETHYLBENZANTHRACENE
SKIN, RAT (2952)
CELL
ADRENOCORTICAL CARCINOMA, METABOLIC
REGULATION, ULTRASTRUCTURE, RAT
(3531)*
ALVEOLAR CARCINOMA, LUNG, ULTRASTRU-
TURE, HUMAN (3497)*
BRONCHOPULMONARY CANCER, BLOOD STREAM,
HUMAN (3363)*
CANCER, NUCLEIC ACID KINETICS, HUMAN
(3305)
DIFFUSION, CANCER, CHICKEN EGG (3241)*
GAUCHER, CHRONIC MYELOGENOUS LEUKEMIA
(3545)*
GLIA-LIKE, PROLIFERATION, HUMAN
(3420)*
HELA, BIOTIN SYNTHESIS, CULTURE
(3501)*
LEYDIG TUMORS, EXPERIMENTALLY PRODUCED
RAT, REVIEW (2919)*
MALIGNANT, CHARACTERIZATION,
BIOCHEMICAL, MOUSE, HUMAN (3474)*
MESOTHELIAL, INCREASED PROLIFERATION,
INTRAPERITONEAL ENDOTOXIN INJECTION,
RAT (3535)*
NEOPLASTIC, PROLIFERATION, DEVELOPMENT
ACTINOMYCIN D, FLAVONOID COMPOUNDS
(3366)*
NEOPLASTIC MAST CELL, GLYCOSPHINGO-
LIPIDS, AMINES, MOUSE (3424)*
POPULATION KINETICS, MAMMARY FIBRO-
ADENOMA, SERIAL TRANSPLANTATION, RAT
(3303)
PROLIFERATION, PANCREATIC ACINAR
EPITHELIA, AUTORADIOGRAPHIC STUDIES,
3H-THYMIDINE, RAT (3242)*
PULMONARY, STUDY METHOD, RAT, HAMSTER
(3405)*
SQUAMOUS CELL CARCINOMA, HISTOPATHOL-
OGY, ULTRASTRUCTURE, HUMAN (3533)*
B-CELL
FUNCTIONAL ONTOGENY, THYMUS, MOUSE
(3188)
LEUKEMIA, LYMPHOMA, MOUSE (3179)
T-CELL
FUNCTIONAL ONTOGENY, THYMUS, MOUSE
(3188)
LEUKEMIA, LYMPHOMA, MOUSE (3179)
CELL CYCLE
DEPRESSION, DNA SYNTHESIS, METHYL-
NITROSOUREA, MOUSE EMBRYO (2934)
CELL MEMBRANE
TUMOR, PROTEOLYTIC PRODUCTS, N-ACETYL-
NEURAMINIC ACID (3509)*
CERUMINOUS GLAND
ADENOCARCINOMA, ULTRASTRUCTURE, CASE
REPORT, HUMAN (3409)*
CERVIX
CANCER
BSP HALF-TIME, HUMAN (3415)*
EPIDEMIOLOGICAL STUDIES, SPECIFIC
SOCIAL FACTORS, ANALYSIS (3268)
MORTALITY, UNITED STATES,
ENGLAND (3246)
SOCIOECONOMIC STATUS, RELATIONSHIP
CONNECTICUT (3272)
CARCINOMA, CHROMOSOME PATTERN, HUMAN
(3546)*
EPIDERMOID CARCINOMA, ENDOMETRIUM
CARCINOMA OF UTERUS, CASE REPORTS
(3244)*
VAGINAL-CERVIX-INNervation, CARCINOMA,
RELATIONSHIP, HUMAN (3347)*
CERVIX UTERI
EPITHELIAL LESIONS, CYTOLOGY,

- HISTOLOGY, REVIEW (2918)*
- CHEMICAL CARCINOGEN
TUMORIGENESIS DETERMINATION, GENETICS, HAMSTER (2925)
- CHEMICAL CARCINOGENESIS
INHIBITION, VIRAL VACCINES, MOUSE (2964)
- CHLOROLEUKEMIA
HISTONE ISOLATION, PRIMARY STRUCTURE, RAT (3348)*
- CHOLESTEROL
SYNTHESIS, METABOLIC CONTROLS, PRECANCEROUS LIVER, N-2-FLUORENYL-ACETAMIDE, RAT (2963)
- CHORIOCARCINOMA
GESTATIONAL, INVASIVE HYDATID MOLE, INCIDENCE, DENMARK (3250)
- HL-A ANTIGENS, HUMAN (3172)
- CHROMOSOME
ABERRATION, MALIGNANT TUMORS, HUMAN (3417)*
- ANEUPLOIDY, ACUTE LYMPHATIC LEUKEMIA, TRISOMY 21, CASE REPORT (3315)
- BONE MARROW C, MYELOPROLIFERATIVE DISEASE, PRE-LEUKEMIA STATE, CHILDREN (3232)
- EFFECTS OF EQUINE HERPES 3 VIRUS, HERPES SIMPLEX, COMPARATIVE STUDY, KIDNEY CELLS, RABBIT (3079)
- FLUORESCENT PATTERN
HEPATOCELLAR CARCINOMA, RAT (3469)*
- MALIGNANT LYMPHOMAS, HUMAN (3309)
- GLIOMAS, METHYLCHOLANTHRENE INDUCED, KARYOLOGICAL STUDY, MOUSE (3304)
- HYBRIDIZATION, ADENOVIRUS RNA AND DNA, HUMAN (3108)
- MALIGNANT LYMPHOMA, CASE REPORTS (3317)
- PATTERN, CERVICAL CARCINOMA, ATYPICAL HYPERPLASIA, HUMAN (3546)*
- QUINACRINE FLUORESCENT KARYOTYPES, DIPLOID, HETEROID, HUMAN (3473)*
- RHABDOMYOSARCOMA, C-TYPE VIRUS, HUMAN (3076)
- TELOCENTRIC, ABERRATION VULNERABILITY, 7,12-DIMETHYLBENZ(A)ANTHRACENE, BONE MARROW, RAT (3010)
- COLON
CANCER PLASMA, LYMPHOCYTE INHIBITION, CARCINOEMBRYONIC ANTIGEN, SERUM ALPHA-GLOBULIN, HUMAN (3181)
- RECTUM, CARCINOMA, INCIDENCE, GERMANY (3282)*
- TUMOR TISSUES, CARCINOEMBRYONIC ANTISERA PREPARATION (3218)*
- COMPLEMENT
LYMPHOMA GRAFT REJECTION, ANTIBODY, MOUSE (3182)
- CRANIOPHARYNGIOMA
CHEMICAL STATISTICAL ANALYSIS (3069)*
- CROTON OIL
7,12-DIMETHYLBENZ(A)ANTHRACENE, TUMOR, PEROXIDATION, MOUSE (3245)*
- EPIDERMIS, DNA CONCENTRATION, MOUSE (2969)
- CYTOSINE ARABINOSIDE
HERPESVIRUS, INDUCTION OF LATENCY, HUMAN (3033)
- DUT
EFFECT ON FETAL LUNG TISSUE, MOUSE (2995)
- DIABETES
ALLOXAN, INSULIN DEPRIVATION, MAMMARY CARCINOMA, GROWTH, RAT (2993)
- DIBENZ(A,H)ANTHRACENE
EPOXIDES, FRAMESHIFT MUTAGEN, SALMONELLA (2984)
- 7H-DIBENZO(C,G)CARBAZOLE
CARCINOGENICITY, RESPIRATORY TRACT, EPITHELIUM, HAMSTER (2940)
- DIBUTYRYL ADENOSINE 3,5-CYCLIC MONOPHOSPHATE
NEUROBLASTOMA, DIFFERENTIATION, MOUSE (2924)
- DIET
ZINC DEFICIENCY, TUMOR INHIBITION, MOUSE, RAT (3306)
- DIETHYLAMINOETHYL(DEAE)DEXTRAN
ETHYLNITROSUREA, SARCOMA INDUCTION, MOUSE (3001)
- RESTRICTION OF MYXOMA VIRUS INFECTION, RABBIT (3143)
- DIETHYLNITROSAMINE
HEPATIC ACTIVITIES OF 1-CARBON ENZYMES, RAT (3022)*
- 4-DIMETHYLAMINOAZOBENZENE
HEPATOMA INDUCTION, RESISTANCE, BLOOD TRANSFUSION, RAT (2931)
- RNA POLYMERASE SUPPRESSION, LIVER CARCINOGENESIS, NITROFURAN, RAT (2946)
- N,N-DIMETHYL-4-AMINOAZOBENZENE
HEPATIC ACTIVITIES OF 1-CARBON ENZYMES, RAT (3022)*
- P-DIMETHYLAMINOAZOBENZENE
LIVER CANCER
ALKALOID EFFECT, FUNTUMINE, IREHDAMINE, RAT (2957)

ESTROGEN EFFECT, RAT (2956)
 2,3-DIMETHYL-4-AMINOAZOBENZENE
 LIVER MICROSOMES, ANTIGENICITY, MOUSE
 (2930)
 3,2'-DIMETHYL-4-AMINOBIPHENYL
 TUMOR INDUCTION, URINARY BLADDER,
 HAMSTER (2958)
 DIMETHYLBENZANTHRACENE
 CARCINOGENESIS, SKIN, CASTRATION, RAT
 (2952)
 EAR LOBE TUMOR, RAT (3019)*
 7,12-DIMETHYLBENZ(A)ANTHRACENE
 CONTACT SENSITIVITY INDUCTION,
 TOLERANCE, GUINEA PIG (2937)
 EPIDERMIS, DNA CONCENTRATION, MOUSE
 (2969)
 MAMMARY CARCINOMA, INSULIN DEPRIVATION
 EFFECT, ALLOXAN DIABETES, RAT (2993)
 MAMMARY GLAND TUMOR, REGRESSION AND
 RECURRENCE, RAT (3013)
 MAMMARY TUMOR, REGRESSION, ERGOCORININE
 RAT (2929)
 NEONATAL CARCINOGENESIS, ANAMNESTIC
 IMMUNE RESPONSE, MOUSE (2970)
 SKIN TUMOR INDUCTION, DOSE LEVEL, RAT
 (2923)
 TELOCENTRIC CHROMOSOME, ABERRATION
 VULNERABILITY, BONE MARROW, RAT
 (3010)
 TUMORIGENESIS INHIBITION, 7,8-BENZO-
 FLAVONE, MOUSE (2928)
 TUMORS, CROTON OIL, PEROXIDATION,
 MOUSE (3245)*
 9,10-DIMETHYL-1,2-BENZANTHRACENE
 CARCINOGENESIS, TUMOR PROMOTION,
 INSULIN, GROWTH HORMONE, GENITAL
 TRACT, RAT (3007)
 4-N'-DIMETHYLETHYLENEDINITROSOAMINE
 ESOPHAGEAL CARCINOMA, RAT (2944)
 DIMETHYLNITROSAMINE
 METABOLISM, DNA, MOUSE (2997)
 4-DIMETHYLNITROSAMINE
 TOBACCO, SMOKE CONDENSATE (2955)
 4-N'-DIMETHYLNITROSOUREA
 CARCINOGENESIS, HAMSTER (2974)
 DIMETHYL SULPHATE
 MUTAGEN, NUCLEIC ACID, ALKYLATION
 (2971)
 DNA
 BINDING
 BENZO(A)PYRENE, MOUSE (2961)
 URETHAN, LUNG, KIDNEY AND LIVER
 TISSUES, MOUSE, RAT (2988)
 EPIDERMAL CONCENTRATION,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,

URETHAN, CROTON OIL, MOUSE (2969)
 FLUORESCENCE STUDIES, INTERACTION,
 ACRIDINE ORANGE (3481)*
 INTEGRATION, SV40, PERMISSIVE KIDNEY
 CELLS, MONKEY (3124)
 LIVER, REGENERATION, NUCLEAR
 PROLIFERATION, MOUSE (3390)*
 MITOCHONDRIAL, TRANSFORMED CELLS,
 ADENOVIRUS, SV40 (3117)
 POLYOMA VIRUS, SECONDARY STRUCTURE
 (3139)
 POLYMERASE
 RNA-DEPENDENT, ACTIVITY, MURINE
 LEUKEMIA VIRUS, MURINE SARCOMA
 VIRUS, MOUSE (3132)
 TEMPLATE SPECIFICITIES, COMPARA-
 TIVE STUDY, AVIAN MYELOBLASTOSIS
 VIRUS, E. COLI, M. LUTENS (3073)
 POLYMERASE ACTIVITY, TUMORS, A-TYPE
 PARTICLES (3103)
 PROTEIN, SCISSION, REPAIR,
 4-NITROQUINOLINE-1-OXIDE, MOUSE
 (2936)
 REPLICATION CONTROL, NAD PYROPHOS-
 PHORYLASE ACTIVITY, PHYSARUM POLY-
 CEPHALUM (3434)*
 REPLICATOR SITES, MAMMALIAN NUCLEI
 (3494)*
 ROUS SARCOMA VIRUS, SOURCE AND
 SIGNIFICANCE (3086)
 SCISSION, REPAIR, 4-NITROQUINOLINE-1-
 OXIDE, MOUSE (3005)
 SV40, ENDONUCLEASE ACTIVITY (3088)
 SV40 OLIGOMER INFECTION, RECOMBINANT
 ISOLATION, KIDNEY CELLS, MONKEY
 (3060)
 SYNTHESIS
 AMINO ACID DEPRIVATION, SV40
 TRANSFORMATION, KIDNEY CELLS,
 HAMSTER (3063)
 CELL CYCLE DEPRESSION, METHYL-
 NITROSOUREA, MOUSE EMBRYO (2934)
 HERPESVIRUS INFECTION, RIBONUCLEO-
 TIDE REDUCTASE, KB CELLS (3059)
 MORRIS HEPATOMA, RAT (3504)*
 OLIGO-ISOLATES, HELA CELLS,
 IN VITRO (3406)*
 TRITIATED THYMIDINE INCORPORATION,
 ELECTRON MICROSCOPIC AUTORADIOGRAPHY
 ASCITES CELLS, RAT (3487)*
 URETHAN BINDING, LIVER, PARTIAL
 HEPATECTOMY, MOUSE (2933)
 DUODENUM
 CARCINOMA, HUMAN (3526)*
 EHRLICH ASCITES TUMOR

- CELL
 NA⁺ AND K⁺ POTENTIAL, ACTIVE
 TRANSPORT, AMINO ACIDS (3432)*
 PHOSPHORUS INCORPORATION (3447)*
 CYTOLOGY, MORPHOLOGY, ULTRASTRUCTURE,
 MOUSE (3536)*
- ENDOCRINE
 MEDIASTINAL NEOPLASM, CARCINOID TUMOR,
 HUMAN (3525)*
 POLYPEPTIDE TUMORS, APUDAMYLOID
 GENESIS, HUMAN (3396)*
- ENDOMETRIAL CANCER
 RESULTS OF STUDIES ON 600 WOMEN
 (3598)*
- LYN:OTOXIN
 MESOTHELIAL CELLS, INCREASED PROLIF-
 ERATION, RAT (3535)*
- ENVIRONMENTAL HAZARD
 AIRPLANE ENGINE SOOT, BENZO(A)PYRENE,
 MOUSE (3011)
- ENZYME
 ACUTE LEUKEMIA, LYSOSOMES, HUMAN
 (3493)*
 ADENINE PHOSPHORIBOSYLTRANSFERASE
 ACTIVITY, EHRlich ASCITES TUMOR,
 MOUSE (2992)
 ADENOSINE DEAMINASE, LEUKOCYTE,
 LEUKEMIA, HUMAN (3302)
 ALKALINE PHOSPHATASE, ACTIVITY, PLASMA
 MEMBRANE, LIVER, RAT (3450)*
 AMINOPEPTIDASE ACTIVITY, LEUKOCYTES,
 HUMAN (3550)*
 L-ASPARAGINASE ACTIVITY, MALIGNANT
 TUMORS, HUMAN, RAT (3440)*
 BRINASE, AUTOCYTOTOXICITY, ACUTE
 LEUKEMIA, IMMUNOTHERAPY, HUMAN
 (3205)
 1-CARBON, HEPATIC ACTIVITIES,
 HEPATOCARCINOGEN ADMINISTRATION, RAT
 (3022)*
 CARCINOGENIC AMIDE HYDROLYSIS, LIVER
 MICROSOMES, GUINEA PIG (2926)
 CATALASE-DEPRESSING ACTIVITY,
 RHODAMINE SARCOMA, LIVER, RAT (2949)
 CATALASE-DEPRESSING FACTOR, FRIEND
 VIRUS INFECTION, SPLEEN, MOUSE
 (3077)
 CATALASE SYNTHESIS, TRANSLATION
 REGULATION, MORRIS HEPATOMA (3511)*
 COLLAGENASE DISTRIBUTION, MALIGNANT
 MELANOMAS, HUMAN (3528)*
 CYCLIC AMP-PHOSPHODIESTERASE ACTIVITY,
 REGULATION BY INTRACELLULAR CAMP,
 FIBROBLASTS, MOUSE (3308)
 DEOXYTHYMIDINE KINASE, PURIFICATION
 AND PROPERTIES, YOSIDA SARCOMA
 (3502)*
 DEOXYTHYMIDINE KINASE ACTIVITY,
 THERMAL STABILITY DIFFERENCES,
 HERPES SIMPLEX VIRUS TYPE 1 AND 2
 (3083)
 DNA POLYMERASE
 RNA-DEPENDENT, ACTIVITY, MURINE
 LEUKEMIA VIRUS, MURINE SARCOMA
 VIRUS, MOUSE (3132)
 ROUS SARCOMA VIRUS-ASSOCIATED,
 PURIFICATION AND CHARACTERIZA-
 TION (3110)
 TEMPLATE SPECIFICITIES COMPARATIVE
 STUDY, AVIAN MYELOBLASTOSIS
 VIRUS, E. COLI, M. LUTENS (3073)
 DNA POLYMERASE ACTIVITY, TUMORS,
 A-TYPE PARTICLES (3103)
 DRUG METABOLIZING, EFFECT OF HEPATOMA
 ASCITES FLUID, LIVER MICROSOME, RAT
 (3460)*
 ENDONUCLEASE ACTIVITY, DNA, SV40
 (3088)
 ESTERASE, INHIBITION, LEUKOCYTE
 CYTOSOL, HUMAN (3433)*
 FIBRINOLYTIC SYSTEM, HEPATIC CIRRHOSIS
 MALIGNANT METASTASES, HUMAN (3452)*
 HEPATIC CATALASE ACTIVITY, OXIDATION
 INHIBITION, LIVER TUMOR, RAT (3322)*
 HEXOKINASE, GLUCOKINASE, ACTIVITIES,
 HUMAN AND ANIMAL TUMORS (3292)
 ISOCITRATE DEHYDROGENASE, ISOENZYMES,
 CYTOPLASM, SQUAMOUS CELL CARCINOMA,
 HUMAN (3311)
 LACTATE DEHYDROGENASE, DIFFERENTIAL
 RELEASE DURING REPLICATION,
 ADENOVIRUS TYPES 5 AND 12 (3150)*
 LACTATE DEHYDROGENASE ISOENZYMES
 BRAIN TUMOR, HUMAN (3443)*
 NERVOUS SYSTEM TUMORS, HUMAN
 (3425)*
 LACTATE DEHYDROGENASE ISOZYME,
 ACTIVITY, LUNG CANCER, 4-NITRO-
 QUINOLINE-1-OXIDE, MOUSE (2982)
 LIVER, ADENOSINE 5'-PHOSPHATE
 DEAMINASE, HEPATOCARCINOGEN
 INDUCTION, KINETIC, IMMUNOCHEMICAL,
 PHYSICAL PROPERTIES, RAT (2990)
 LIVER CATALASE, IMPAIRED SYNTHESIS,
 RAT (3491)*
 NAD PYROPHOSPHORYLASE ACTIVITY,
 CONTROL OF DNA REPLICATION, PHYSARUM
 POLYCEPHALUM (3434)*
 NEUROAMINIDASE, EFFECT ON GROWTH,
 FIBROSARCOMA, 3-METHYLCHOLANTHRENE-

INDUCED, MOUSE (2968)
 POLYMERASE, ROUS SARCOMA VIRUS-
 ASSOCIATED, PURIFICATION, CHARACTER-
 IZATION (3110)
 PROTEASE, LYSOSOMES, POLYMORPHONUCLEAR
 LEUKOCYTES, HUMAN (3478)*
 PHOSPHATASE ACTIVITY, MALIGNANT
 MELANOMA, HUMAN (3528)*
 RIBONUCLEOTIDE REDUCTASE, HERPESVIRUS
 INFECTION, DNA SYNTHESIS, KB CELLS
 (3059)
 RNA DEGRADING, ACTIVITY CHANGES,
 ACTINOMYCIN D, EHRLICH ASCITES CELLS
 MOUSE (2980)
 RNA-DEPENDENT DNA POLYMERASE,
 TEMPLATE REQUIREMENTS (3047)
 +RNA METHYLASE ACTIVITY, EFFECT OF
 N-NITROSOMETHYLUREA, CELLS, HAMSTER
 (3009)
 SERINE BIOSYNTHESIS, LEUKEMIA,
 LEUKOCYTE, HUMAN (3316)
 SERUM ALKALINE PHOSPHATASE ISOENZYMES,
 CANCER METASTASIS STUDIES (3556)*
 SERUM MURAMIDASE, MYELOPROLIFERATIVE
 DISEASE, LEUKEMIA, CASE REPORTS
 (3233)
 TERATOCARCINOMA, EMBRYO-DERIVED,
 HISTOCHEMISTRY, MOUSE (3462)*
 TETRAHYDROFOLATE DEHYDROGENASE,
 PURIFICATION, LEUKEMIA, CHROMATO-
 GRAPHY, MOUSE (3325)*
 TRANSFER RNA METHYLASE ACTIVITY,
 LEUKEMIC CELLS, MOUSE (3155)*
 TYROSINE-ALPHA-KETOGLUTARATE TRANS-
 AMINASE, REGULATION, LIVER, HEPATOMA
 CELLS, RAT (3295)
 P. SKIN
 EPIDERMOLYTIC ACANTHOMA, HUMAN (3370)*
 P. EPITHELIUM
 BASAL CELLS, UREMIA EFFECT, MOUSE
 (3459)*
 MALIGNANT TUMORS, BLOOD BORNE
 METASTASES, HISTOGENESIS, HUMAN
 (3560)*
 P. G. CORNINE
 MAMMARY TUMOR, REGRESSION,
 7,12-DIMETHYLBENZANTHRACENE, RAT
 (2929)
 P. THROBLAST
 EARLY PROLIFERATING CELLS, HEMOPOIETIC
 COLONIES (3515)*
 P. PHAGUS
 CANCER, MAIZE RELATIONSHIP, INCIDENCE,
 AFRICA (3277)
 CARCINOMA
 CASE REPORTS (3396)*
 N,N'-DIMETHYLETHYLENEDINITROSAMINE
 RAT (2944)
 ESOPHAGITUS, BARRETT'S EPITHELIUM,
 TRANSMURAL POTENTIAL, HUMAN
 (3437)*
 MEGAESOPHAGEAL CANCER, POST-SURGICAL,
 CASE REPORTS (3514)*
 ESTROGEN
 BASAL CELL CARCINOMA, TRANSPLANTATION,
 VAGINA, MOUSE (3298)
 CARCINOGENESIS, MAMMARY TUMOR,
 PROLACTIN, PITUITARY, MOUSE (2950)
 LIVER CANCER, DIMETHYLAMINOAZOBENZENE,
 RAT (2956)
 ETHYLNITROSUREA
 DEAE-Dextran, SARCOMA INDUCTION, MOUSE
 (3001)
 THYMIC LYMPHOMA, MYELOID LEUKEMIA, RAT
 (2996)
 ETHYLUREA
 LUNG ADENOMA INDUCTION, NITROSAMIDE
 FORMATION, MOUSE (2966)
 EXCRETO-URINARY TRACT
 CANCER, ANATOMICOPATHOLOGICAL STUDY,
 HUMAN (3555)*
 EYE
 CHOROID MEMBRANE, MELANOMA PROPAGATION
 HISTOPATHOLOGY, CASE REPORT (3371)*
 CHOROID METASTASIS, HUMAN (3527)*
 MALIGNANT MELANOMA, IMMUNE RESPONSE,
 GRAFTING ON HAMSTER, CASE REPORT
 (3174)
 PROTEIN, ANTI-IDIOTYPIC ANTIBODY,
 HAPTEN-BINDING SITE, RABBIT (3175)
 RETINOBLASTOMA, IRIS NEOVASCULARIZA-
 TION, ULTRASTRUCTURE, HUMAN (3352)*
 FACE
 NECK, DEBREUILH'S MELANOSIS (3557)*
 TUMORS, INTRA-ARTERIAL CYTOSTATIC
 PERFUSION, HISTOLOGY, HUMAN (3496)*
 FIBROADENOMA
 MAMMARY GLAND, POPULATION KINETICS,
 SERIAL TRANSPLANTATION, RAT (3303)
 FIBROBLAST
 MORPHOLOGICAL TRANSFORMATION,
 EPSTEIN-BARR VIRUS, HUMAN (3107)
 MORPHOLOGY AND GROWTH REGULATION,
 ADENOSINE MONOPHOSPHATE, MOUSE,
 HAMSTER (3314)
 FIBROSARCOMA
 CASE REPORT, HUMAN (3327)*
 GARDNER-FELINE VIRUS, MELANOMA
 INDUCTION, GNOTOBIOTIC, CAT (3066)
 3-METHYLCHOLANTHRENE-INDUCED,

- NEURAMINIDASE EFFECT, GROWTH, RAT (2968)
- TRANSPLANT RESISTANCE, SENSITIZING IMPLANT, MOUSE (3169)
- FIBROXANTHOSARCOMA
- HISTIOCYTOMA, SOFT TISSUES, HISTOLOGY, HUMAN (3355)*
- FLAVONOID COMPOUNDS
- NEOPLASTIC CELLS, PROLIFERATION, DEVELOPMENT (3366)*
- N-2-FLUORLILYLACETAMIDE
- HEPATOMA, POLYNUCLEOTIDE LIGASE ACTIVITY, RAT (2945)
- PRECANCEROUS LIVER, METABOLIC CONTROLS
- CHOLESTEROL SYNTHESIS, RAT (2963)
- N,N'-2,7-FLUORENYLENEBISACETAMIDE
- X-RAY, ADENOCARCINOMA, GLANDULAR STOMACH, RAT (2960)
- FRIEND DISEASE
- BCG IMMUNOTHERAPY, MOUSE (3161)
- GALLBLADDER
- ATOMIC BOMB RADIATION, TUMOR, INCIDENCE, HUMAN, REVIEW (3027)
- CARCINOMA, DEEP CHOLECYSTIC FOSSA, RELATIONSHIP, HUMAN (3455)*
- IMMUNOGLOBULIN-CARRYING CELLS, AUTOIMMUNE DISEASE, NZB MICE (3185)
- GASTRIC
- STUMP CANCER, ANATOMOPATHOLOGICAL CHARACTERISTICS (3596)*
- GASTRIC CARCINOMA
- METASTASIS, HYPERNEPHROID CANCER, KIDNEY, CASE REPORT (3554)*
- SERUM PROTEIN CHANGES, ALPHA GLOBULIN FRACTIONS, HUMAN (3378)*
- GASTROINTESTINAL TRACT
- CANCER
- BLOOD SERUM PROTEIN FRACTIONS, PROPERDIN TITER, HUMAN (3553)*
- INCIDENCE, SURVIVAL, ISRAEL (3258)
- GENETICS
- CHROMOSOMES, QUINACRINE FLUORESCENT KARYOTYPES, DIPLOID, HETEROPLOID LINES, HUMAN (3473)*
- SUSCEPTIBILITY, VACCINIA VIRUS, 3-METHYLCHOLANTHRENE, MOUSE (3121)
- TUMOR VARIABILITY, H102 TISSUE CULTURE MORPHOLOGY (3475)*
- TUMORIGENESIS DETERMINATION, CHEMICAL CARCINOGEN, HAMSTER (2925)
- GENITAL
- MALIGNANT TUMOR, EPIDEMIOLOGICAL STUDIES, WOMEN, GERMANY (3256)
- GENITAL TRACT
- DIMETHYLBENZANTHRACENE, TUMOR
- PROMOTION, INSULIN, GROWTH HORMONE, RAT (3007)
- GLIOMA
- MIXED, POLYMORPHIC, PATHOGENESIS, NITROSOUREA-INDUCED BRAIN TUMORS, RAT (3014)*
- GLOFULIN
- HEMATOLOGY, FIBRIN POLYMERIZATION, HUMAN (3394)*
- GLOMUS TUMOR
- HISTOCHEMICAL STUDIES, EPITHELIOID CELLS (3580)*
- GLUCOSAMINE
- TRANSPORT, INHIBITION, HEPATOMA, RAT (3510)*
- D-GLUCOSAMINE
- CYTOTOXIC EFFECTS, NORMAL AND NEOPLASTIC TISSUES, ULTRASTRUCTURE, RAT (2989)
- GLUCOSE
- TRANSPORT, INHIBITION, HEPATOMA, RAT (3510)*
- BETA-GLUCURONIDASE
- RESOLUTION OF, EHRLICH ASCITES CARCINOMA CELLS, MOUSE BRAIN, ISOELECTROFOCUSING, POLYACRYLAMIDE (3593)*
- DL-GLYCERALDEHYDE
- EFFECT ON NEUROBLASTOMA CELLS, MOUSE (3465)*
- GLYCERATE 3-PHOSPHATE DEHYDROGENASE
- SERINE BIOSYNTHESIS, LEUKEMIA, LEUKOCYTE, HUMAN (3316)
- GLYCIDYL STEARATE
- CARCINOGENESIS, ACTIVITY BIOASSAY, MOUSE (2981)
- GRANULOMA
- BONE, MALIGNANT RETICULOENDOTHELIOSIS, CASE REPORT (3484)*
- GROWTH
- LYMPHOID TUMOR, MOLONEY VIRUS, ULTRASTRUCTURE, MOUSE (3097)
- MAMMARY CARCINOMA, INSULIN DEPRIVATION EFFECT, ALLOXAN DIABETES, RAT (2993)
- MYELOMA CELLS, CHARACTERISTICS, MOUSE (3498)*
- TRANSPLANTABLE TUMORS, PHAGOCYTOSIS, OPSONIN CHANGES, CELLULAR INFLUENCES, RAT (3192)
- TUMOR
- EHRLICH'S CELLS, NK/LY LYMPHOMA, ENERGY EXCHANGE (3312)
- HISTONE EFFECT, MOUSE (2938)
- IMMUNODEPRESSION, MOUSE (3213)
- HALO-ETHER
- BIS(CHLOROMETHYL)ETHER ANALOGS,

CARCINOGENESIS, STRUCTURE ACTIVITY
RELATIONSHIP, MOUSE (3002)

HAPTEN
ATTACHMENT, DINITROPHENYLATION,
TYROSYLATION, TUMOR CELLS, MOUSE
(3224)*

HEAD
NECK, ADENOID CYSTIC CARCINOMA, HUMAN
(3410)*

HEMATOPOIESIS
COLONIES, ALKYLATING AGENTS, MOUSE
(3466)*
RAUSCHER-LEUKEMIA, HYPERTRANSFUSION
EFFECT, MOUSE (3145)*

HEMOGLOBIN
SYNTHESIS, BONE MARROW AND SPLEEN CELL
SUSPENSION, ACUTE MYELOGENOUS
LEUKEMIA, RAT (3541)*

HEPATO-CARCINOGENESIS
SYNGENETIC TRANSPLANT OF SKIN, MOUSE
(3463)*

HEPATOMA
AMINOAZO DYE, ANTIGENS, RAT (3170)
ASCITES, SURFACE MEMBRANE, RAT (3404)*
ASCITES FLUID, DRUG METABOLIZING
ENZYMES, LIVER MICROSOMES, RAT
(3460)*
FEEDBACK CONTROL, CHOLESTEROL SYNTHESIS,
HUMAN (3401)*
N-2-FLUORENYLACETAMIDE INDUCED,
POLYNUCLEOTIDE LIGASE ACTIVITY, RAT
(2945)
INDUCTION RESISTANCE, 4-DIMETHYLAMINO-
AZOBENZENE, BLOOD TRANSFUSION, RAT
(2931)
INHIBITION, GLUCOSE AND GLUCOSAMINE
TRANSPORT, RAT (3510)*

MORRIS
COMPARATIVE STUDY, CELLULAR
ORGANELLES, RAT (3403)*
DNA SYNTHESIS, RAT (3504)*
ELECTRON TRANSPORT, RAT (3321)*
PHYTOSTEROL, RAT (3301)
MORRIS 5123TC, CATALASE SYNTHESIS,
TRANSLATION REGULATION (3511)*
SYNTHESIS OF BLOOD COAGULATION FACTOR,
ACTINOMYCIN D INHIBITION, RAT (3296)
3924A, MAMMARY TUMOR, CATION MOVEMENT
(3423)*

HERPES ZOSTER-VARICELLA
LYMPHOMA, HODGKIN'S DISEASE, ANALYSIS
(3208)

ISTIOCYTOMA

FIBROXANTHSARCOMA, SOFT TISSUES,
HISTOLOGY, HUMAN (3355)*

HISTONE
INHIBITORY EFFECTS, ENHANCING EFFECTS,
TUMOR GROWTH, MOUSE (2938)

HODGKIN'S DISEASE
CLINICOPATHOLOGIC STUDY (3523)*
CYTOGENETICS, CASE REPORTS (3317)
HERPES ZOSTER-VARICELLA INFECTION,
LYMPHOMA, ANALYSIS (3208)
MULTIPLE MYELOMA, HL-A ANTIGEN,
ANALYSIS (3222)*
PATHOGENESIS, HYPOTHESIS, VIRAL
INFECTION, HOST IMMUNITY (3237)
PHA-STIMULATED LYMPHOCYTE RESPONSE,
SERUM EFFECT, HUMAN (3165)

HORMONE
ANDROGEN BIOSYNTHESIS, ADRENAL GLAND
TUMORS, HUMAN (3294)

CARCINOGENESIS
MAMMARY TUMOR, ESTROGEN,
PROGESTERONE, PROLACTIN,
PITUITARY, MOUSE (2950)
TSH, LH, PROLACTIN, MOUSE (2942)
CONTRACEPTIVES, MAMMARY CARCINOMA,
MORPHOLOGY, HUMAN (2973)
DISTURBANCES, PRECANCEROUS DISEASES,
BREAST CANCER, WOMEN (3236)
ECTOPIC PRODUCTION, TUMORS, HUMAN
(3400)*
ESTRADIOL RECEPTOR, BREAST CARCINOMA,
HUMAN (2948)
ESTROGEN PRODUCTION, TROPHOBLASTIC
TUMOR, TISSUE CULTURE (3307)
GROWTH, LUNG CARCINOMA, HUMAN (3023)*
GROWTH HORMONE, INSULIN, CARCINO-
GENESIS, DIMETHYLBENZANTHRACENE,
GENITAL TRACT, RAT (3007)
HETEROPHYLLY, PHYTOHORMONE, INVERTE-
BRATE ENDOCRINOLOGY (3350)*
PROGESTIN SECRETION, DECIDUOMATA
MAINTENANCE MECHANISM, 3-METHYL-
CHOLANTHRENE TREATMENT, RAT (3006)

HYBRIDIZATION
ADENOVIRUS RNA AND DNA, CHROMOSOMES,
HUMAN (3108)

RNA-DNA
LEUKOCYTES, RAUSCHER LEUKEMIA
VIRUS, MOUSE, HUMAN (3131)
MURINE SARCOMA VIRUS, MURINE
LEUKEMIA VIRUS, GENETIC
DIFFERENCES (3135)
ROUS SARCOMA VIRUS, CELL INFECTION
RAT, CHICK (3040)

3-HYDROXYURIC ACID

ONCOGENICITY, SYNTHESIS, RAT (2972)
 HYPERPLASIA
 ENDOMETRIUM, CHROMOSOME PATTERN, HUMAN (3546)*
 HYPERTENSION
 HORMONE SECRETING TUMORS, RAT (3500)*
 HYPOSENSITIVITY
 MULTIPLE MYELOMA, HUMAN (3520)*
 IMMUNITY
 AUTOCHTHONOUS CANCER CELLS, LEUKOCYTE MIGRATION TEST, HUMAN (3214)
 DEFICIENCY, THYMUS, AMES DWARF MOUSE (3229)*
 SPLEEN CELL-MEDIATED CELLULAR, CENTRAL INHIBITION, LEUKEMIA, ISOANTIBODY, MOUSE (3159)
 T CELL, B CELL, FUNCTIONAL ONTOGENY, THYMUS, MOUSE (3188)
 TUMOR-ASSOCIATED, ENHANCEMENT, MYCOBACTERIUM BUTYRICUM, RAT (3156)
 IMMUNOFLOUORESCENCE
 DETECTION OF HERPESVIRUS ANTIGENS, LUCKE RENAL ADENOCARCINOMA, FROG (3035)
 IMMUNOGLOBULIN
 G, FREE KAPPA-CHAIN SYNTHESIS, LYMPHOMA CELLS, MYELOMA CELLS, MOUSE (3168)
 GAMMA GLOBULIN-CARRYING CELLS, AUTOIMMUNE DISEASE, NZB MICE (3185)
 RECEPTOR
 LEUKEMIA, LYMPHOMA, MOUSE (3184)
 MASTOCYTOMA CELL, MOUSE (3180)
 IMMUNOLOGY
 CANCER, MOUSE, REVIEW (2914)*
 IMMUNE RESPONSE
 EHRLICH ASCITES TUMOR, CLOSTRIDIUM BUTYRICUM, MOUSE (3220)*
 PRIMARY, ACUTE BOVINE LYMPHOCYTIC LEUKEMIA, ANTIBODY, E.COLI, COW (3197)
 RADIATION-RESISTANT A CELL, SHEEP ERYTHROCYTES, MOUSE (3176)
 IMMUNE RESPONSE DEPRESSION, PRECANCEROUS CONDITIONS, REVIEW (2907)
 IMMUNODEPRESSION, TUMOR GROWTH, MOUSE (3213)
 IMMUNOTHERAPY
 BCG, FRIEND DISEASE, MOUSE (3161)
 INDUCTION
 TUMOR, CELO VIRUS, TUMOR TISSUE AND CELLS, MORPHOLOGY, HAMSTER (3130)
 INFECTIOUS MONONUCLEOSIS
 EPSTEIN-BARR VIRUS, CAPSID ANTIGEN, ANTIBODY, HUMAN (3042)
 INSULIN
 DEPRIVATION, EFFECT ON GROWTH, MAMMARY CARCINOMA, ALLOXAN DIABETES, RAT (2993)
 INTERFERON
 INHIBITION, SOLID MALIGNANT TUMOR, PULMONARY METASTASES, MOUSE (3341)*
 MACROMOLECULE, VIRUS (3444)*
 MURINE SARCOMA VIRUS, CELL SENSITIVITY LOSS, MOUSE (3091)
 POLY I:C-INDUCED, HERPESVIRUS HOMINIS INFECTION, MOUSE (3149)*
 INTESTINE
 LYMPHORETICULAR SARCOMA, CASE REPORT (3369)*
 SMALL, LYMPHOSARCOMA, CLINICO-PATHOLOGIC STUDY, HUMAN (3381)*
 IODODEOXYURIDINE
 BURKITT LYMPHOBLASTOID CELLS, HYBRIDIZATION, INACTIVATED SENDAI VIRUS, CHROMOSOME ANALYSIS, MOUSE AND HUMAN CELL LINES (3053)
 KERATINISATION
 BASAL CELL CARCINOMA, CULTURE, HUMAN (3234)
 KERATOACANTHOMA
 HISTOPATHOLOGY, ULTRASTRUCTURE, HUMAN (3533)*
 KIDNEY
 ADENOCARCINOMA, HERPESVIRUS CONTENT, FROG (3061)
 CELL CARCINOMA, AUTOANTIBODIES, HUMAN (3203)
 HYPERNEPHROID CANCER, GASTRIC CARCINOMA METASTASE, CASE REPORT (3554)*
 MULTIPLE MYELOMA, LIPOID NEPHROSIS, HISTOCHEMICAL GLOMERULAR STUDIES, HUMAN (3453)*
 NEPHROBLASTIC NEPHROBLASTOMA, AVIAN LEUKOSIS GROUP VIRUS, SEQUENCE OF DEVELOPMENT, ULTRASTRUCTURE, CHICKEN (3100)
 NEPHROBLASTOMA, HISTOLOGY, HUMAN (3454)*
 RENAL CARCINOMA, HEPATIC DYSFUNCTION, CASE REPORTS (3331)*
 RENAL CELL CARCINOMA, ULTRASTRUCTURE, ULTRACYTOCHEMISTRY, HUMAN (3318)
 RENAL METABOLISM, EHRLICH ASCITES TUMORS, MOUSE (3431)*
 SV40 DNA OLIGOMER INFECTION, RECOMBINANT ISOLATION, MONKEY (3060)
 SV40 TRANSFORMATION, AMINO ACID

DEPRIVATION, DNA SYNTHESIS, HAMSTER
 (3063)
 WILM'S TUMOR, 2-MUTATION MODEL (3238)
 RYNX
 CANCER, RECURRENCE, CASE REPORTS
 (3373)*
 CARCINOMA, CIGARETTE, INCIDENCE, HUMAN
 (2962)
 VESTIBULAR CANCER, METASTASES, HUMAN
 (3552)*
 IOMYOMA
 STOMACH, CASE REPORT (3566)*
 UKEMIA
 ACUTE
 BENZENE, OCCUPATIONAL HAZARD,
 CASE REPORTS (2976)
 CELL, DNA SYNTHESIS (3449)*
 CHILDREN, DIURNAL ACTIVITY OF
 ADRENAL CORTEX (3590)*
 FACTOR XIII, HUMAN (3506)*
 LYSOSOMES, ENZYMES, HUMAN (3493)*
 MICROBIAL AGENTS, ISOLATION AND
 IDENTIFICATION, BLOOD, BONE
 MARROW, HUMAN (3538)*
 PROTEOLYTIC ENZYME BRINASE,
 AUTOCYTOTOXICITY, IMMUNOTHERAPY,
 HUMAN (3205)
 ACUTE MYELOGENOUS, HEME SYNTHESIS,
 BONE MARROW AND SPLEEN CELL SUSPEN-
 SIONS, RAT (3541)*
 ACUTE PROMYELOCYTIC, FIBRINOGEN,
 FACTOR XIII, DEFICIENCIES, HUMAN
 (3456)*
 AMINOPEPTIDASE ACTIVITY, LEUKOCYTES,
 HUMAN (3550)*
 ATOMIC BOMB RADIATION, INCIDENCE,
 TUMOR, HUMAN, REVIEW (3027)
 BLOOD ANTICOAGULATION SYSTEM, HUMAN
 (3343)*
 CANCER, MORTALITY, FRANCE (3249)
 CELLS, MAMMARY TUMOR VIRUS-ASSOCIATED
 ANTIGENICITY, MOUSE (3193)
 CHILDREN, MATERNAL AGE FACTOR,
 RELATIONSHIP (3275)
 CHRONIC LYMPHOCYTIC, LYMPHOSARCOMA
 CELL, BLOOD LYMPHOCYTES, ULTRA-
 STRUCTURE, HUMAN (3339)*
 CHRONIC LYMPHOID, DISSEMINATED CRYPTO-
 COCCOSIS, HUMAN (3561)*
 CHRONIC MELOGENOUS, GAUCHER CELLS
 (3545)*
 CHRONIC MYELOLEUCOSIS, CELL STUDY,
 HUMAN (3418)*
 ENZYME, SERINE BIOSYNTHESIS, LEUKOCYTE
 HUMAN (3316)

ERYTHROBLASTIC, REGRESSION, HYPO-
 PHYSECTOMY, RAT (3375)*
 IMMUNE SUPPRESSION, 4-NITROQUINOLINE-
 1-OXIDE INDUCED, MOUSE (2977)
 IMMUNOCOMPETENT LYMPHOID CELLS,
 ALLOGENEIC TRANSFER, GUINEA PIG
 (3164)
 IMMUNOGLOBULIN RECEPTOR, MOUSE (3184)
 LEUKEMOGENESIS, EFFECTS OF INOCULATION
 ROUTES, VIRAL PREPARATIONS, MOUSE
 (3120)
 LEUKOCYTE, ADENOSINE, DEAMINASE, HUMAN
 (3302)
 LYMPHOCYTE CHANGES, BIOCHEMISTRY
 (3518)*
 LYMPHOCYTIC, ACUTE BOVINE, PRIMARY
 IMMUNE RESPONSE, ANTIBODY, E.COLI,
 COW (3197)
 LYMPHOCYTIC CHROMATIN ALTERATIONS,
 HUMAN (3505)*
 MENINGOSIS, CYTOCHEMICAL FINDINGS,
 HUMAN (3508)*
 MIGRATION OF TUMORAL CELLS, SPECIFIC
 INHIBITION, SENSITIZED LYMPHOID CELL
 MOUSE (3201)
 MONOCYTIC, HUMAN (3507)*
 MURINE, XENOGRAFT, KARYOLOGY, HAMSTER
 (3407)*
 MYELOGENOUS, SUBCLONES, DRUG SENSI-
 TIVITY, KARYOTYPES (3448)*
 MYELOIC, CYTOKINETICS, HUMAN (3346)*
 MYELOID, THYMIC LYMPHOMA, ETHYL-
 NITROSUREA-INDUCED, RAT (2996)
 MYELOPROLIFERATIVE DISEASE, SERUM
 MURAMIDASE, CASE REPORTS (3233)
 PRE-LEUKEMIC STATE, CHILDHOOD, MISSING
 BONE MARROW C CHROMOSOME, MYELOPRO-
 LIFERATIVE DISORDER, CASE REPORT
 (3232)
 PROLIFERATIVE PATTERNS, CHILDREN
 (3391)*
 RAUSCHER
 HEMATOPOIESIS, HYPERTRANSFUSION
 EFFECT, MOUSE (3145)*
 SPONTANEOUS REGRESSION, MOUSE
 (3146)*
 RAUSCHER VIRUS, TUMOR TRANSPLANTATION,
 MOUSE (3070)
 RAUSCHER-VIRUS-INDUCED, RIFAMPICIN,
 INHIBITORY EFFECT, MOUSE (3136)
 REMISSION INDUCTION, DEVELOPING IN
 BURKITT'S LYMPHOMA, CASE REPORT
 (3384)*
 SPLEEN CELL-MEDIATED IMMUNITY,
 INHIBITION, ISOANTIBODY, MOUSE

- (3159)
T CELL, B CELL, MOUSE (3179)
TETRAHYDROFOLATE DEHYDROGENASE
PURIFICATION, CHROMATOGRAPHY, MOUSE
(3325)*
THROMBOPLASTIC LYMPHOCYTE ACTIVITY,
HUMAN (3519)*
- LEUKOCYTE
CARBOHYDRATE METABOLISM, CHRONIC
LEUKOSIS, HUMAN (3485)*
CHRONIC MYELOLEUCOSIS, CELL STUDY,
HUMAN (3418)*
- LEUKEMIA
ADENOSINE DEAMINASE, HUMAN (3302)
SERINE BIOSYNTHESIS, ENZYME, HUMAN
(3316)
NORMAL AND LEUKEMIC STRAIN,
COMPARATIVE STUDIES (3537)*
POLYMORPHONUCLEAR, PROTEASES, HUMAN
(3478)*
TRANSFORMATION, CYTOPATHIC CHANGES,
VIRAL ANTIGENS, EPSTEIN-BARR VIRUS,
MONKEY (3118)
- LEUKOPLAKIA
EPIDEMIOLOGIC STUDY, INDIA (3264)
- LEUKOSIS
BENZENE INDUCED, PROTEIN LEVELS,
CORTICOSTEROID TREATMENT, HUMAN
(3367)*
- LIPOFUSCIN
MALIGNANT AND NON-MALIGNANT PROSTATE
TISSUE, HUMAN (3476)*
- LIPOMAS
PAROTID, CASE REPORT (3564)*
- LIPOPROTEIN
SARCOMA 180, NK-LYMPHOMA ASCITES TUMOR
CELLS, CHEMICAL COMPOSITION, ULTRA-
STRUCTURE (3389)*
- LIVER
CANCER
AUSTRALIAN ANTIGEN, INCIDENCE,
AFRICA (3157)
DIETARY AFLATOXINS, HEPATOMEGALY,
INCIDENCE, THAILAND (3008)
P-DIMETHYLAMINOAZOBENZENE,
ESTROGEN EFFECT, RAT (2956)
P-DIMETHYLAMINOAZOBENZENE-INDUCED,
ALKALOID EFFECT, FUNTUMINE AND
IREHDIAMINE, RAT (2957)
ETIOLOGY, CLINICAL STUDY (3297)
1-CARBON ENZYME ACTIVITIES, ADMINIS-
TRATION OF HEPATOCARCINOGENS, RAT
(3022)*
CARCINOGENESIS
2-ACETYLAMINOFLUORENE, 3-METHYL-
CHOLANTHRENE, DNA-BINDING,
RNA-BINDING, RAT (2941)
4-DIMETHYLAMINOAZOBENZENE, RNA
POLYMERASE SUPPRESSION, NITRO-
FURAN, RAT (2946)
- CARCINOMA
CIRRHOSES, INCIDENCE, ISRAEL
(3254)
MESOTHELIOMA, INTERSTITIAL CELL
TUMOR, NITROSAMINE, GENITAL
MESOTHELIUM, RAT (2951)
CATALASE, IMPAIRED SYNTHESIS, RAT
(3491)*
CATALASE-DEPRESSING FACTOR, FRIEND
VIRUS INFECTION, SPLEEN, MOUSE
(3077)
CHOLESTEROL SYNTHESIS, FEEDBACK
CONTROL, HEPATOMA, HUMAN (3401)*
DNA REPAIR SYNTHESIS, 3'-METHYL-4-
DIMETHYLAMINOAZOBENZENE, RAT (2979)
HEPATOBLASTOMA, STRUCTURE, EPITHELIAL
TYPE, CASE REPORT (3332)*
HEPATOCELLULAR CARCINOMA, HEPATITIS
ASSOCIATED ANTIGEN AND ANTIBODY,
HUMAN (3166)
HEPATOMA INDUCTION, RESISTANCE,
4-DIMETHYLAMINOAZOBENZENE, BLOOD
TRANSFUSION, RAT (2931)
MALIGNANT HEMANGIOENDOTHELIOMA,
CHRONIC ARSENICISM, HUMAN (3017)*
METHYLCHOLANTHRENE, BINDING AND
DISTRIBUTION, RAT (2953)
3'-METHYL-4-DIMETHYLAMINOAZOBENZENE,
CARCINOMA, AGE, SEX, RAT (2967)
MICROSOMES, ANTIGENICITY,
2':3 DIMETHYL-4-AMINOAZOBENENE,
MOUSE (2930)
MORRIS HEPATOMA, PHYTOSTEROL, RAT
(3301)
PARTIAL HEPATECTOMY, NUCLEIC ACID,
URETHAN BINDING, MOUSE (2933)
PRECANCEROUS, METABOLIC CONTROLS,
CHOLESTEROL SYNTHESIS,
N-2-FLUORENYLACETAMIDE, RAT (2963)
PRIMARY CARCINOMA
ALPHA-FETOGLOBULIN, HUMAN (3219)*
PATHOLOGY, CASE REPORTS (3337)*
PROLIFERATIVE RESPONSE, CYTOPLASMIC
MASS, RAT (3441)*
REGENERATION
AMINOACYL SYNTHETASES, ISOACCEPT-
ING TRANSFER RNA, RAT (3359)*
NUCLEAR PROLIFERATION, DNA, MOUSE
(3390)*
TUMOR

FINE STRUCTURAL CHANGES, MICRO-SOMAL HYPOFUNCTION, RAT (3379)*
 HEPATIC CATALASE ACTIVITY, OXIDATION INHIBITION, RAT (3322)*
 TYROSINE TRANSAMINASE REGULATION, HEPATOMA CELLS, RAT (3295)
 VIRAL HEPATITIS, CIRRHOSIS, PRIMARY CANCER, IVORY COAST (3255)

ALVEOLAR CELL CARCINOMA, ULTRA-STRUCTURE, HUMAN (3497)*
 BRONCHIAL CARCINOMA
 ANALYSIS OF CASES (3259)
 CYTOSTATIC TREATMENT, IMMUNOLOGICAL BEHAVIOR, HUMAN (3216)*
 SEX RATIO, INCIDENCE, WORLD-WIDE DIFFERENCES (3261)
 BRONCHOPULMONARY, ONCOGENESIS, HORMONAL ASPECT, HUMAN (3365)*
 BRONCHOPULMONARY CANCER CELLS, BLOOD STREAM, HUMAN (3363)*
 CANCER
 BLOOD AND URINARY TRACE ELEMENTS, METABOLIC DISORDERS (3574)*
 CYTOLOGIC IMMUNOLOGICAL TESTS, HUMAN (3221)*
 ENVIRONMENTAL INFLUENCE, INCIDENCE ITALY (3267)
 INCIDENCE, JAMAICA (3253)
 METASTASES, CRANIAL BASIS (3576)*
 7-NITROQUINOLINE-1-OXIDE, LACTATE DEHYDROGENASE ACTIVITY, MOUSE (2982)
 PERIPHERAL CATHETERIZATION, CYTOLOGICAL FEATURES, HUMAN (3562)*
 RATS, URANIUM DUST RADON, INHALATION (3028)
 SMOKING METHODS, HUMAN, REVIEW (2901)
 CARCINOMA
 COINCIDENT TUBERCULOSIS, HUMAN (3446)*
 GROWTH HORMONE, HUMAN (3023)*
 NECROPSY FINDINGS, HUMAN, REVIEW (2902)
 FETAL TISSUE, DDT ADMINISTRATION, MOUSE (2995)
 LEWIS CARCINOMA, GROWTH, TREATMENT, CYCLOPHOSPHAMIDE SENSITIVITY, MOUSE (3377)*
 LOCAL METASTASIS OF PRIMARY LUNG TUMOR (3592)*
 LYMPHANGIOMA, TUBEROUS SCLEROSIS, CASE REPORT (3334)*

LYMPHOMA, ADENOMA, NITROSAMIDE FORMATION, METHYLUREA, ETHYLUREA, NITRITE, MOUSE (2966)
 PLEURAL-PULMONARY MALIGNANCY, ASBESTOS RELATIONSHIP, LIGURIA (3016)*
 PULMONARY CYTOLOGY, STUDY METHOD, RAT, HAMSTER (3405)*
 PULMONARY METASTASES, SOLID MALIGNANT TUMOR, INHIBITION BY INTERFERON, MOUSE (3341)*
 TUMOR INDUCTION, MALIGNANT LYMPHOMA, METRONIDAZOLE, MOUSE (2999)
 YOSHIDA SARCOMA METASTASES, E-AMINO-CAPROIC ACID ADMINISTRATION, SINTROM RAT (3439)*
 LYMPH NODE
 HUMAN, NORMAL LYMPHOMA, MALIGNANT LYMPHOMA, ORGAN CULTURE (3571)*
 HYPERPLASIA, HYALINE-VASCULAR AND PLASMA CELL TYPES, CASE REPORTS (3363)*
 INVASION, CANCER OF TONGUE, HUMAN (3344)*
 LYMPHOCYTE, TUMOR CELL, MAMMARY GLAND HUMAN (3191)
 SYNGENEIC LYMPHOMA, CELLS, MOUSE (3492)*
 LYMPHANGIOMA
 MESOCYSTIC, CHILDREN (3349)*
 LYMPHANGIOMYOMA
 TUBEROUS SCLEROSIS, CASE REPORT (3334)*
 LYMPHANGIOSARCOMA
 IDIOPATHIC LYMPHOEDEMA, CHRONIC CONGENITAL, HUMAN (3422)*
 LYMPHOCYTE
 BLOOD, ULTRASTRUCTURE, LYMPHOCYTIC AND LYMPHOSARCOMA CELL LEUKEMIA, HUMAN (3339)*
 CHROMATIN ALTERATIONS, CHRONIC LEUKEMIA, HUMAN (3505)*
 CYTOTOXIC ACTIVITY DEVELOPMENT, LEUKEMIA CELLS, MOUSE (3196)
 CYTOTOXICITY OF AFLATOXIN B1, PHYTO-HEMAGGLUTININ CULTURE (3018)*
 IMPAIRED TRANSFORMATION, ACUTE LYMPHATIC LEUKEMIA, HUMAN (3210)
 INHIBITION, PLASMA, CARCINOEMBRYONIC ANTIGEN, SERUM ALPHA-GLOBULIN, COLON CANCER, HUMAN (3181)
 LYMPH NODE, TUMOR CELL, MAMMARY GLAND, HUMAN (3191)
 MIXED REACTION, CALCIUM, MAGNESIUM, CYCLIC ADENOSINE 3',5'-MONOPHOSPHATE HUMAN (3186)

- PHA STIMULATION, INFLUENCE OF
HODGKIN'S DISEASE SERUM, HUMAN
(3165)
- T CELLS, B CELLS, KILLING OF ALLOGENIC
TARGET CELLS, MOUSE (3226)*
- TRANSFORMED, PHYTOHEMAGGLUTININ,
ENDOCYTOSIS, LYSOSOME FORMATION
(3435)*
- LYMPHOGRANULOMATOSIS
BLOOD SERUM PROTEINS, IMMUNOELECTRO-
PHORETIC STUDIES, HUMAN (3217)*
- LYMPHOMA
ACTIVE RIBOSOME SUBUNITS, MOUSE
(3460)*
- CELL-COLONIES, ALKYLATING AGENTS,
MOUSE (3466)*
- GRAFT REJECTION, ANTIBODY, COMPLEMENT,
MOUSE (3182)
- HERPES ZOSTER-VARICELLA INFECTION,
HODGKIN'S DISEASE, ANALYSIS (3208)
- HISTIOCYTIC TYPE, SCLEROSING RETICULUM
CELL SARCOMA, CASE REPORTS (3356)*
- HODGKIN'S-LIKE, BIOLOGICAL, HISTO-
LOGICAL AND ULTRASTRUCTURAL ASPECTS,
MICE (3572)*
- IMMUNOGLOBULIN RECEPTOR, MOUSE (3184)
- INCREASED INCIDENCE, THYMECTOMIZED
MICE (3206)
- INTESTINAL, MALABSORPTION, INCIDENCE,
MEDITERRANEAN POPULATIONS (3271)
- MALIGNANT
CHROMOSOMES, FLUORESCENT PATTERN,
HUMAN (3309)
- CYTOGENETICS, CASE REPORTS (3317)
- HUMAN LYMPH NODES, ORGAN CULTURE
(3571)*
- TUMOR INDUCTION, METRONIDAZOLE,
MOUSE (2999)
- MEDITERRANEAN ABDOMINAL, MALABSORPTION
PATHOLOGY, ISRAEL (3231)
- SERUM COPPER MEASUREMENT, HUMAN
(3408)*
- SPONTANEOUS DEVELOPMENT, MOUSE (3223)*
- T CELL, B CELL, MOUSE (3179)
- TESTICULAR
CASE REPORT (3333)*
HUMAN (3328)*
- THYMUS, CHEMICALLY AND GAMMA-
IRRADIATION INDUCED, IMMUNOLOGIC
PROPERTIES, MOUSE (3227)*
- LYMPHORETICULOSARCOMA
SMALL INTESTINE, CASE REPORT (3369)*
- LYMPHOSARCOMA
BOVINE, C-TYPE VIRUS-LIKE PARTICLES,
INOCULATION, CALVES (3113)
- CELL LEUKEMIA, BLOOD LYMPHOCYTES,
ULTRASTRUCTURE, HUMAN (3339)*
- METASTASIS, TEMPORAL BONE, HUMAN
(3542)*
- MOLONEY VIRUS, GROWTH, ULTRASTRUCTURE,
MOUSE (3097)
- RETICULOSARCOMA, TUMOR CELL KINETICS
(3573)*
- SMALL INTESTINE, CLINICOPATHOLOGIC
STUDY, HUMAN (3381)*
- LYPOSARCOMA
TISSUE CULTURE STUDY, MIXOID AND
PLEOMORPHIC FORMS (3570)*
- LYSOSOME
FORMATION, ENDOCYTOSIS, LYMPHOCYTE
TRANSFORMATION, PHYTOHEMAGGLUTININ
(3435)*
- MALIGNANT DISEASE
METASTATIC, CARDIAC LYMPHATIC INVOLVE-
MENT, HUMAN (3388)*
- PNEUMOCYSTIS CARINII, CHILDREN (3387)*
- MALIGNANT MELANOMA
BONE METASTASES, HUMAN (3490)*
- COLLAGENASE DISTRIBUTION, ACID PHOS-
PHATASE ACTIVITY, HUMAN (3528)*
- MAMMARY GLAND
BREAST CANCER ETIOLOGY, VIRUS LIKE
PARTICLES, CHRONIC MASTITIS, HUMAN
(3056)
- CARCINOMA
METASTASES, CHROMOPHOBE ADENOMA,
HYPOPHYSIS, HUMAN (3436)*
- MITOCHONDRIA, IMMUNOLOGY, MOUSE
(3202)
- MORPHOLOGY, HORMONAL CONTRACEPTIVE
HUMAN (2973)
- SKELETAL METASTASES, HUMAN (3489)*
- CARCINOMA VIRUS, ONCOGENIC RNA VIRUSES
ULTRASTRUCTURAL COMPARISON, MONKEY
(3116)
- PRENEOPLASTIC, NEOPLASTIC, NUCLEAR
MAGNETIC RESONANCE SPECTROSCOPY,
MOUSE (3230)
- SPONTANEOUS TUMORS, INHIBITION, AGING
OF INHIBITOR EFFECT, MOUSE (3451)*
- TUMOR
7,12-DIMETHYLBENZ(A)ANTHRACENE,
REGRESSION AND RECURRENCE, RAT
(3013)
- 3-METHYLCHOLANTHRENE TREATMENT,
SERIAL TRANSPLANTATION, MOUSE
(3004)
- PROLACTIN, MOUSE (2942)
- REGRESSION, 7,12-DIMETHYLBENZ-
ANTHRACENE, ERGOCORNINE, RAT

(2929)
 URETHAN-INDUCTION, SERIAL TRANS-
 PLANTATION, MOUSE (3003)
 TUMOR CELL, LYMPHOCYTE, LYMPH NODE,
 HUMAN (3191)
 TUMOR CELL LINE, VIRUS PRODUCTION,
 KINETICS, MOUSE (3049)
 TUMOR VIRUS, REPLICATION, GROWTH
 REGULATION, MOUSE (3067)
 TUMORIGENESIS, PHENYLALANINE
 DEFICIENCY, PITUITARY ISOGRAFT,
 MOUSE (2932)
 TUMORIGENESIS INHIBITION, ERGOT
 ALKALOIDS, MOUSE (2975)
 TUMORIGENESIS PROMOTION, PITUITARY
 ISOGRAFTS, MOUSE (2975)
 ECK'S DISEASE
 AVIAN NEUROLYMPHOMATOSIS, CHICK
 (3084)
 T CELL
 MASTOCYTOMA, IMMUNOGLOBULIN RECEPTOR,
 MOUSE (3180)
 ANOBLASTOMA
 CEREBRAL LEPTOMENINGES, REVIEW (2911)*
 ANOMA
 INCIDENCE, SUNLIGHT, OCCUPATIONAL
 EXPOSURE, ENGLAND, SWEDEN (3252)
 INDUCTION, GARDNER-FELINE FIBROSARCOMA
 VIRUS, GNOTOBIOTIC, CAT (3066)
 MALIGNANT COLLAGENASE DISTRIBUTION,
 ACID PHOSPHATASE ACTIVITY, HUMAN
 (3528)*
 METASTASES, BONE, HUMAN (3490)*
 METASTATIC, PRESENCE OF SEX CHROMATIN,
 CASE REPORT (3338)*
 PROPAGATION, CHOROID MEMBRANE, HISTO-
 PATHOLOGY, CASE REPORT (3371)*
 ARANE
 ALTERATIONS, TRANSFORMATION, SV40,
 HUMAN, HAMSTER (3094)
 DIONE
 AFFINITY LABEL SYNTHESIS, MYELOMA
 PROTEIN REACTION (3532)*
 ANGIOBLASTIC, HEPATIC METASTASIS, CASE
 REPORTS (3392)*
 HISTOCHEMISTRY, BIOPSY, HUMAN (3548)*
 THELIOMA
 ASBESTOS, INCIDENCE, SCOTLAND (3270)
 GENITAL, NITROSAMINE, LIVER NEOPLASM,
 RAT (2951)
 LARGE OMENTUM, CASE REPORT (3567)*
 BOLISM
 CARBOHYDRATE, NEOPLASTIC PROCESS,
 HUMAN (3313)

METASTASIS
 BLOOD, ORGAN, PRIMARY BROWN-PEARCE
 CARCINOMA, RABBIT (3516)*
 BLOOD BORNE, MALIGNANT EPITHELIAL
 TUMORS, HISTOGENESIS, HUMAN (3560)*
 CANCER, SERUM ALKALINE PHOSPHATASE
 ISOENZYMES, RELATIONSHIP (3556)*
 CERVICAL LYMPH NODE, HUMAN (3421)*
 CHOROID, HUMAN (3527)*
 GASTRIC CARCINOMA, HYPERNEPHROID
 CANCER, KIDNEY, CASE REPORT (3554)*
 MALIGNANT LYMPHOSARCOMA, TEMPORAL BONE
 HUMAN (3542)*
 MALIGNANT MELANOMA, BONE, HUMAN
 (3490)*
 MAMMARY CARCINOMA, CHROMOPHOBE ADENOMA
 HYPOPHYSIS, HUMAN (3436)*
 MANDIBULAR AMELOBLASTOMA, LUNGS, LYMPH
 NODES, CASE REPORT (3522)*
 MECHANISMS OF ESTABLISHMENT, REVIEW
 (2908)
 NEUROBLASTOMA, MANDIBLE, CASE REPORT
 (3419)*
 TUMOR, CARDIAC LYMPH INVOLVEMENT,
 HUMAN (3388)*
 VESTIBULAR LARYNX CANCER, HUMAN
 (3552)*
 7-METHYLBENZ(A)ANTHRACENE
 EPOXIDES, FRAMESHIFT MUTAGEN,
 SALMONELLA (2984)
 METHYLCHOLANTHRENE
 BINDING AND DISTRIBUTION, LIVER, RAT
 (2953)
 3-METHYLCHOLANTHRENE
 CONTACT SENSITIVITY INDUCTION,
 TOLERANCE, GUINEA PIG (2937)
 DECIDUOMATA MAINTENANCE MECHANISM,
 PROGESTIN SECRETION, RAT (3006)
 DNA-BINDING, RNA-BINDING,
 2-ACETYLAMINOFLUORENE, LIVER, RAT
 (2941)
 FIBROSARCOMA, NEURAMINIDASE EFFECT,
 GROWTH, RAT (2968)
 MAMMARY NODULE TREATMENT, SERIAL TUMOR
 TRANSPLANTATION, MOUSE (3004)
 SARCOMA, CARCINOGENESIS INHIBITION,
 VACCINE, VIRUS, MOUSE (2964)
 TUMOR REGRESSION, NEURAMINIDASE,
 BACILLUS CALMETTE-GUERIN, MOUSE
 (3199)
 VACCINIA VIRUS, COMBINED CARCINO-
 GENICITY, GENETIC FACTOR, MOUSE
 (3121)
 20-METHYLCHOLANTHRENE
 TUMORIGENESIS, PERSISTENT ESTRUS,

- ESTROGEN DEFICIENCY, RAT (2943)
- 1-METHYLCYTOSINE
BENZO(A)PYRENE, PHOTOCHEMICAL
COUPLING, PHOTOENHANCEMENT OF
CARCINOGENICITY (3025)*
- 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE
CARCINOMA, LIVER, AGE, SEX, RAT
(2967)
- DNA REPAIR SYNTHESIS, LIVER, RAT
(2979)
- METHYLNITROSOUREA
CELL CYCLE DEPRESSION, DNA SYNTHESIS,
MOUSE EMBRYO (2934)
- N-METHYL-N-NITROSOUREA
MUTAGEN ACID, ALKYLATION (2971)
- METHYL STEARATE
CARCINOGENESIS, ACTIVITY BIOASSAY,
MOUSE (2981)
- METHYLUREA
LUNG ADENOMA INDUCTION, NITROSAMIDE
FORMATION, MOUSE (2966)
- MICROSOME
LIVER, DRUG METABOLIZING ENZYMES,
EFFECT OF HEPATOMA ASCITES FLUID,
RAT (3460)*
- METROI.DIAZOLE
LUNG TUMOR INDUCTION, MALIGNANT
LYMPHOMA, MOUSE (2999)
- MINERAL OIL
CANCER OF THE SCROTUM, NETHERLANDS
(3024)*
- MUCOPOLYSACCHARIDE
PANCREATIC CANCER, HUMAN (3488)*
- MULTIPLE MYELOMA
HISTOMETRICAL GLOMERULAR STUDIES,
KIDNEYS, HUMAN (3453)*
- HYPOSENSITISATION, HUMAN (3520)*
- MUTAGENESIS
DIMETHYL SULPHATE,
N-METHYL-N-NITROSOUREA, NUCLEIC
ACID, ALKYLATION (2971)
- MUTAGENICITY
FRAMESHIFT MUTAGENS, CARCINOGENIC
POLYCYCLIC HYDROCARBONS, EPOXIDES,
SALMONELLA (2984)
- MUTATION
TEMPERATURE-SENSITIVE EXPRESSION,
CELL TRANSFORMATION, SV40, MOUSE
(3055)
- MYASTHENIA GRAVIS
THYMECTOMY, TUMOR INCIDENCE, HUMAN
(3189)
- MYELOMA
CULTURED CELLS, GROWTH CHARACTERISTICS
MOUSE (3498)*
- MULTIPLE
HODGKIN'S DISEASE, HL-A ANTIGEN,
ANALYSIS (3222)*
- HYPOSENSITISATION, HUMAN (3520)*
- PROTEIN, LIGAND BINDING SITES, AUTO-
IMMUNE-LIKE ANTIBODIES, MOUSE (3158)
- MYELOPROLIFERATIVE DISEASE
LEUKEMIA, SERUM MURAMIDASE, CASE
REPORTS (3233)
- PRE-LEUKEMIC STATE, CHILDHOOD, MISSING
BONE MARROW C CHROMOSOME, CASE
REPORT (3232)
- MYOBLASTOMA
GRANULAR CELL, ULTRASTRUCTURE, HUMAN
(3468)*
- MYXOMA
INTRACARDIAC, FAMILIAL, HUMAN (3445)*
- NASOPHARYNGEAL CARCINOMA
ULTRASTRUCTURE, CELL CULTURES, HUMAN
(3402)*
- NEOPLASIA
PRIMARY, MULTIPLE, HUMAN (3345)*
- NEOPLASM
ARGININE, ALBUMIN FRACTION, HUMAN
(3471)*
- EPIDEMIOLOGIC STUDY, INCIDENCE,
SARDINIA (3285)*
- HEMATOPOIETIC, LIZARD (3513)*
- MALIGNANT, MORTALITY, U.S.S.R. (3279)*
- MALIGNANT AND BENIGN, FEMALE GENITAL
ORGANS, ERYTHROCYTIC AND PLASMATIC
POTASSIUM, AND SODIUM LEVELS (3578)*
- MAST CELLS, GLYCOSPHINGOLIPIDS, AMINES
MOUSE (3424)*
- MEDIASTINAL ENDOCRINE
CARCINOID TUMOR, HUMAN (3525)*
- MULTIPLE ADENOMATOSIS, CASE REPORT
(3521)*
- MESENCHYMAL, OYSTER (3397)*
- PRIMARY PAPILLOMA OF CEREBELLOPONTINE
ANGLE WITH METASTASES TO CEREBRAL
HEMISPHERE, FREQUENCY, PATHOLOGICAL
CHARACTERISTICS (3599)*
- NEPHROBLASTOMA
HISTOLOGY, HUMAN (3454)*
- NERVOUS SYSTEM
EPENDYMOMA, ULTRASTRUCTURE, HUMAN
(3457)*
- NEOPLASTIC AND PARANEOPLASTIC,
PERIPHERAL DISEASES, HUMAN (3558)*
- TUMORS
N-ACETYL-L-ASPARTIC ACID CONTENT,
HUMAN, BOVINE (3324)*
- INCIDENCE, ISRAEL (3260)
- LACTATE DEHYDROGENASE ISOENZYMES,

HUMAN (3425)*
 URANINIDASE
 BACILLUS CALMETTE-GUERIN, 3-METHYL-
 CHOLANTHRENE, TUMOR REGRESSION,
 MOUSE (3199)
 LYMPHOID CELL, SURFACE ANTIGEN, HUMAN
 (3163)
 URINOMA
 HISTOGENESIS, HUMAN (3243)*
 UROBLASTOMA
 DIBUTYRYL ADENOSINE 3':5'-CYCLIC
 MONOPHOSPHATE, X-IRRADIATION,
 DIFFERENTIATION, MOUSE (2924)
 MANDIBLE, METASTATIC, CASE REPORT
 (3419)*
 VITAMIN B12 DISTRIBUTION, INFANT
 (3503)*
 RNA
 ESTABLISHMENT IN VITRO, ULTRASTRUCTURE,
 HUMAN (3360)*
 SUPERFICIAL AMPUTATION, ENUCLEATION,
 HUMAN (3549)*
 RIT
 LUNG ADENOMA INDUCTION, NITROSAMIDE
 FORMATION, MOUSE (2966)
 ITROPERBENZOIC ACID
 CARCINOGENESIS, ACTIVITY BIOASSAY,
 MOUSE (2981)
 ITROQUINOLINE-1-OXIDE
 RNA
 PROTEIN, SCISSION, REPAIR, MOUSE
 (2936)
 SCISSION, REPAIR, MOUSE (3005)
 RNA BINDING ABILITY, CARCINOGENIC
 ACTIVITY, EHRlich ASCITES CELLS
 (2983)
 IMMUNE SUPPRESSION, MOUSE (2977)
 LUNG CANCER, LACTATE DEHYDROGENASE
 ACTIVITY, MOUSE (2962)
 MALIGNANT TRANSFORMATION, PULMONARY
 AND EMBRYONIC CELLS, MOUSE (2985)
 ROSAMINE
 LUNG ADENOMA INDUCTION, METHYLUREA,
 ETHYLUREA, NITRITE, MOUSE (2966)
 NITROSOPYRROLIDINE, NEOPLASMS, LIVER,
 GENITAL MESOTHELIUM, RAT (2951)
 ITROSAMINE
 CIGARETTES, SMOKE CONDENSATE (2954)
 ITROSOMETHYLUREA
 RNA METHYLASE ACTIVITY, CELLS,
 HAMSTER (3009)
 ROSOUREA
 BRAIN TUMORS, GLIOMAS, PATHOGENESIS,
 RAT (3014)*
 LIC ACID

KINETICS, CANCER CELLS, HUMAN (3305)
 SYNTHESIS, PYRIMIDINE UTILIZATION,
 CATABOLISM (3540)*
 NUCLEOLUS
 CYTOPLASMIC FIBRILLAR BODIES, HEPATO-
 CELLULAR CARCINOMA, ULTRASTRUCTURE,
 HUMAN (3358)*
 OCCUPATIONAL HAZARD
 BENZENE, ACUTE LEUKEMIA, CASE REPORTS
 (2976)
 CANCER, CHEMICAL INDUSTRY, EPIDEMIO-
 LOGIC STUDY, GERMANY (3234)*
 CARCINOGENIC AROMATIC AMINES, URINARY
 CYTOLOGY (2987)
 COAL BRIQUETTE PRODUCTION, PREVENTIVE
 MEASURES, RUSSIA (3021)*
 ETHMOID ADENOCARCINOMA, WOODWORKERS
 (3247)
 SUNLIGHT EXPOSURE, MALIGNANT MELANOMA
 INCIDENCE, ENGLAND, SWEDEN (3252)
 ONCOLOGY
 IMMUNOLOGICAL PROBLEMS, REVIEW (2903)
 ORAL CONTRACEPTIVE
 BREAST, PATHOLOGICAL CHANGES (3240)
 ORAL MUCOSA
 CARCINOMA, VINCENT'S ULCEROUS NECROTIC
 GINGIVITIS, STOMATITIS, CYTOLOGICAL
 STUDIES, HUMAN (3483)*
 OSTEOSARCOMA
 FBV VIRUS TUMOR INDUCTION, HISTO-
 PATHOLOGY, HUMAN, MOUSE (3071)
 VIRAL ETIOLOGY, REVIEW (2905)
 OVARY
 TUMOR, HUMAN (3499)*
 PAGET'S DISEASE
 PERIANAL, ULTRASTRUCTURE, HUMAN
 (3413)*
 SACRUM, SARCOMATOUS DEGENERATION,
 CASE REPORT, REVIEW (2912)*
 PANCREAS
 ADENOACANTHOMA, HUMAN (3412)*
 CANCER, MUCOPOLYSACCHARIDE CONTENT,
 HUMAN (3488)*
 PANCREATIC ISLET CELLS, BETA CELL
 TUMORS, ULTRASTRUCTURE, HUMAN
 (3442)*
 PAPILLARY ADENOMA
 NIPPLE, CLINICOPATHOLOGIC STUDY, HUMAN
 (3524)*
 PAPILLOMA
 EPIDERMAL, QUININE-SULFATE TREATMENT,
 REVERSION OF GROWTH, EEL (3362)*
 PAROTID
 ANGIOMA, CASE REPORTS (3565)*
 LIPOMA, CASE REPORT (3564)*

PATHOGENESIS
 HODGKIN'S DISEASE, HYPOTHESIS, VIRAL
 INFECTION, HOST IMMUNITY (3237)
 PERITONEUM
 TUMOR, ADENOVIRUS TYPE 12, TRANS-
 FORMATION, HAMSTER (3078)
 PHAGOCYTOSIS
 OPSONIN CHANGES, CELLULAR INFLUENCES,
 TRANSPLANTABLE TUMOR GROWTH, RAT
 (3192)
 PHARYNX
 CANCER, PATTERN OF LYMPHATIC SPREAD,
 HUMAN (3395)*
 PHENMETRAZINE
 CONVERSION, N-NITROSO DERIVATIVE,
 RABBIT (2978)
 PHENYLALANINE
 DEFICIENCY, MAMMARY TUMORIGENESIS,
 PITUITARY ISOGRAFT, MOUSE (2932)
 PHEOCHROMOCYTOMA
 ADRENAL AND EXTRA-ADRENAL,
 BIOCHEMISTRY, ULTRASTRUCTURE, CASE
 REPORTS (3372)*
 ATYPICAL, HUMAN (3482)*
 BENIGN, MALIGNANT, DNA CONTENT,
 CYTOPHOTOMETRIC STUDY (3291)
 PHORBOL ESTER
 SKIN, TUMORIGENESIS, MOUSE (2927)
 PHYTOHEMAGGLUTININ
 LYMPHOCYTE TRANSFORMATION, LYSOSOME
 FORMATION, ENDOCYTOSIS (3435)*
 PITUITARY
 LYMPHOID SYSTEM, IMMUNODEFICIENCY,
 DWARF MOUSE, AMES (3229)*
 PITUITARY GLAND
 ISOGRAFT, MAMMARY TUMORIGENESIS,
 PHENYLALANINE DEFICIENCY, MOUSE
 (2932)
 PLASMA
 LYMPHOCYTE INHIBITION, CARCINO-
 EMBRYONIC ANTIGEN, SERUM ALPHA-
 GLOBULIN, COLON CANCER, HUMAN (3181)
 PLASMA MEMBRANE
 ALKALINE PHOSPHATASE ACTIVITY, LIVER,
 RAT (3450)*
 PNEUMONIA
 PNEUMOCYSTIS CARINII, MALIGNANT
 DISEASE, CHILDREN (3387)*
 POLYADENYLIC ACID
 CHEMICAL, PHOTOCHEMICAL AND PHYSICAL
 PROPERTIES, N-ACETOXY-2-ACETYLAMINO-
 FLUORENE TREATMENT (2994)
 POLYCATION
 MYXOMA VIRUS INFECTION, RESTRICTION,
 RABBIT (3143)
 POLYCYCLIC HYDROCARBON
 EPOXIDES, FRAMESHIFT MUTAGENS,
 SALMONELLA (2984)
 POLYLYSINE
 RESTRICTION OF MYXOMA VIRUS INFECTION,
 RABBIT (3143)
 POLYORNITHINE
 RESTRICTION OF MYXOMA VIRUS INFECTION,
 RABBIT (3143)
 PRECANCEROUS CONDITION
 DUBREUILH MELANOSIS, MUCOUS MEMBRANE,
 ULTRASTRUCTURE, HISTOLOGY (3235)
 HORMONE DISTURBANCES, WOMEN (3236)
 PROGESTERONE
 CARCINOGENESIS, MAMMARY TUMOR,
 PROLACTIN, PITUITARY, MOUSE (2950)
 PROLACTIN
 CARCINOGENESIS, MAMMARY TUMOR, MOUSE
 (2942)
 PROLIFERATION
 CELL, PANCREATIC ACINAR EPITHELIA,
 AUTORADIOGRAPHIC STUDIES,
 3H-THYMIDINE, RAT (3242)*
 GLIA-LIKE CELLS, HUMAN (3420)*
 MESOTHELIAL CELLS, INTRAPERITONEAL
 ENDOTOXIN INJECTION, RAT (3535)*
 NEOPLASTIC CELLS, ACTINOMYCIN D,
 FLAVONOID COMPOUNDS (3366)*
 PROSTAGLANDIN
 PRODUCTION, INHIBITION, FIBROSARCOMA
 CELLS, MOUSE (3351)*
 PROSTATE
 CARCINOMA, SERUM COMPLEMENT LEVEL,
 HUMAN (3177)
 MALIGNANT, NORMAL, ANTIGENIC
 DEFICIENCY, HUMAN (3187)
 MALIGNANT AND NON-MALIGNANT TISSUE,
 LIPOFUSCIN, HUMAN (3476)*
 PROSTATIC
 ADENOCARCINOMA, METASTASIS, TEMPORAL
 BONE (3575)*
 PROTEIN
 BLOOD SERUM, MALIGNANT LYMPHOGRANULO-
 MATOSIS, IMMUNOELECTROPHORETIC
 STUDIES, HUMAN (3217)*
 BLOOD SERUM FRACTIONS, PROPERDIN TITER
 GASTROINTESTINAL CANCER, HUMAN
 (3553)*
 CORE, STRUCTURE, ADENOVIRUS TYPES 2
 AND 3, PROPERTIES (3095)
 DNA, SCISSION, REPAIR,
 4-NITROQUINOLINE-1-OXIDE, MOUSE
 (2936)
 MYELOMA
 ENVIRONMENTAL ANTIGEN, MOUSE

(3190)
 HAPTEN-BINDING SITE, ANTI-
 IDIOTYPIC ANTIBODY, RABBIT
 (3175)
 LIGAND BINDING SITES, AUTOIMMUNE-
 LIKE ANTIBODIES, MOUSE (3158)
 SERUM, UROGENITAL TUMOR, CLINICAL
 STUDY, HUMAN (3544)*
 SV40-INDUCED, CV-1 CELLS (3038)
 SYNTHESIS, SV40 INFECTION, CELLS,
 MONKEY (3140)
 LUNARY METASTASIS
 PRIMARY LUNG NEOPLASIA (3592)*
 DIATION
 ATOMIC BOMB, TUMOR, INCIDENCE, HUMAN,
 REVIEW (3027)
 ATOMIC BOMB SURVIVORS, CANCER (3032)*
 ATOMIC ENERGY LEVEL CHANGES, 40 K,
 CARCINOGENESIS, REVIEW (2904)
 LIVER CELLS, OXYGEN CONSUMPTION,
 RESPIRATORY CONTROL, RAT (3030)*
 SKIN, SWEAT GLAND CARCINOMA, HUMAN
 (3031)*
 TRITON X-100, ACID PHOSPHATASE, BRAIN
 TUMORS, RAT (3376)*
 ULTRAVIOLET
 INACTIVATION OF MOLONEY LEUKEMIA
 VIRUS, REPLICATION, ABILITY TO
 RESCUE MSV (3111)
 SV40, TUMORIGENIC ACTIVITY,
 HAMSTER (3092)
 X-RAY
 CARCINOGENESIS, LOW DOSE, RAT
 (3029)
 N,N'-2,7-FLUORENYLENEBISACETAMIDE,
 ADENOCARCINOMA, STOMACH, RAT
 (2960)
 NEUROBLASTOMA, DIFFERENTIATION,
 MOUSE (2924)
 TUM
 CARCINOID TUMOR, HUMAN, REVIEW (2920)*
 COLON, CARCINOMA, INCIDENCE,
 GERMANY (3282)*
 REGENERATION
 LIVER, NUCLEIC ACID, URETHAN BINDING,
 MOUSE (2933)
 REPRESSION
 TUMOR, 3-METHYLCHOLANTHRENE, NEUR-
 AMINIDASE, BACILLUS CALMETTE-GUERIN,
 MOUSE (3199)
 PRODUCTIVE ORGANS
 ATOMIC BOMB RADIATION, TUMOR,
 INCIDENCE, HUMAN, REVIEW (3027)
 ISTANCE
 TOXIC ANTINEOPLASTIC AGENTS, NORMAL
 EMBRYONAL TISSUE, POLYOMA VIRUS
 TRANSFORMED CELLS, MOUSE, HAMSTER
 (3147)*
 RESPIRATORY TRACT
 7H-DIBENZO(C,G)CARBAZOLE, CARCINOGEN-
 ICITY, EPITHELIUM, HAMSTER (2940)
 TOXICITY, CILIARY MOVEMENT, CIGARETTE
 SMOKE, CAT (2939)
 RETICULOSARCOMA
 LYMPHOSARCOMA, TUMOR CELL KINETICS
 (3573)*
 RETICULUM CELL
 SARCOMA, PLACENTAL METASTASIS, CASE
 REPORT (3368)*
 RETINOBLASTOMA
 IRIS NEOVASCULARIZATION, ULTRASTRUCTURE,
 HUMAN (3352)*
 RHABDOMYOSARCOMA
 C-TYPE VIRUS, CHROMOSOMES, HUMAN
 (3076)
 EMBRYONAL, MIDDLE EAR, CASE REPORT,
 HUMAN (3386)*
 RIFAMPICIN
 INHIBITORY EFFECT, RAUSCHER-VIRUS-
 INDUCED LEUKEMIA, MOUSE (3136)
 RNA
 AVIAN MYELOBLASTOSIS VIRUS, IN VITRO
 PROTEIN SYNTHESIS, GEL ELECTRO-
 PHORESIS, RADIOIMMUNE ASSAY,
 FERRITIN, E. COLI (3068)
 COMPLEMENTARY RNAS, MURINE MYELOMA DNA
 TEMPLATES (3074)
 EQUINE ABORTION VIRUS-SPECIFIC,
 HYBRIDIZATION, MOUSE (3087)
 HUMAN LEUKEMIC CELLS, MOUSE LEUKEMIA
 VIRUS, RELATIONSHIP (3131)
 HYBRIDIZATION CHARACTERISTICS, MURINE
 MYELOMA DNA TEMPLATES (3074)
 IMMUNITY MEDIATION, TUMOR-SPECIFIC
 TRANSPLANTATION ANTIGEN, ISOGRAFT
 GROWTH, SPLEEN CELL, RAT (3160)
 ISOACCEPTING TRANSFER, AMINOACYL
 SYNTHETASES, LIVER REGENERATION, RAT
 (3359)*
 MESSENGER, ASCITES CELLS, TRANSLATION
 (3495)*
 PARTIALLY DOUBLE STRANDED, SPLEEN
 CELLS, RAUSCHER VIRUS INFECTION,
 MOUSE (3090)
 POLYMERASE SUPPRESSION,
 4-DIMETHYLAMINOAZOBENZENE, LIVER
 CARCINOGENESIS, NITROFURAN, RAT
 (2946)
 REOVIRUS-SPECIFIC, POLYSOMES, INFECTED
 L CELLS, MOUSE (3105)

- SYNTHESIS, TOBACCO SMOKE CONDENSATE
EFFECT, SKIN, MOUSE (3012)
- TRANSFER
ALTERED PATTERNS, SV40 INFECTED
TRANSFORMED CELLS (3033)
METHIONINE-ACCEPTING, PEPTIDE-
CHAIN ELONGATION, ASCITES TUMOR
CELLS, MOUSE (3534)*
- TRANSFER METHYLASE ACTIVITY, LEUKEMIC
CELLS, MOUSE (3155)*
- URIDINE-3H UPTAKE, HAMSTER CELLS
(3458)*
- VIRUS-SPECIFIC
POLYOMA VIRUS-TRANSFORMED CELLS,
PROPERTIES, HAMSTER, MOUSE
(3109)
ROUS SARCOMA VIRUS CELLS, DETEC-
TION, CHARACTERIZATION (3115)
- SALIVARY GLAND
ATOMIC BOMB RADIATION, TUMOR,
INCIDENCE, HUMAN, REVIEW (3027)
MUCO-EPIDERMAL CARCINOMA, HUMAN
(3529)*
- SARCOMA
INDUCED, SUCCESSIVE TRANSPLANT
GENERATIONS, RAT (3374)*
INDUCTION, DEAE-DEXTRAN, ETHYL-
NITROSOUREA, MOUSE (3001)
LYMPHORETICULAR, SMALL INTESTINE,
CASE REPORT (3369)*
METACHRONOUS ANGIOPLASTIC, STEWART-
TREVES SYNDROME, ETIOLOGY, CLINICAL
SYMPTOMS, PREVENTION (3559)*
NEUROGENIC, ESTABLISHMENT IN VITRO,
ULTRASTRUCTURE, HUMAN (3360)*
RETICULUM CELL
CYTOGENETICS, CASE REPORTS (3317)
PLACENTAL METASTASIS, CASE REPORT
(3368)*
RHODAMINE, CATALASE-DEPRESSING
ACTIVITY, LIVER, RAT (2949)
ROUS, VITAMIN A, ENHANCING EFFECT,
CHICKENS (3112)
SCLEROSING RETICULUM CELL, HISTIOCYTIC
LYMPHOMA, CASE REPORTS (3356)*
SOFT TISSUE, HUMAN (3395)*
TRANSPLANTATION, SPLENECTOMY, MOUSE
(3299)
TUBICULIN
L-AMINOCAPROIC ACID, SINTROM,
BLOOD CLOTTING SYSTEM, RAT
(3434)*
DEOXYTHYMIDINE KINASES, PURIFICA-
TION AND PROPERTIES (3502)*
SARCOMA 180 CELLS
- BRUSH CELL, COMPLEMENT FIXING ANTIBODY
MOUSE (3163)
- SQUAMOUS
CANCER, MINERAL OIL, FARMER, LUNG
(3024)*
- SEMINOMA
CYTOGENETIC ANALYSIS, HUMAN (3318)
- SERUM
COMPLEMENT LEVEL, PROSTATIC CARCINOMA,
HUMAN (3177)
HODGKIN'S DISEASE, PHO-STIMULATED
LYMPHOCYTES, HUMAN (3161)
- SIALIC ACID
BONE TUMORS, HUMAN (3530)*
- SKIN
CANCER
BENZO(A)PYRENE, TAR-CONTAINING
(3000)
EFFECT OF MALE HORMONE, METHYL-
CHOLANTHRINE, MOUSE (2947)
RISK FACTORS (3026)
CARCINOMA, DIMETHYLBENZANTHRACENE,
CASTRATION, RAT (2952)
MALIGNANT MELANOMA, OCCUPATIONAL
EXPOSURE, SUNLIGHT, INCIDENCE,
ENGLAND, SWEDEN (3252)
RADIATION, SWEAT GLAND CARCINOMA,
HUMAN (3031)*
SYNGENETIC TRANSPLANT, HEPATOCARCINO-
GENESIS, MOUSE (3453)*
TUMOR INDUCTION, 7,12-DIMETHYLBENZ(A)-
ANTHRACENE, DOSE LEVEL, RAT (2923)
TUMORIGENESIS, PHORBOL ESTER,
BIOCHEMICAL MECHANISM, MOUSE (2927)
TUMORS, PATHOLOGY, HUMAN (3461)*
UREMIA EFFECT, BASAL CELLS, MOUSE
(3459)*
- SPERM
EXTRAMEDULLARY TUMORS, SUPRAFOCAL
DISORDERS, SUPERFICIAL SENSITIVITY,
HUMAN (3416)*
- SPLEEN
CELLULAR IMMUNITY, INHIBITION,
LEUKEMIA, ISOANTIBODY, MOUSE (3159)
MURINE SARCOMA VIRUS, GUAROA VIRUS,
COINFECTION, MOUSE (3064)
SPLENECTOMY, SARCOMA TRANSPLANTATION,
MOUSE (3299)
SPLENOMEGALY, RAUSCHER LEUKEMIA VIRUS
INFECTION, VIRUS RECOVERY, FETAL
ANTIGEN, SUPPRESSION, MOUSE (3204)
- SQUAMOUS CELL CARCINOMA
ELECTRON MICROSCOPE EXAMINATION, HUMAN
EPIDERMIS, ENDOPLASMIC RETICULUM,
NEOPLASTIC KERATINOCYTES (3579)*

TEARIC ACID
 CARCINOGENESIS, ACTIVITY BIOASSAY,
 MOUSE (2981)
 GAMMA-STEAROLACTONE
 CARCINOGENESIS, ACTIVITY BIOASSAY,
 MOUSE (2981)
 FLUORANTHOCYSTIN
 AFLATOXIN, EFFECT ON PRIMARY CELL
 CULTURES (2959)
 LEROL
 PLANT, MORRIS HEPATOMA, RAT (3301)
 ILGESTROL
 VAGINAL ADENOCARCINOMA, MATERNAL
 THERAPY, CASE REPORTS (3477)*
 SMACH
 ADENOCARCINOMA, X-RAY,
 N,N'-2,7-FLUORENYLENEBISACETAMIDE,
 RAT (2960)
 CANCER
 CASE REPORT (3364)*
 ENVIRONMENTAL INFLUENCE, INCIDENCE
 ITALY (3267)
 INCIDENCE, SENEGAL (3280)*
 GASTRIC CANCER
 BENZO(A)PYRENE, INCIDENCE,
 MANITOBA (3265)
 CHRONIC GASTRITIS, HISTOAUTHORADIO-
 GRAPHIC EXAMINATIONS, HUMAN
 (3426)*
 COMPARATIVE HISTOLOGY, INCIDENCE,
 ISRAEL (3248)
 PRECANCEROUS CONDITION,
 EPIDEMIOLOGY (3287)*
 GASTRIC CANCER CELLS, PHOSPHORYLASE
 ACTIVITY, HISTOCHEMICAL STUDIES,
 HUMAN (3430)*
 GASTRIC CARCINOMA
 CLINICOMORPHOLOGY, PROGNOSIS,
 HUMAN (3479)*
 METASTASIS, HYPERNEPHROID CANCER,
 KIDNEY, CASE REPORT (3554)*
 GASTRIC CARDIA ADENOCARCINOMA, CLINICAL
 AND PATHOLOGIC FEATURES, HUMAN
 (3380)*
 GASTRIC LEIOMYOBlastoma, ULTRASTRUC-
 TURE, HUMAN (3323)*
 GASTRIC MUCOSA, ATROPHIC GASTRITIS,
 AUTORADIOGRAPHIC PATTERNS, NUCLEIC
 ACID, PROTEIN SYNTHESIS (3239)
 LEIOMYOMA, CASE REPORT (3566)*
 NEUROGENIC TUMORS (3577)*
 PARTIAL GASTRECTOMY, GASTRIC STUMP
 CANCER, HUMAN (3411)*
 LIGHT
 OCCUPATIONAL EXPOSURE, MALIGNANT
 MELANOMA INCIDENCE, ENGLAND, SWEDEN
 (3252)
 TERATOCARCINOMA
 ENZYME HISTOCHEMISTRY, EMBRYO-DERIVED,
 MOUSE (3462)*
 TERATOMA
 UTERINE TUBE, CASE REPORT (3543)*
 TESTES
 SEMINOMAS, CYTOGENETIC ANALYSIS,
 HUMAN (3310)
 TESTICULAR CANCER, CHILDREN, MORTALITY
 UNITED STATES (3251)
 TUMOR, LYMPHOMA, CASE REPORT (3333)*
 TESTIS
 CARCINOMA, ORCHIDOPEXY, CASE REPORT
 (3414)*
 LYMPHOMAS, HUMAN (3328)*
 TESTOSTERONE
 EFFECT ON SKIN CANCER, METHYL-
 CHOLANTHRENE, MOUSE (2947)
 THIAMINE
 TISSUE CONTENT, TRANSKETOLASE ACTIVITY
 EXPERIMENTAL TUMOR DEVELOPMENT
 (3597)*
 THROMBOPLASTIN
 ACTIVITY, LEWIS SARCOMA CELLS, MOUSE
 (3382)*
 THYMUS
 IMMUNODEFICIENCY, AMES DWARF MOUSE
 (3229)*
 LYMPHOMA, MYELOID LEUKEMIA, ETHYL-
 NITROSUREA-INDUCED, RAT (2996)
 T CELL, B CELL, FUNCTIONAL ONTOGENY,
 MOUSE (3188)
 THYMECTOMY
 INCREASED INCIDENCE OF LYMPHOMAS,
 IMMUNOLOGICAL THEORY OF AGING,
 MOUSE (3206)
 TUMOR INCIDENCE, MYASTHENIA GRAVIS
 HUMAN (3189)
 TUMOR INDUCTION, MOUSE (3209)
 THYROID
 ATOMIC BOMB RADIATION, TUMOR,
 INCIDENCE, HUMAN, REVIEW (3027)
 CARCINOMA, BIOCHEMICAL CHANGE, HUMAN
 (3472)*
 TUMOR, TSH, MOUSE (2942)
 TOBACCO
 CIGARETTE SMOKE, TOXICITY, RESPIRATORY
 TRACT, CAT (2939)
 CIGARETTE SMOKE CONDENSATE,
 N-NITROSAMINES (2954)
 CIGARETTE SMOKING, BLADDER CANCER,
 POPULATION TRENDS, UNITED STATES,
 ENGLAND, DENMARK (3266)

IMPROVED CIGARETTE DEVELOPMENT
 BIOASSAY METHODS, REVIEW (2961)*
 DEVELOPMENT, REVIEW (2962)*
 SMOKE CONDENSATE
 N-DIMETHYLNITROSAMINE, REVIEW
 INDUCED CARCINOGENIC EFFECTS, RAT
 (3020)*
 RNA SYNTHESIS, SKIN, MOUSE (3012)
 SMOKING, CARCINOMA, INCIDENTS, LARYNX,
 HUMAN (2962)
 SMOKING METHODS, CANCER RISK, HUMAN,
 REVIEW (2901)
 TONGUE
 CANCER, LYMPH NODE INVASION, HUMAN
 (3344)*
 TOXICITY
 CIGARETTE SMOKE, RESPIRATORY TRACT,
 CILIARY MOVEMENT, CAT (2939)
 DYES, MEAT MARKING COLORS,
 NEW ZEALAND (2966)
 TRANSFORMATION
 ADENOVIRUS TYPE 12, TUMOR, HAMSTER
 (3078)
 ASCITIC, SOLID TUMORS (2985)*
 CELLULAR, SV40 INDUCED, LIFESPAN (3138)
 HERPES SIMPLEX VIRUS TYPE 1
 LEUKOSIS VIRUS MARKER, ONCOGENE,
 HAMSTER (3043)
 LEUKOCYTES, EPSTEIN-BARR VIRUS
 MONKEY (3118)
 MALIGNANT
 FIBROBLASTS, LABELED LECTIN
 FIXATION, ULTRASTRUCTURE, HUMAN
 (3085)
 4-NITROQUINOLINE-1-OXIDE, PULMON-
 ARY AND CHURTON, RAT, MOUSE
 (2985)
 SV40 DNA, MEMBRANE ALTERATIONS,
 EMBRYO CELLS, MOUSE, HAMSTER,
 HUMAN (3133)
 MORPHOLOGICAL, FIBROBLASTS, EPSTEIN-
 BARR VIRUS, HUMAN (3107)
 MURINE SARCOMA VIRUS, REMOVALS,
 VIRUS RESCUE, MOUSE (3058)
 ROUS SARCOMA VIRUS RESCUE, CELL FUSION
 MAMMAL (3093)
 SPONTANEOUS NEOPLASTIC, MOUSE EMBRYO
 CELLS, HAMSTER LUNG CELLS (3293)
 SV40 VIRUS DNA, CELL MEMBRANE ALTERA-
 TIONS, HUMAN, HAMSTER (3094)
 TRANSPLANTATION
 RESISTANCE, SENSITIZING IMPLANT,
 FIBROSARCOMA, MOUSE (3109)
 SARCOMA
 MELANOMA, ROUTE OF PRODUCTION,
 MOUSE (3300)
 SPLENECTOMY, MOUSE (3299)
 TROPHOBLASTIC TUMOR, HAMSTER CHEEK
 POUCH, HUMAN (3278)*
 VAGINAL CARCINOMA, ESTROGEN TREATMENT,
 MOUSE (3298)
 TRICAPRYLIN
 CARCINOGENESIS, ACTIVITY BIOASSAY,
 MOUSE (2981)
 TROPHOBLASTIC TUMOR
 ESTROGEN PRODUCTION, TISSUE CULTURE
 (3307)
 TRANSPLANTATION, HAMSTER CHEEK POUCH,
 HUMAN (3278)*
 TUMOR
 ASTROCYTE SERIES, SUCCINATE-DEHYDRO-
 GENASE DISTRIBUTION, HISTOCHEMICAL
 STUDY (3591)*
 ATOMIC BOMB, BREAST, REPRODUCTIVE
 ORGANS, GALLBLADDER, SALIVARY
 GLAND, LEUKEMIA, THYROID, HUMAN,
 REVIEW (3027)
 CHILDHOOD, BIOPTIC DATA, GERMANY
 (3283)*
 ECTOPIC HORMONE PRODUCTION, PATHOLOGY,
 HUMAN (3400)*
 HEXOKINASE AND GLUCOKINASE ACTIVITIES,
 HUMAN, ANIMALS (3292)
 HORMONE SECRETION
 HYPERTENSION, RAT (3500)*
 PATHOLOGICANATOMICAL ASPECTS,
 REVIEW (2916)*
 HUMAN, PRIMARY IMPLANTATION, HAMSTER
 CHEEK POUCH (3198)
 INHIBITION, ZINC DIET DEFICIENCY,
 MOUSE, RAT (3306)
 INTRACRANIAL, EPIDEMIOLOGICAL STUDY,
 NORTH MORAVIA (3288)*
 MALIGNANT
 AUTOPSY STUDY, FREQUENCY, AMERICAN
 NEGRO (3276)
 CHROMOSOME ABERRATIONS, HUMAN
 (3417)*
 PRIMARY, MULTIPLE, GYNECOLOGY, HUMAN
 (3470)*
 PRIMARY INTRACRANIAL, ELDERLY,
 AUTOPSY STUDIES, REVIEW (3269)
 RAT TISSUE
 EFFECT OF HYPERGLYCEMIA ON OXYGEN
 AND GLUCOSE UPTAKE, DS-CARCINO-
 SARCOMA (3581)*
 OXYGEN PRESSURE MEASUREMENTS,
 DS-CARCINOSARCOMA (3582)*
 VARIABILITY, H102 TISSUE CULTURE,
 MORPHOLOGY, GENETICS (3475)*

UMOR TISSUES

EMBRYONIC NERVE CELLS, MUTUAL GROWTH
INFLUENCE, TISSUE CULTIVATION
TECHNIQUE (3588)*

IMMUNOGENESIS

PERSISTENT ESTRUS, ESTROGEN DEFICIENCY
RAT (2943)

PRECANCEROUS CONDITION, DEPRESSION OF
IMMUNE RESPONSE, REVIEW (2907)

ULCER

PARTIAL GASTRECTOMY, CANCER OF GASTRIC
STUMP, HUMAN (3411)*

URETHRA

CARCINOGENESIS, STRAIN DIFFERENCE,
RAT (2965)

DNA BINDING, LUNG, KIDNEY AND LIVER
TISSUES, MOUSE, RAT (2988)

EPIDERMIS, DNA CONCENTRATION, MOUSE
(2969)

LIVER, PARTIAL HEPATECTOMY, NUCLEIC
ACID, BINDING, MOUSE (2933)

MAMMARY NODULE INDUCTION, SERIAL TUMOR
TRANSPLANTATION, MOUSE (3003)

UROGENITAL TRACT

CARCINOMA, SV40-NEUTRALIZING ANTI-
BODIES, SERUM, HUMAN (3054)

TUMOR, SERUM PROTEIN, CLINICAL STUDY,
HUMAN (3544)*

UTERINE ADENOCARCINOMA

DEHYDROGENASE ACTIVITY (3595)*

UTERINE CANCER

ANDROGENOUS METABOLITE EXCRETION
(3569)*

TETRAHYDRO-S DETERMINATION, CHROMATO-
GRAPHY (3568)*

UTERINE CERVIX

PRECANCEROUS LESIONS, CYTOLOGIC AND
HISTOLOGIC RELATIONSHIPS, HUMAN
(3551)*

UTERINE TUBE

TERATOMA, CASE REPORT (3543)*

UTERUS

ENDOMETRIUM CARCINOMA, EPIDERMAL
CARCINOMA OF CERVIX, CASE REPORTS
(3244)*

HEMANGIOPERICYTOMA, ULTRASTRUCTURE,
HUMAN (3393)*

MALIGNANT MUELLERIAN TUMORS, HUMAN
(3467)*

VAGINA

ADENOCARCINOMA, MATERNAL SYNTHETIC
ESTROGEN THERAPY, CASE REPORTS
(3477)*

BASAL CELL CARCINOMA, TRANSPLANTATION,
ESTROGEN TREATMENT, MOUSE (3298)

VAGINAL-CERVIX-INNervation, CARCINOMA,
RELATIONSHIP, HUMAN (3347)*

VIRUS

ADENO-ASSOCIATED AAV2H, DNA,

NUCLEOTIDE STRAND SEPARATION (3072)

ADENOVIRUS, SV40, TRANSFORMED CELLS,
MITOCHONDRIAL DNA (3117)

ADENOVIRUS 2, HEXON, PHYSICAL AND
CHEMICAL PROPERTIES (3057)

ADENOVIRUS TYPES 2 AND 3, STRUCTURAL
CORE PROTEINS, PROPERTIES (3095)

ADENOVIRUS TYPES 5 AND 12, CELLULAR
LACTATE DEHYDROGENASE, DIFFERENTIAL
RELEASE DURING REPLICATION (3150)*

ADENOVIRUS TYPE 12

RNA AND DNA, HYBRIDIZATION, HUMAN
(3108)

T-ANTIGEN, COMPLEMENT FIXING

ANTIBODY, IMMUNOLOGY (3167)

TRANSFORMATION, HAMSTER (3078)

AVIAN LEUKOSIS

DEFECTIVENESS (3075)

GROUP-SPECIFIC ANTIGEN AND

ANTIBODY, DETECTION (3039)

SERUM ANTIBODY, HUMAN (3178)

AVIAN LEUKOSIS GROUP

SEQUENCE OF DEVELOPMENT, NEPHRO-

BLASTIC NEPHROBLASTOMA, ULTRA-

STRUCTURE, CHICKEN (3100)

AVIAN MYELOBLASTOSIS

CORE, ABSENCE OF RNA METHYLASE
(3106)

DETECTION, FIBROBLAST CULTURES,
CHICK (3081)

IN VITRO PROTEIN SYNTHESIS, GEL

ELECTROPHORESIS, RADIOIMMUNE

ASSAY, FERRITIN, E-COLI (3068)

AVIAN SARCOMA

GENETIC STABILITY, TRANSFORMED

NONPRODUCER CELLS (3096)

AVIAN TUMOR, ROUS SARCOMA, MIXED

INFECTION, REASSORTMENT OF MARKERS
(3052)

C-TYPE

GROWTH, CYTOPATHIC EFFECT, CELL
CULTURE, RAT (3069)

RHABDOMYOSARCOMA, CHROMOSOMES,

HUMAN (3076)

CELO, TUMOR INDUCTION, MORPHOLOGY,
HAMSTER (3130)

EPSTEIN-BARR

ANTIBODY, TREATMENT WITH PLATINUM

COMPOUND (3101)

CAPSID ANTIGEN, SOLUBLE ANTIGEN,

ANTIBODY, INFECTIONS MONONUCLEO-

- SIS, HUMAN (3042)
 LEUKOCYTE TRANSFORMATION,
 CYTOPATHIC CHANGES, MONKEY
 (3118)
 PRODUCTION, NON-VIRION ANTIGEN
 SYNTHESIS, BURKITT LYMPHOMA
 (3062)
 EQUINE ABORTION (HERPES), INFECTION,
 RNA SYNTHESIS, MOUSE (3087)
 EQUINE HERPES 3, HERPES SIMPLEX,
 COMPARATIVE STUDY, CHROMOSOMES,
 KIDNEY CELLS, RABBIT (3079)
 VIRUS - CONTINUED
 FBJ, TUMOR INDUCTION, HISTOPATHOLOGY,
 RELATION TO OSTEOSARCOMA, HUMAN,
 MOUSE (3071)
 FELINE LEUKEMIA, LONG-TERM REPLICATION
 IN CELL CULTURES, CANINE (3036)
 FRIEND
 LEUKEMIA, SPLEEN FOCUS-FORMING
 ACTIVITY, HUMAN LEUKEMIC TISSUE
 EXTRACTS, MOUSE (3122)
 LIVER CATALASE-DEPRESSING FACTOR,
 SPLEEN, MOUSE (3077)
 GARDNER-FELINE FIBROSARCOMA, MELANOMA
 INDUCTION, GNOTOBIOTIC, CAT (3066)
 HERPES
 ANTIGEN DETECTION, INDIRECT
 IMMUNOFLUORESCENCE, LUCKE RENAL
 ADENOCARCINOMA, FROG (3035)
 INFECTION, RIBONUCLEOTIDE
 REDUCTASE, DNA SYNTHESIS,
 KB CELLS (3059)
 LATENCY, CYTOSINE ARABINOSIDE
 TREATMENT, HUMAN (3033)
 PRESENCE IN RENAL ADENOCARCINOMA,
 FROG (3061)
 SIMPLEX
 CELL DEPENDENT DIFFERENCE,
 SUPRAOPTIMAL TEMPERATURE,
 RABBIT, HAMSTER (3141)
 VIRUS-SPECIFIC PROTEINS,
 PURIFICATION (3050)
 SIMPLEX TYPE 1, ORAL INFECTION,
 GUINEA PIG (3114)
 SIMPLEX TYPE 1 AND 2
 DEOXYTHYMIDINE KINASE ACTIVITY,
 THERMAL STABILITY DIFFERENCES
 (3083)
 IMMUNOFLUORESCENT ASSAY, RABBIT
 RABBIT (3171)
 SIMPLEX TYPE 2
 CELL TRANSFORMATION, LEUKOSIS
 VIRUS MARKER, ONCOGENE,
 HAMSTER (3043)
 REVERSIBLE VULVAR ATYPIA, CASE
 REPORT (3329)*
 TYPE, CYTOMEGALOVIRUS, ULTRA-
 STRUCTURE, MONKEY (3099)
 ZOSTER, VARICELLA, PRESENCE IN
 NERVE AND GANGLION, IMMUNO-
 FLUORESCENCE, ULTRASTRUCTURE,
 HUMAN (3123)
 HERPESVIRUS HOMINIS INFECTION,
 POLY I:C-INDUCED INTERFERON EFFECT,
 MOUSE (3149)*
 HERPESVIRUS SYLVILAGUS, MORPHOLOGICAL
 STUDY, KIDNEY CELL CULTURE, RABBIT
 (3151)*
 MACROMOLECULE, INTERFERON INDUCING
 ACTIVITY (3444)*
 MAMMARY
 CARCINOMA
 ONCOGENIC RNA, ULTRASTRUCTURAL
 COMPARISON, MONKEY (3116)
 TUMOR
 REPLICATION, GROWTH REGULATION,
 MOUSE (3067)
 VIRUS PRODUCTION, KINETICS,
 MOUSE (3049)
 MAMMARY TUMOR-ASSOCIATED ANTIGENICITY,
 LEUKEMIA CELLS, MOUSE (3193)
 MAREK'S DISEASE HERPESVIRUS
 PARTICLES, PRECIPITATING ANTIBODY-
 FREE TISSUES, CHICKEN (3152)*
 TURKEY HERPESVIRUS, INTERFERENCE
 OF TYPE 1 AND 2 PLAQUE-PRODUCING
 AGENTS, KIDNEY CELL CULTURE,
 CHICKEN (3148)*
 MASON-PFIZER, MORPHOLOGY, BIOPHYSICAL
 PROPERTIES, MONKEY (3137)
 MOLONEY, LYMPHOID TUMOR, GROWTH,
 ULTRASTRUCTURE, MOUSE (3097)
 VIRUS - CONTINUED
 MOLONEY LEUKEMIA, UV RADIATION,
 INACTIVATION OF REPLICATION,
 ABILITY TO RESCUE MSV (3111)
 MOLONEY MURINE SARCOMA, INHIBITOR,
 CELLS, MOUSE (3102)
 MURINE LEUKEMIA
 INFECTION, ULTRASTRUCTURE (3142)
 MURINE SARCOMA, RNA-DEPENDENT
 DNA POLYMERASE, ACTIVITY, MOUSE
 (3132)
 TRANSFORMATION, FISCHER RAT EMBRYO
 CELLS, CANNABINOIDS (3080)
 VACCINE 3-METHYLCHOLANTHRENE,
 CARCINOGENESIS INHIBITION, MOUSE
 (2964)
 MURINE RAUSCHER LEUKEMIA, CHARACTER-

IZATION, EMBRYONIC KIDNEY CELLS,
HUMAN (3104)

MURINE SARCOMA
ANTIGEN SYNTHESIS, MOUSE, RAT,
HAMSTER, CHICKEN, HUMAN (3065)
GENETIC STABILITY, TRANSFORMED
NONPRODUCER CELLS (3096)
GUAROA, COINFECTION, SPLEEN CELLS,
MOUSE (3064)
LEUKEMIA, RNA-DNA HYBRIDIZATION,
GENETIC DIFFERENCES (3135)
LOSS OF CELL SENSITIVITY TO INTER-
FERON, MOUSE (3091)
NONPRODUCER AND S+L- TRANSFORMED
CELLS, COMPARISON (3126)
TRANSFORMATION, REVERTANTS, VIRUS,
RESCUE, MOUSE (3058)
TUMORIGENESIS, LEUKEMIA, MOUSE,
HAMSTER, RAT (3098)

ONCOGENIC RNA, DETECTION, CHARACTER-
IZATION, LASER BEAT FREQUENCY
SPECTROSCOPY (3154)*

ONCORNAVIRUS, ANTIGEN SYNTHESIS,
CHROMATOGRAPHY, CHICKEN, MOUSE,
HAMSTER, CAT (3144)

POLIOVIRUS, VESICULAR STOMATITIS VIRUS
DOUBLE INFECTION, INTERFERENCE,
HELA CELL (3041)

POLYOMA
CELL INFECTION, ARGININE BIOSYN-
THESIS, MOUSE (3046)
DNA SECONDARY STRUCTURE (3139)
PROPERTIES OF TRANSFORMED CELLS,
REVERSION, RE-REVERSION (3045)

US - CONTINUED
RADIATION LEUKEMIA, VACCINE,
3-METHYLCHOLANTHRENE, CARCINOGENESIS
INHIBITION, MOUSE (2964)
RAUSCHER, INFECTION, RNA, SPLEEN
CELLS, MOUSE (3090)
RAUSCHER LEUKEMIA
AVIAN MYELOBLASTOSIS, RNA-DEPLEND-
ENT DNA POLYMERASE, TEMPLATE
REQUIREMENT (3047)
INFECTION, ERYTHROPOIETIC
RESPONSES, MOUSE (3119)
RECOVERY, SPLENOMEGALY, FETAL
CELL ANTIGEN, SUPPRESSION,
MOUSE (3204)
TUMOR TRANSPLANTATION, MOUSE
(3070)
VACCINE, 3-METHYLCHOLANTHRENE,
CARCINOGENESIS INHIBITION,
MOUSE (2964)
RETICULOENDOTHELIOSIS, AVIAN TUMOR,
SEPARATION (3127)

ROUS SARCOMA
AVIAN MYELOBLASTOSIS, GROUP-
SPECIFIC ANTIGENS, IMMUNO-
ELECTROPHORESIS (3051)
DNA, SOURCE AND SIGNIFICANCE
(3086)

DNA POLYMERASE, PURIFICATION,
CHARACTERIZATION (3110)
DNA:RNA HYBRIDIZATION, CELL
INFECTION, RAT, CHICK (3040)
EARLY INFECTION, ANTIGENS (3044)
RESCUE, CELL FUSION, MAMMAL (3093)
SPECIFIC RNA, DETECTION,
CHARACTERIZATION (3115)
TEMPERATURE-DEPENDENT ALTERATIONS,
SUGAR TRANSPORT, CYTOSINE
ARABINOSIDE (3128)
VITAMIN A, ENHANCING EFFECT,
CHICKEN (3112)

ROWSON-PARR, INFECTION, ULTRASTRUCTURE
MOUSE (3082)
SENDAI INFECTION, LIPID METABOLISM,
FIBROBLASTS, EMBRYO, CHICK (3129)
SIMIAN SARCOMA TYPE 1, FOCUS ASSAY,
NONTRANSFORMING ASSOCIATED VIRUS,
ULTRASTRUCTURE (3153)*
SIMIAN TUMOR, ISOLATE, CYTOPATHIC
EFFECTS, CELLS, MONKEY HUMAN (3134)

SV40
DNA, TRANSFORMATION, MEMBRANE
ALTERATIONS, HUMAN, HAMSTER
(3094)
ENDONUCLEASE ACTIVITY, DNA (3088)
INFECTED TRANSFORMED CELLS,
TRANSFER RNA, ALTERED PATTERNS
(3089)
INFECTION
ANTIBODY, HUMAN (3034)
PROTEIN SYNTHESIS, CELLS,
MONKEY (3140)
NEUTRALIZING ANTIBODIES,
GENITOURINARY CARCINOMA, HUMAN
(3054)
RECOMBINANTS, DNA OLIGOMER INFEC-
TION, KIDNEY CELLS, MONKEY
(3060)
SYNTHESIS, ASSEMBLY (3048)
TRANSFORMATION, AMINO ACID
DEPRIVATION, DNA SYNTHESIS,
KIDNEY CELLS, HAMSTER (3063)
TUMORIGENIC ACTIVITY, UV RADIATION
HAMSTER (3092)
VIRUS-INDUCED PROTEINS, CV-1 CELLS
(3038)

VACCINIA, 3-METHYLCHOLANTHRENE,
COMBINED CARCINOGENICITY, GENETIC
FACTOR, MOUSE (3121)
VARIOLA, GROWTH, HYPERPLASTIC FOCUS
FORMATION, HELA CELLS (3037)

VITAMIN A
ENHANCING EFFECT, ROUS SARCOMA,
CHICKEN (3112)
DISTRIBUTION, NEUROBLASTOMA, INFANT
(3503)*

WILM'S TUMOR
KIDNEY, 2-MUTATION MODEL (3238)

ZINC
DIET DEFICIENCY, TUMOR INHIBITION,
MOUSE, RAT (3306)



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Editor

Robert Love, M.D.
Jefferson Medical College, Philadelphia

Associate Editor

George P. Studzinski, M.D.
Jefferson Medical College, Philadelphia

NCI Staff Consultants

Elizabeth Weisburger, Ph.D.

Sidney Siegel, Ph.D.

Louis P. Greenburg, M.S.

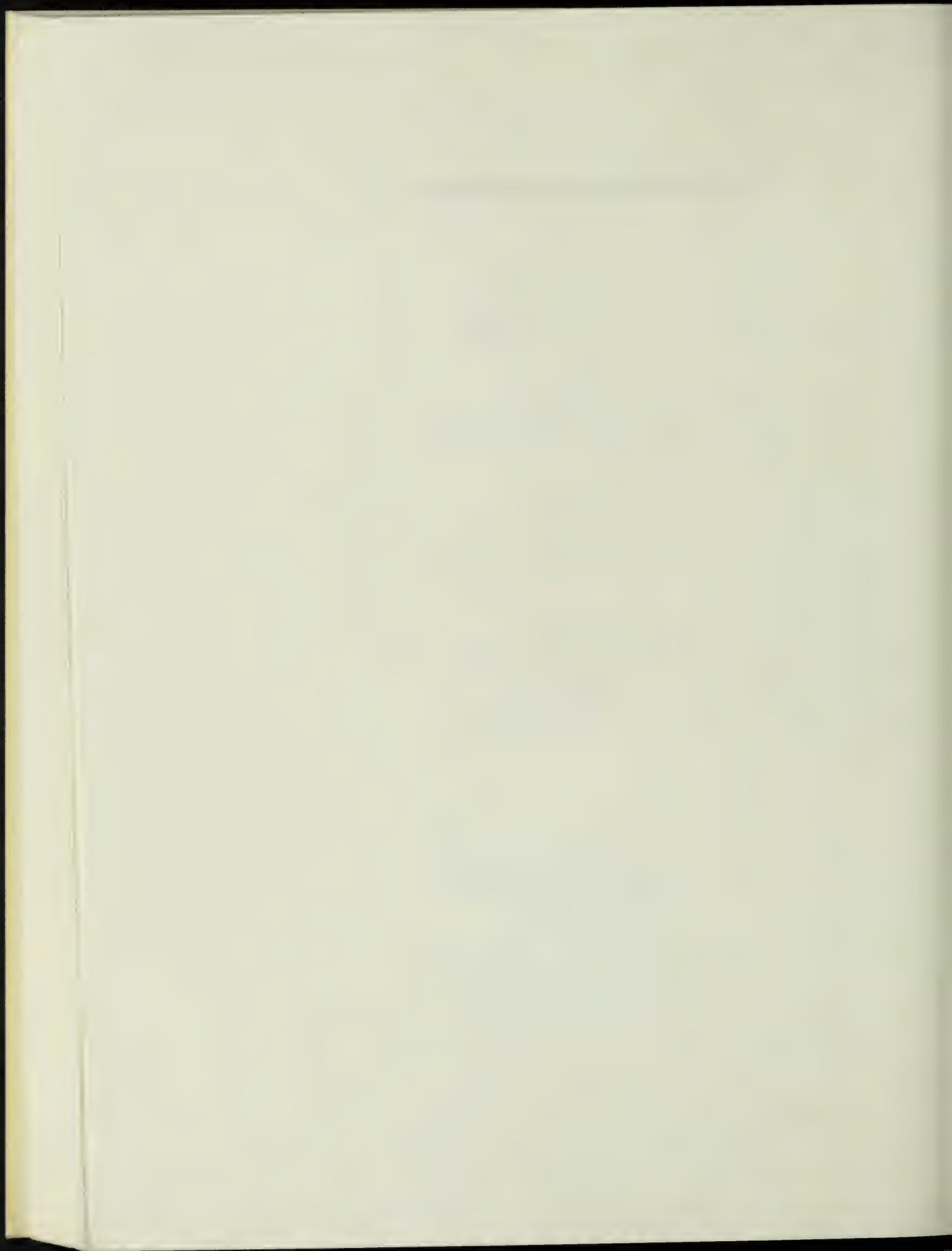
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PREFACE

Carcinogenesis Abstracts is a publication of the National Cancer Institute. The journal serves as a vehicle through which current documentation of carcinogenesis research highlights are compiled, condensed, and disseminated on a regular basis. It represents an integral part of the Institute's program of fostering and supporting coordinated research into cancer etiology. Issues of *Carcinogenesis Abstracts* normally contain three-hundred-fifty abstracts and three-hundred-fifty citations (unaccompanied by corresponding abstracts). Abstracts and citations refer to the current scientific literature that describes the most significant carcinogenesis research carried on at the National Cancer Institute, other governmental agencies, and private institutions. *Carcinogenesis Abstracts* is intended to be a highly useful current awareness tool for scientists engaged in carcinogenesis research or related areas. The great number and diversity of publications relevant to carcinogenesis make imperative the availability of this service to investigators whose work requires that they keep abreast with current developments in the field.

Carcinogenesis Abstracts is normally published monthly. Volume X covers the scientific literature published from July 1971 through Dec 1972. A cumulative subject and author index for Volume X will be published shortly after the final regular issue. This journal is available free of charge to libraries and to individuals who have a professional interest in carcinogenesis. Requests for *Carcinogenesis Abstracts* from qualified individuals should include statements of their relationship to carcinogenesis research. All correspondence should be addressed as follows.

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NOTE

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LANGUAGE ABBREVIATIONS

Afr.	Afrikaans	It.	Italian
Ar.	Arabic	Jap.	Japanese
Bul.	Bulgarian	Kor.	Korean
Ch.	Chinese	Latv.	Latvian
Cz.	Czech	Lith.	Lithuanian
Dan.	Danish	Nor.	Norwegian
Dut.	Dutch	Pol.	Polish
E.	English	Por.	Portuguese
Eston.	Estonian	Rum.	Rumanian
Fin.	Finnish	Rus.	Russian
Fl.	Flemish	Ser.	Serbo-Croatian
Fr.	French	Sl.	Slovak
Ger.	German	Sp.	Spanish
Gr.	Greek	Sw.	Swedish
Heb.	Hebrew	Th.	Thai
Hun.	Hungarian	Turk.	Turkish
Ic.	Icelandic	Uk.	Ukrainian
In.	Indonesian	Viet.	Vietnamese

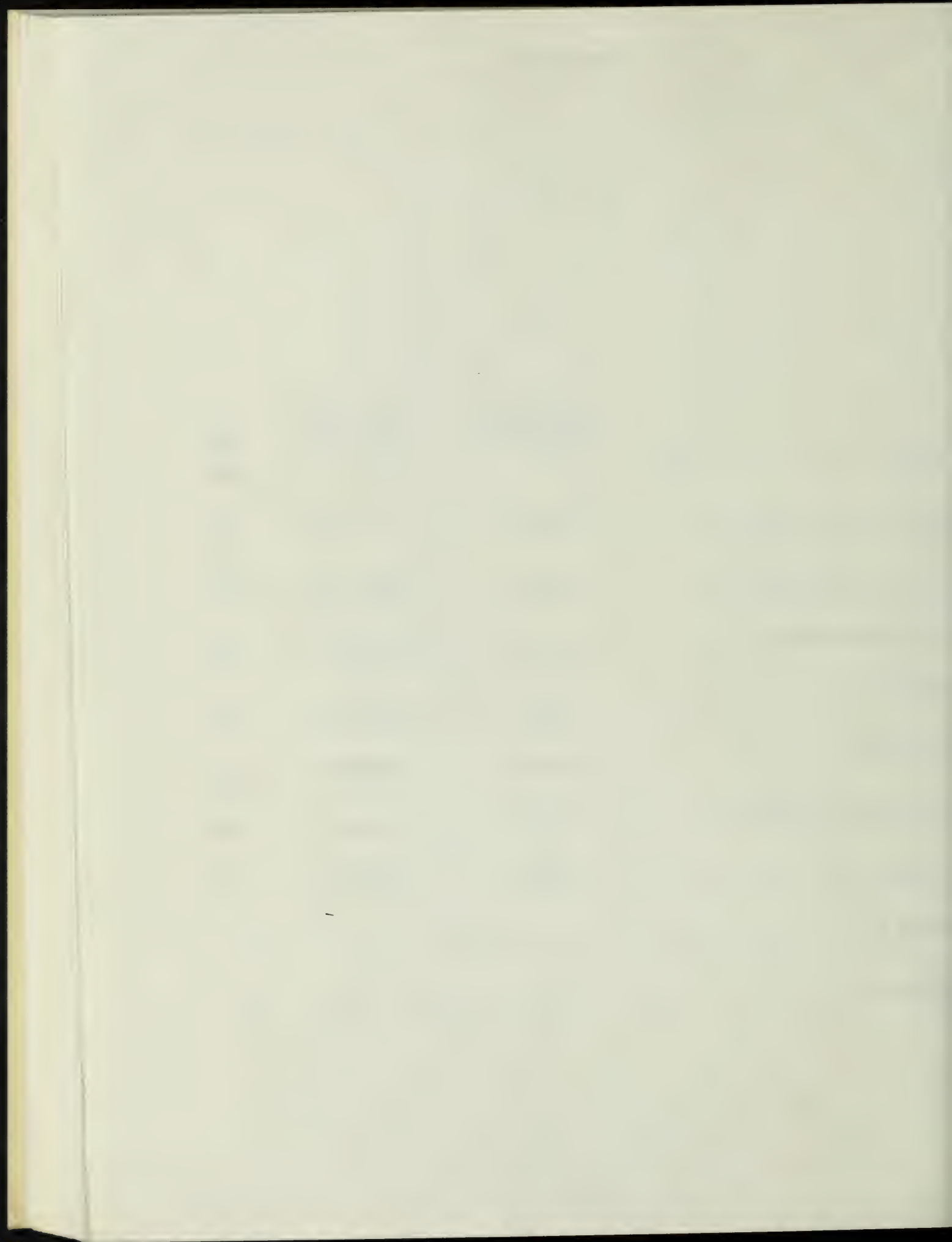
ABBREVIATIONS USED IN ABSTRACTS

adrenocorticotrophic hormone	mg	milligram(s)
adenosine diphosphate	min	minute(s)
adenosine monophosphate	ml	milliliter(s)
adenosine triphosphate	mm	millimeter(s)
degrees centigrade	MTD	maximum tolerated dose
centimeter(s)	ng	nanogram (10^{-9})
central nervous system	pg	picogram (10^{-12})
counts per minute	p.o.	orally
deoxyribonucleic acid	ppm	parts per million
for example	r	Roentgen
gram(s)	RBC	red blood cells (erythrocytes), red blood count
microgram(s)	resp.	respectively
hour(s)	Rev.	review (only in citations)
intramuscular	RNA	ribonucleic acid
intraperitoneal	s.c.	subcutaneous
international unit(s)	sec	second(s)
intravenous	U	unit(s)
kilogram(s)	UV	ultraviolet
median lethal dose(s)	WBC	white blood cells (leukocytes), white blood count
meter(s)	wk	week(s)
molar	wt	weight
milliequivalent(s)	yr	year(s)
millimolar		
micromolar		
milli-,microcurie(s)		



CONTENTS

	Cross Reference Abbreviations	Abstracts, Citations	Page
REVIEW.....	(Rev).....	3601-3643	583
CHEMICAL CARCINOGENESIS.....	(Chem).....	3644-3724	590
PHYSICAL CARCINOGENESIS.....	(Phys).....	3725-3736	610
VIRAL CARCINOGENESIS.....	(Viral).....	3737-3834	613
IMMUNOLOGY.....	(Immun).....	3835-3935	635
PATHOGENESIS.....	(Path).....	3936-3964	655
EPIDEMIOLOGY AND BIOMETRY.....	(Epid-Biom).....	3965-3984	660
MISCELLANEOUS.....	(Misc).....	3985-4300	664
AUTHOR INDEX.....			i
SUBJECT INDEX.....			xx



01 CARCINOGENICITY OF AMOSITE ASBESTOS. (E.)
Selikoff, I. J. (Mount Sinai Sch. Med., New York, N.Y.), E. C. Hammond and J. Churg. *Arch Environ Health (Chicago)* 25(3):183-186, 1972.

data exist concerning the comparative neoplastic potential of the several kinds of asbestos in man. determine whether the amosite variety is carcinogenic, the mortality experience of a group of 230 previously employed in an amosite asbestos factory in the U.S. was studied from 1960 through 1971. Total deaths were twice the expected number (5 vs 46.4 expected). Fourteen deaths were due to asbestosis when none was expected. Deaths from lung cancer and mesothelioma were also excessive (lung cancer deaths vs 2.4 expected). Thus, occupational exposure to amosite asbestos may constitute a serious cancer hazard and its continued industrial use warrants rigorous control. (15 references)

2 ADENOVIRUSES IN HUMAN CANCER. (E.)
McAllister, R. M. (U. Southern California Sch. Med., Los Angeles), R. V. Gilden and M. Green. *Cancer* 27(7):831-833, 1972.

capacity of human viruses to induce tumors in rats, mice and rabbits and their ability to transform rodent cells *in vitro* are the bases for suggesting that adenoviruses are possibly oncogenic in man. In the adenovirus/hamster-tumor system, tumor cells contain no infectious virus but induce T antigen and contain virus-specific RNA. Although a number of reports describe the isolation of adenoviruses from human cancer tissues, attempts to detect adenovirus T antigens and virus-specific antigens in tumor cells have been unsuccessful. Furthermore, adenoviruses differing in oncogenic potential do not induce tumors in cynomolgus or rhesus monkeys during a 2-7 yr observation period. The negative results obtained in serological, biochemical and histological tests suggest that adenoviruses are unlikely to be important causes of human cancer. (15 references)

CYTOGENESIS AND DIFFERENTIATION OF PRIMITIVE CENTRAL NEUROEPITHELIAL TUMORS. (E.)
Stein, L. J. (Stanford U. Sch. Med., Calif.). *Neuropath* 31(1):7-26, 1972.

potential or actual differentiating capacities of primitive neoplasms of the central nervous system are reviewed, including medulloepithelioma, cerebral glioblastoma, polar spongioblastoma, ependymoblastoma and pineal parenchymal tumors. Autoradiographic and electron microscopic evidence of morphological, biochemical and divergent differentiation is presented. Capacity of medulloepithelioma, cerebral neuroblastoma and medulloblastoma for stroma induction is also described. The phenomenon of cellular differentiation is discussed in terms of the facultative or potential genome of a cell providing a basis for effective genomes and thus a genetic basis for embryonal competence or capacity, and for patho-

logical metaplasia. The observations reported constitute a body of evidence which will enable improved diagnostic patterns to be used. (107 references)

3604 SELECTIVE REDUCTION OF TUMORIGENICITY OF TOBACCO SMOKE. II. EXPERIMENTAL APPROACHES. (E.) Hoffmann, D. (Amer. Hlth. Fdn., New York, N.Y.) and E. L. Wynder. *J Nat Cancer Inst* 48(6):1855-1868, 1972.

Recent information on the identity of carcinogens in tobacco smoke is reviewed and measures presently under investigation to reduce smoking-related tumorigenesis are described. Three types of tumorigenic agents have been identified in tobacco smoke: tumor initiators, tumor accelerators and tumor promoters. Tumor initiators in tobacco smoke tar include polynuclear aromatic hydrocarbons formed as tobacco burns. Tumor accelerators do not act as whole carcinogens, promoters or tumor initiators. However, they do accelerate the activity of carcinogens and initiators. Tumor accelerators in tobacco smoke include *trans*-4,4'-dichlorostilbene, *N*-alkyl indoles and *N*-alkyl carbazoles. Tumor promoters have been shown to reside in the weakly acidic portion of tobacco tar. *N*-alkyl-aminophenols, volatile phenols and fatty acids are among identified tumor promoters. However, most tumor promoters in tobacco smoke have not been identified. Carcinogens which have been identified in the gaseous phase of tobacco smoke include arsenic, nickel carbonyl, nitro olefins and volatile *N*-nitrosamine. The bladder carcinogens aminofluorene and β -naphthylamine are present in trace amounts in tobacco smoke. However, it is thought that the metabolism of tobacco constituents, including nicotine, rather than bladder carcinogens in smoke, is responsible for the increased incidence of bladder cancer in smokers. Among methods for reducing tumorigenicity of tobacco smoke are decreasing the amount of leaf tobacco in cigarettes while increasing the proportion of stalk and stem tobacco, altering tobacco curing procedures, altering nitrate concentrations of cigarette tobacco and manufacturing cigarettes from reconstituted tobacco sheets rather than from natural tobacco. Experiments on tumorigenicity of tobacco substitutes, including spinach and hay, are also underway. (64 references)

3605 HERPES-LIKE SIMIAN VIRUSES: RETROSPECTIVE AND PROSPECTIVE CONSIDERATIONS. (E.)
Weller, T. H. (Harvard Sch. Public Hlth., Boston, Mass.) and R. P. Strong. *J Nat Cancer Inst* 49(1):209-211, 1972.

Initial studies on poliomyelitis and the development of polio-vaccines established a basic pattern for applied virologic research that included the preferential use of old-world monkeys as experimental subjects. Subsequent work using old-world monkeys led to an accumulation of knowledge regarding simian viruses. To date, 57 serotypes of simian agents representing seven different virus families have been discovered. The use of old-world monkeys, however, introduced new occupational hazards invol-

ving infection by herpes B virus. Some lots of polio vaccine were discovered to be contaminated with SV40. In 1967, seven people died following exposure to a previously unrecognized agent affecting a shipment of African green monkeys. Recently, several genera of new-world monkeys have become available for research purposes and have been rapidly accepted by workers outside the field of classical virology. This has increased the opportunities for contact of humans with new, unknown or poorly-understood simian viruses. *Herpesvirus saimiri*, recovered from the squirrel monkey, can induce highly malignant lymphomas in other new-world primates and in animals as taxonomically distant as rabbits. The cytomegaloviruses, a host-specific group of herpes-type viruses, can produce congenital brain damage and a wide variety of clinical syndromes in man. Thus, until the hazards to man of the new oncogenic herpesviruses are defined, distribution of the new agents and of their natural hosts should be limited to laboratories equipped to handle dangerous viruses. (6 references)

- 3606 IMMUNOLOGY OF MAMMARY GLAND CANCER OF THE MOUSE. (Fr.) Hollmann, K. H. (Broussais Hosp. Paris, France). *Rev Eur Etudes Clin Biol* 16(10):969-980, 1971.

The essential etiologic agent of mouse mammary cancer is mammary tumor virus (MTV), which is usually transmitted through the mother's milk to the nursing young. Tumors then appear at 12-15 months of age and their appearance depend on various factors, especially hormonal ones. The characteristic sudden and simultaneous appearance of several tumors suggests disruption of the equilibrium in the host defense mechanism and points up the importance of immune factors in mouse mammary cancer. The MTV virion, called the "B" particle, is the main antigen for mouse mammary cancer, as has been demonstrated by the immunodiffusion technique *in vitro* and by the homograft rejection test *in vivo*. Actually, several antigens are involved, some derived from the envelope and some from the interior of the virion. Tumor-specific antigens, not associated with the virus, have also recently been demonstrated; they vary from one tumor to another, and are not present in all tumors. The immune response of the host against these viral and tumor-specific antigens depends on the integrity of the host's immune system. Particularly important factors in mouse mammary cancer are the age of the mouse at time of infection and the condition of the thymus. (56 references)

- 3607 BRONCHIOLO-ALVEOLAR CARCINOMA. A REAPPRAISAL AFTER 24 YEARS. (E.) Delarue, N. C. (Toronto General Hosp., Canada), W. Anderson, D. Sanders and J. Starr. *Cancer* 29(1):90-97, 1972.

A five-year follow-up study was made of 74 patients with bronchiolo-alveolar carcinoma treated at

Toronto General Hospital between 1948-1965. The age distribution of the patients was similar to that for lung cancer in general: 10.7% were under 40 yr, 79. between 40-70, and 9.6% over 70. Two-thirds of the cases had a history of heavy smoking. The overall three-year survival rate for the 74 patients was 34%, with 41% of the peripheral lesions surviving this period. Only one of four hilar lesions and only two of ten central scars survived three years; none of the multicentric lesions survived this period. Twenty-five of 49 patients having curative or palliative resections survived three years (52%) and 16 survived five years (34%). None of 25 patients with nonresectable or inoperable disease survived the three-year period. When the resection was a lobectomy, a five-year survival of 52% was achieved. This rate is a clear indication of the potential curability of bronchiolo-alveolar carcinoma that is recognized and treated in its early localized peripheral state. (35 references)

- 3608 ROLE OF IMMUNOLOGIC DISTURBANCE IN HUMAN ONCOGENESIS: SOME FACTS AND FANCIES. (E.) Kaplan, H. S. (Stanford U. Sch. Med., Calif.). *Brit J Cancer* 24(4):620-634, 1971.

Immunologic mechanisms in the genesis of neoplastic processes are reviewed. Recent investigations into the impairment of immunologic surveillance mechanisms permitting the outgrowth of transformed clones confirm the postulated relationship between certain deficiency states in man and the increased incidence of neoplasms. The vital role of the thymus gland in maintaining immunologic competence is discussed on the basis of steroid, antimetabolite and antilymphatic globulin activity. Evidence of the widening spectrum of congenital immunologic deficiency concomitant with oncogenesis is presented. Studies on the impairment of cell-mediated immunity in the early stages of Hodgkin's disease are summarized along with studies of the significance of prior occurrence of infectious mononucleosis in some cases of Hodgkin's disease. There is evidence that lymphoid cells of patients with infectious mononucleosis undergo sustained antigenic alteration. By inducing antigenic alterations in lymphoid cell subpopulations, EB and other noncogenic viruses may initiate sustained autoimmune lymphoproliferative responses leading ultimately to Hodgkin's disease and other forms of lymphoid neoplasia. (64 references)

- 3609 IMMUNOLOGICAL AND RELATED ASPECTS OF NASOPHARYNGEAL CARCINOMA. (E.) Nelson, D. (Dept. Bacteriol., U. Sydney, Australia) and M. Nelson. *Aust Radiol* 15(3):227-232, 1971.

Evidence, mainly sero-epidemiological, was examined for an association between Epstein-Barr virus (E.B.) infection and nasopharyngeal carcinoma (N.P.C.). Recent studies bearing on N.P.C. antigens and the general immunological status of N.P.C. patients were

reviewed. Patients with N.P.C. have much higher levels of antibodies to E.B.V. and its associated antigens than do appropriate controls. Tissue culture studies have also demonstrated an association between a herpes-type virus and N.P.C. Lymphoblastoid cell lines carrying herpes-type virus particles established from biopsies of N.P.C. tumors. Cell lines differ from those derived from Burkitt's lymphoma in that they carry a receptor which complexes of sheep erythrocytes and anti-sheep erythrocyte antibody IgM can become attached. Cell lines from Burkitt's lymphoma carry instead a receptor for complexes of sheep erythrocytes and anti-sheep erythrocyte antibody IgG. Sera from N.P.C. patients reacted with one or more tumor cell constituents--nuclei, membranes and/or cytoplasm. The nuclear and membrane antigens were also found on normal epithelial and lymphoid cells and the cytoplasmic antigen on all normal epithelial cells. Nuclear and membrane antigens could represent, respectively, antigens of a virus and antigens determined by that virus; however, their presence on the epithelial and lymphoid cells must be explained. There is no evidence for an immunological defect playing a part in the development of N.P.C. It is concluded that N.P.C. has a viral etiology; the virus remains to be identified. A genetic susceptibility may explain the racial distribution of N.P.C. (References)

ADENOCARCINOMA OF THE VAGINA IN YOUNG WOMEN. THE STILBESTROL-ADENOSIS-ADENOCARCINOMA OF THE VAGINA SYNDROME. (E.) Fetherston, (St. Mary's Hosp., Milwaukee, Wis.), A. S. and M. E. Speckhard. *Wisconsin Med J* 73:87-93, 1972.

histories of a patient with adenocarcinoma of the vagina and a patient with a benign vaginal adenosis are presented as evidence of a stilbestrol-adenosis-adenocarcinoma syndrome. Both patients had been subject in utero to the influence of stilbestrol administered to their mothers during pregnancy. Adenosis and adenocarcinoma were limited to the upper vagina and may have originated in Muellerian tissue sensitive to estrogen. The possibility of placental stilbestrol transfer with subsequent stimulation of receptor sites of the vaginal anlage during organogenesis is suggested. The stilbestrol may influence the developing Muellerian tissue in such a way that abnormal glandular tissue persists in the upper vagina. Pelvic examinations and close follow-up of asymptomatic young women subject to in utero stilbestrol are recommended. (16 references)

THEORY OF THE ORGANIZATION OF THE MAMMALIAN CELL AND VIRAL DNA GENOMES AND THE MECHANISM OF CARCINOGENESIS. (E.) Becker, Y. Hebrew U.-Hadassah Med. Sch., Jerusalem, Israel). *Israel J Biol Sci* 10(1):47-59, 1972.

ent theory suggests that different families of

DNA molecules are present in the mammalian cell DNA genome and that viral DNA genome resembles, in its organization, cellular DNA. The role of these molecules in the mechanism of carcinogenesis is discussed. The different families of DNA molecules in mammalian cell DNA genome are characterized by the presence or absence of poly-dG-dC or poly-dA-dT sequences; the DNA molecules with poly-dG-dC sequences are transcribed during the S phase of the mammalian cell, while the molecules with poly-dA-dT sequences are transcribed during the G₂ phase along with the DNA that contains information for ribosomal RNA. A prediction of the theory is that transformation of mammalian cells by DNA and RNA tumor viruses, chemical carcinogens and X-irradiation involves the poly-dG-dC sequences in the cellular chromosomal DNA which controls cellular DNA synthesis. Any chemical capable of affecting the poly-dG-dC sequences adjacent to cellular genes controlling DNA synthesis, in a manner that cannot be reversed by the cell, might bring about the transformation of a normal cell into a cancer cell. This possibility might also explain the spontaneous transformation of cells. (53 references)

3612 EVIDENCE FOR AN SV40-RELATED PAPOVAVIRUS INFECTION OF MAN. (E.) Shah, K. V. (Johns Hopkins U. Sch. Hyg. Public Hlth., Baltimore, Md.). *Amer J Epidemiol* 95(3):199-206, 1972.

Evidence of SV40-related papovavirus infections in man is reviewed. The populations studied include subjects exposed to SV40 contaminated poliomyelitis vaccines in the USA and elsewhere, and also inhabitants of northern India where free-living rhesus groups often live close to human communities. Nearly 20% of 12-14 yr old Maryland children who received contaminated polio vaccine had SV40 antibodies in their sera. Antibodies were also found in some elderly cancer patients who did not give a history of immunization with polio vaccines, in children born after the vaccines were cleared of SV40, and in sera collected before the introduction of monkey kidney vaccine. The highest prevalence of antibody (27%) occurred in Indian monkey handlers. Available evidence indicates that man is probably not a primary host for SV40 infection. The lack in the USA of primates other than man and the inability to detect SV40 antibodies in sera from goats, sheep, cows and buffalos from South India suggest that the existence of nonsimian hosts of SV40 are unlikely. Recently virus strains containing SV40-neutralizing antibodies of SV40 antigens were isolated from the brains of two patients with progressive multifocal leucoencephalopathy. A papovavirus (B.K. virus) bearing a minor antigenic relation to SV40 has also been isolated from the urine of a renal allograft recipient. If additional tests establish immunological identity between these viruses and SV40, then it is possible that SV40 does infect man independently of contact with monkeys or monkey products. Screening of 1700 patients, 1300 of which had cancer, provided no evidence of a relationship between SV40 infection and human cancer. However, cancers of the urogenital tract and brain and cancers in

immunosuppressed individuals show some promise for the implication of SV40 as an etiological agent. (46 references)

- 3613 EXCRETO-URINARY CANCERS OF THE URETHRA. (Fr.) Cukier, J. (Neckar Hosp., Paris, France), J. Vacant and D. Beurton. *Vie Med* 41(4):5073-5078, 1971.

Primary cancer of the urethra in males is a rare but very serious disease which most commonly occurs in patients aged 60-69 yr. About one-third of the patients with urethral cancer have a history of chronic urethritis or gonococcal disease. The precursive relations of these diseases to cancer are undoubtedly due to malpighian metaplasia from which epidermoid cancers originate. In contrast, urethral cancer in females is more common than in men, and the only condition it appears to be associated with is kraurosis vulvae. The histology, diagnosis, clinical symptoms, extension, and treatment of these tumors are discussed. (5 references)

- 3614 BLADDER CANCERS. (Fr.) Cukier, J. (Neckar Hosp., Paris, France), D. Beurton and J. Vacant. *Vie Med* 41(4):5057-5070, 1971.

Certain chemicals, chronic infections, mechanical irritation, and urinary schistosomiasis are often associated with bladder cancer. Although aniline and benzidine were the first bladder carcinogens discovered, β -naphthylamine, 4-aminobiphenyl, and tryptophan metabolites appear to be more dangerous. For this reason, chemical workers who handle these substances should be followed closely. Unidentified carcinogens are present in urine from patients with epithelial tumors of the bladder. When injected into the bladders of animals, this urine induces epithelial tumors in 50% of the animals. Although *Schistosoma* eggs were found in 75 biopsies from 96 Egyptian patients with bladder cancer, this may not be significant since almost the entire population is infested with *Schistosoma*. Biopsy and clinical findings, the prognosis, diagnosis, and surgical treatment and radiotherapy are considered for malignant epithelial and nonepithelial tumors of the bladder. (No references)

- 3615 CANCER VIRUS THEORIES: FOCUS OF RESEARCH DEBATE. (E.) Culliton, B. J. (No Affiliation). *Science* 177(4043):44-47, 1972.

Three models currently dominate the field of viral oncogenesis in humans. The provirus hypothesis, introduced in the early 1960's, states that an RNA tumor virus infects a cell, which then incorporates the genetic information contained in the viral RNA into its own DNA and thereby acquires the capacity to produce an oncogenic virus and become transformed into a neoplastic cell. The viral genetic information is located at a single site on one chromosome.

The integration takes place using a viral reverse transcriptase which makes a DNA copy of the viral RNA. According to the oncogene hypothesis, put forward in 1969, infection of cells by C-type RNA viruses occurred millions of years ago. Every cell now contains an oncogene, a region of DNA that is normally repressed. Derepression of the oncogene by another virus, chemicals, or radiation results in production of a "transforming protein" which causes the cell to become malignant even though no viruses are produced. The provirus hypothesis, similar to the oncogene model, evolved in 1970 as a logical extension of the discovery of RNA-dependent DNA polymerase. This hypothesis holds that cancer viruses arise from proviruses--segments of genetic information randomly brought together through a variety of genetic events. The reverse transcriptase is also present in normal cells where it plays a role in differentiation. Recent evidence supports one or more of these models. Attempts to isolate a whole cancer virus from human tissues has resulted in a number of "candidate" viruses, including C-type and B-type. Molecular hybridization experiments have suggested that C-type virus information is present in human leukemias, lymphomas and sarcomas. A reverse transcriptase has been found in many leukemia patients and is associated with a high molecular wt RNA that is homologous to Rauscher leukemia virus RNA. The oncogene hypothesis has received support from experiments in which C-type viruses were induced in normal, supposedly virus-free cells. The ability of susceptible cell strains to be infected by their own virus is also consistent with the oncogene model since the oncogene would be derepressed in this state. The provirus model is supported by the finding of reverse transcriptase activity in normal embryo cells and in normal PHA-stimulated lymphocytes. (No references)

- 3616 HEALTH HAZARDS OF ASBESTOS. (E.) Gilson, J. C. (Llandough Hosp., Penarth, England). *Composites* 3(2):57-59, 1972.

Inhalation of asbestos dust, which has been recognized as an occupational hazard for over 50 yr, causes fibrosis of lung tissues (asbestosis), especially the respiratory bronchioles and visceral pleura, resulting in reductions in inspiratory capacity, tissue compliance and oxygen perfusion. Asbestos workers have an increased risk of developing lung cancers, including bronchial carcinoma and mesothelioma. During the last ten yr there has been a real increase in the incidence of mesothelioma in persons exposed to asbestos. Mesotheliomas are characterized by a long interval (20 to 50 yr) between first exposure to asbestos dust and the detection of cancer, with cigarette smoking apparently playing no part in the etiology. Asbestos dust has also been shown to cause formation of asbestos corns on the fingers, but no cancers of the skin relatable to asbestos have been reported. Risk from asbestos is limited to inhalation of fibers 5-100 μ m long. Although asbestosis and bronchial cancers can be caused by all types of commercially used asbestos (amosite, anthophyllite, chrysotile, and crocidolite), risk of developing these tumors

is greatest with crocidolite and lowest with chrysotile. Risk is lowest in mining and increases along the manufacturing process as exposure to dust increases. The risk of asbestosis and bronchial cancer also appears to be related to the degree of exposure to asbestos; evidence for a dose-response relationship is less clear for mesothelioma. (15 references)

- 3617 THE FATE OF CARCINOGENIC HYDROCARBONS IN THE LUNG. (Ger.) Brockhaus, A. (Duesseldorf U., West Germany), R. Tomingas, W. Dehnen, F. Pott and E. G. Beck. *Prax Pneumol* 25(9):519-526, 1971.

The particle size of polycyclic hydrocarbons and the extent to which they are deposited in human lungs were investigated in experiments in rats, using a mixture of benzpyrene and dust (injected into the lungs) from various inhabited areas. The benzpyrene content in the animal lungs decreased quite rapidly with time. An injection of a suspension of 200 µg of benzpyrene mixture caused a rapid increase in the blood level of benzpyrene (in the first hr), followed by a slow decrease. An enzymatic degradation of benzpyrene in the lung was therefore postulated. *In vitro* studies demonstrated alveolar macrophages in guinea pig lungs, immediately and three hr following incubation with the benzpyrene mixture. Thus, it was established that the benzpyrene enters the lungs together with the dust particles; in the lungs, the dust is separated from the benzpyrene, which is metabolized in the lungs or transported to the liver. The rapid destruction of the benzpyrene in the lungs of experimental animals explains why it is difficult to develop lung carcinoma in animal experiments. Other hydrocarbons, as well as smoke and dust, contribute to the complexity of the effects in man. Animal experiments have shown that benzpyrene stays for a longer interval of time in lungs that have been damaged before benzpyrene exposure. (9 references)

- 3618 EXPERIMENTAL TRANSPLACENTAL BLASTOMOGENESIS AS A MEANS FOR THE STUDY OF TUMOR ETIOLOGY AND PATHOGENESIS IN CHILDREN. (Rus.) Hapalkov, N. P. (Petrov Res. Inst. Onkol., Leningrad, USSR). *Vopr Onkol* 17(8):3-15, 1971.

Published experimental data on embryonal responses to nitroso compounds during the fetal development are summarized. Embryotoxic and teratogenic effects of the following highly blastomogenic nitroso com-

pounds were studied in 1300 pregnant rats: nitroso-dimethyl-, -diethyl-, -dipropyl-, and -dibutylamines; nitroso-methyl-, and ethylanilines; nitroso-methyl-, -ethyl-, -propyl-, and dimethylureas; and nitroso-methylurethane. Dialkylnitrosamines in various doses had no teratogenic or embryotoxic effects. Strong embryotoxic and teratogenic effects were exhibited by nitrosoalkylureas, especially in the first and second weeks of embryogenesis. Nitrosomethylurea showed a high incidence of various neoplasms in the last third of the embryogenesis period. Nitrosoethylurea caused tumors of the nervous system. Nitroso-methylurethane (10 mg) had a teratogenic effect ($91 \pm 4.0\%$) only when it was administered intraplacentally, and not i.p. or i.v. Nitrosodiethylamine caused multiple neoplasms in pre- and postnatal periods. Nitrosomethylurea, when combined with nitrosodiethylamine, showed a stronger transplacental effect, causing lung adenocarcinomas more intensively than methylurea alone. The character of effects (lethal, teratogenic, carcinogenic) depended on the stage of embryogenesis, the doses of the substances, and the species of animal. (56 references)

- 3619 NASOPHARYNGEAL CARCINOMA IN NON-CHINESE POPULATIONS WITH SPECIAL REFERENCE TO SOUTH-EAST ASIA AND AFRICA. (E.) Muir, C. S. (Int. Agency Res. Cancer, Lyons, France). *Int J Cancer* 8:351-363, 1971.

Age-adjusted morbidity rates/100,000/annum for nasopharyngeal carcinoma (NPC) in overseas Chinese, indigenous South East Asian populations, African populations, and migrant groups in Hawaii and Israel were reviewed in relation to the possibility of an unknown environmental factor acting on genetically susceptible populations. For the overseas Chinese, the rates are 10 to 20/100,000/annum for males and 5 to 10 for females. NPC is also fairly common in non-Chinese mongoloid groups in South East Asia. The data for Algeria, Tunisia, and the Sudan strongly suggest a moderate elevation of risk in these countries. NPC does not appear unduly common in Kenya or Uganda but there are differences between ethnic groups in these countries which may be related to environmental factors. In Hawaii, NPC incidence is raised for all ethnic groups, the rate (7.8) for male Hawaiians approaching that for male Chinese (10.4). In Israel, the incidence is higher in the Arab population and in Jews born in Africa or Asia than in Israel-born Jews or Jews born in America or Europe. The trend for NPC to be commoner in South East Asian groups with admixture of Chinese blood is exemplified by NPC incidence in Singapore, where the rates for male and female Chinese are 20.2 and 9.0, resp., while those for the mongoloid Malays are 5.8 and 2.0, resp. By contrast, the rates for the caucasoid Indians and Pakistanis are 0.2 and 0. It is unlikely that these differences are artefactual. (49 references)

- 3620 PUBLIC HEALTH HAZARDS FROM ENVIRONMENTAL CHEMICAL CARCINOGENS, MUTAGENS AND TERATOGENS. (E.) Hueper, W. C. (Ft. Myers, Fla.). *Health Phys* 21(5):689-707, 1971

Environmental chemical cancer hazards form together with radiation cancer hazards the principal segments of the human environmental spectrum of carcinogenic risks. The cancer hazards from both types of carcinogenic agents have been rising during the past 75 yr because of the growing contamination of the human environment with products and wastes of modern industry. This development is responsible for the moderate to marked increases in frequency of certain cancers in many industrialized countries and for the shifts in age and sex distribution of certain cancers in general or circumscribed population groups. Since carcinogenic effects on cells are largely irreversible and thus persistent and cumulative when repeated, exposure to even small doses of carcinogens sustained over long periods in a carcinogenically polluted environment create definite cancer risks. The concept of a "safe" dose for carcinogens is without scientific basis, is deceptive and, if legally adopted, represents a potentially highly dangerous public health policy. While protecting special economic and professional interests, its application tends to raise gradually and insidiously the level of carcinogenic contamination of the human environment. There does not exist moreover a reliable method or procedure for determining and defining a "safe" dose. All avoidable environmental carcinogens therefore should be eliminated and prevented from entering the human environment. All unavoidable carcinogenic risks should be reduced to the lowest possible minimum and the exposed individuals should be kept under life-long medical surveillance for the detection of precancerous and early cancerous lesions which might result from such contacts. (99 references)

- 3621 AFLATOXINS: POTENT FOOD POISONS AND CARCINOGENIC COMPOUNDS. (E.) Elmund, G. K. (Colorado St. U., Fort Collins), T. C. Brewster and A. T. Tu. *J Chem Education* 49(6):398-399, 1972.

Aflatoxins are produced by the fungus, *Aspergillus flavus*. Although numerous foods can support growth of the fungus, the most common substrates are grains, coconuts and oil seeds. Aflatoxins have a pentacyclic structure and are classified as highly substituted coumarins. Of the eight confirmed structures, aflatoxin B₁ is the most toxic, carcinogenic and prevalent. Present evidence indicates that the aflatoxins are synthesized from acetate precursors. Feeding of aflatoxins to vertebrates primarily causes liver damage and especially proliferation of bile duct cells. Aflatoxins are primarily retained in the liver and initially suppress protein synthesis in, and reduce RNA content of, the liver cells. It has been reported that injection s.c. with 2 µg of a mixture of B₁ and G₁ produced tumors in five of six rats at the site of injection; when

aflatoxin was administered to rats over a period of nine weeks, the incidence of liver tumors was 100%. In addition to the liver, aflatoxins have been shown to induce neoplasms in stomach, kidneys, lungs, salivary glands, mesenchymal tissue, brain, lymphatics, skin, pituitary, adrenal cortex, mammary glands, testis and the uterus of rats. Aflatoxins or their metabolites bind to DNA and affect DNA replication, transcription into RNA, and subsequent translation of the messenger RNA into protein. (19 references)

- 3622 THE MOLECULAR ROOTS OF CANCER. (E.) Chedd, G. (No affiliation). *New Sci* 54(802):740-742, 1972. (No references)

- 3623 TISSUE PROTEOLYSIS IN CANCEROLOGY. (Fr.) Guelfi, J. (No affiliation). *Rev Path Comp Med Exp* 9(1):51-57, 1972. (No references)

- 3624 CYTOCHEMICAL DISTINCTION OF ACUTE LEUKOSES. (LITERATURE REVIEW). (Rus.) Balasheva, I. I. (Tomsk Med. Inst., USSR) and Ye. I. Stepanova. *Vop Okhr Materin Dets* 16(10):45-51, 1971. (52 references)

- 3625 ETIOLOGY OF HODGKIN'S DISEASE. (Fr.) Hoerni, B. (Bergonie Fdn., Bordeaux, France) and J. Chauvergne. *Bordeaux Med* 5(4):387-390, 1972. (13 references)

- 3626 GRANULAR CELL TUMOR OF THE VULVA. (Fr.) Babin, Ph. (St. Andre Hosp. U. Bordeaux, France), G. Delmon and X. Ponsan. *Bordeaux Med* 5(4):359-368, 1972. (123 references)

- 3627 CHROMOSOMAL ABERRATIONS IN HUMAN MALIGNANT BLOOD DISEASES. (Rum.) Motoiu-Raileanu, I. (N. Gh. Lupu Inst. Int. Med., Bucharest, Rumania). *St Cerc Med Int* 12(5):423-433, 1971. (73 references)

- 3628 HUMAN CANCER ANTIGENS. (Fr.) Burtin, P. (Cancer Res. Inst., Villejuif, France). *Ann Biol Clin* 30:95-97, 1972. (11 references)

- 3629 RECENT DATA ON CANCER OF THE UTERINE CERVIX. (Fr.) Wolff, J.-P. (Gustave-Roussy Inst., Villejuif, France). *Gaz Med France* 79(9):1297-1304, 1972. (No references)

- 3630 TRANSPLACENTAL CHEMICAL CARCINOGENESIS IN MAN. (E.) Miller, R. W. (Nat'l. Cancer Inst., Bethesda, Md.). *J Nat Cancer Inst* 47(6):1169-1170, 1971. (14 references)

- 3631 AETIOLOGY OF LIVER CANCER. (E.) Anonymous. *Brit Med J* 1(5792):261-262, 1972. (14 references)
- 3632 THE VIROLOGY OF CANCER: GENERAL CONCLUSIONS CONCERNING THE MORPHOLOGIC DEVELOPMENT AND THE TRANSMISSION MECHANISMS OF THE BREAST CANCER VIRUS. (Fr.) Thomas, J. A. (Lab. Biol., U. Paris, France), E. Hollande, M. Henry and C. Vilain. *C R Acad Sci [D] (Paris)* 273(23):2390-2393, 1971. (21 references)
- 3633 BONE TUMORS. (E.) Yamamoto, T. (Atomic Bomb Casualty Commission, Hiroshima, Japan). *Hum Pathol* 2(4):531-532, 1971. (5 references)
- 3634 CANCER AND IMMUNITY. (Fr.) Anonymous. *Sem Hop Paris* 46:16-17, 1971. (No references)
- 3635 PROGESTINS IN ONCOLOGY. (Sp.) Viladiu Quemada, P. (No affiliation), J. Badia Serra, E. Marcullo Gaspar and N. Uriz. *An Med* 57(3):153-168, 1971. (22 references)
- 3636 EPIDEMIOLOGY AND CANCER. (E.) Anonymous. *S Afr Cancer Bull* 15(4):156-163, 1971. (No references)
- 3637 SOFT PART SARCOMAS REVISITED. REVIEW AND COMPARISON OF A SECOND SERIES. (E.) Ferrell, H. W. (Med. Coll. Virginia, Richmond) and W. J. Frable. *Cancer* 30(2):475-480, 1972. (16 references)
- 3638 FORMAL DISCUSSION OF BRIAN MACMAHON'S PAPER, "EPIDEMIOLOGICAL CONSIDERATIONS OF STAGING IN HODGKIN'S DISEASE." (E.) Hutchison, G. (Michael Reese Hosp. Chicago, Ill.). *Cancer Res* 31:1858-1859, 1971. (No references)
- 3639 EPIDEMIOLOGICAL CONSIDERATIONS IN STAGING OF HODGKIN'S DISEASE. (E.) MacMahon, B. (Harvard U., Sch. Public Hlth., Boston, Mass.). *Cancer Res* 31:1854-1857, 1971. (25 references)
- 3640 SUGAR AND AMINO ACID TRANSPORT BY CELLS IN CULTURE - DIFFERENCES BETWEEN NORMAL AND MALIGNANT CELLS. (E.) Isselbacher, K. J. (Harvard Med. Sch., Boston, Mass.). *New England J Med* 286(17):929-933, 1972. (26 references)
- 3641 CUTANEOUS PRECANCER AND CANCER. (E.) Epstein, J. H. (U. California Sch. Med., San Francisco). *Mod Med* 40(8):135-140, 1972. (No references)
- 3642 ORGANIC POLYMER BIOCOMPATIBILITY AND TOXICOLOGY. (E.) Bischoff, F. (Santa Barbara Cottage Hosp. Res. Inst., Calif.). *Clin Chem* 18(9):869-894, 1972. (241 references)
- 3643 ONCOGENIC VIRUSES AND THEIR ROLE IN HUMAN CANCER. (It.) Koller, P. C. (U. London, England). *Recent Progr Med (Roma)* 52(2):105-116, 1972. (30 references)

- 3644 EFFECT OF TUMOR PROMOTERS ON CELL KINETICS IN MOUSE EPIDERMIS. (E.) Frankfurt, O. S. (Inst. Chem. Physics, Moscow, USSR) and E. Raitcheva. *J Nat Cancer Inst* 49(1):131-137, 1972.

The tumor promoters Tween-60 and croton oil were applied on the skin of normal control C3HA inbred female mice and of mice pretreated at the same site one month before by a single topical injection of 7,12-dimethylbenz(a)anthracene (DMBA). The proliferative response of the treated epidermis was estimated from autoradiographs of skin sections taken after i.p. injection of ^3H -thymidine. The number of cells synthesizing DNA in the basal layer increased 12 hr after application of the tumor promoters and was highly elevated after 72 hr. DNA-synthesizing cells also appeared among mature cells. The labeling index (% of cells labeled) for basal cells in DMBA-treated epidermis was significantly higher than in controls 12-16 hr after application of the tumor promoters. During the period of active proliferation, the mitotic cycle, as estimated by the method of labeled mitoses, was 10 hr both in normal and DMBA-treated epidermis (eight times shorter than normal, untreated epidermis). All phases of the cell cycle were shortened, especially G_1 . Cell maturation, as measured by transition of labeled cells from the basal layer into the layer of spinous cells, was accelerated in the epidermis stimulated by the tumor promoters. The number of cells per mm length of epidermis increased by 48 hr after application of tumor promoters. The increase was due to an increase in the number of mature cells only and appeared to be more pronounced in DMBA-treated skin. It is hypothesized that the action of tumor promoters on DMBA-treated epidermis leads to the selection of cells with a shortened G_1 phase, which is possibly associated with a weakened response to the factors regulating cell proliferation.

- 3645 THE SUGAR CONTENT AND THE pH OF THE SMOKE OF CIGARETTE, CIGAR AND PIPE TOBACCOS IN RELATION TO LUNG CANCER. (E.) Elson, L. A. (Inst. Cancer Res., Sutton, England), T. E. Betts and R. D. Passey. *Int J Cancer* 9(3):666-675, 1972.

Over 150 brands of cigarettes from more than 30 countries were used for estimation of tobacco sugar content and for determination of smoke pH. The results were compared with similar estimates from cigar and pipe tobaccos. Sugar content of cigarette tobacco was related to smoke pH. An increase in sugar content from below 1% to about 8% decreased the pH from 8-9 to about 5. Increasing the sugar content from 8-20% decreased the pH by less than one unit. The smoke from cigarettes with a high sugar content (containing a large proportion of flue-cured tobacco) showed a progressive increase in acidity during the course of smoking, whereas that of cigarettes with low sugar content (mainly air-cured tobacco) showed a progressive decrease in acidity. Filters had no significant effect on the direction of pH changes of the smoke. Cigar tobacco, associated with a lower incidence of lung cancer than cigarette tobacco, gave

a smoke with a progressive decrease in acidity. The mean pH of smoke for all tobaccos was greater when the tobacco was smoked in a pipe than when smoked in the form of a cigarette. Rats exposed to nicotine vapors at alkaline pH values showed greater pharmacological effects and more severe signs of nicotine toxicity than rats exposed to nicotine aerosols at acid pH values. The lower lung incidence in cigar and pipe smokes is possibly related to the fact that nicotine is more readily absorbed in the form of the free base (at alkaline pH) than in the form of a stable salt (at acid pH). The incidence of lung cancer in cigarette smokers may be reduced by raising the pH of the smoke to a "safer" level by suitable additives such as urea or guanidine salts.

- 3646 MUTATION AND TRANSFORMATION OF CULTURED MAMMALIAN CELLS BY N-ACETOXY-N-2-FLUORENYL-ACETAMIDE. (E.) Huberman, E. (Natl. Cancer Inst., Bethesda, Md.), P. J. Donovan and J. A. DiPaolo. *J Nat Cancer Inst* 48(3):837-840, 1972.

N-2-fluorenylacetamide (FAA) and its metabolic derivatives, N-hydroxy-N-2-fluorenylacetamide (N-hydroxy-FAA) and N-acetoxy-N-2-fluorenylacetamide (N-acetoxy-FAA), were studied in two cell systems: Chinese hamster for toxicity and mutagenicity and Syrian hamster for toxicity and transformation. Cytotoxicity (ratio of cloning efficiency of treated and control cells), mutagenicity (8-azaguanine-resistant colonies/ 10^5 cells) and transformation frequency (ratio of colonies exhibiting crisscross pattern to surviving treated colonies) increased with concentration and degree of reactivity of the derivative FAA. In both cell systems, N-acetoxy-FAA was the most cytotoxic compound and FAA the least toxic. N-acetoxy-FAA was also highly mutagenic to the Chinese Hamster cells and produced the greatest frequency of transformation in Syrian hamster cells. N-hydroxy-FAA produced a low frequency of transformed or drug-resistant colonies only at high concentrations. FAA was nonmutagenic and had a very weak transforming activity at all doses tested. These results suggest a positive correlation between mutagenicity and transformation.

- 3647 DIMETHYLCARBAMYL CHLORIDE, A MULTIPOTENTIAL CARCINOGEN. (E.) Van Duuren, B. L. (New York U. Med. Ctr., N.Y.), B. M. Goldschmidt, C. Katz and I. Seidman. *J Nat Cancer Inst* 48(5):1539-1541, 1972.

Dimethylcarbamyl chloride (DCC), a urethan-related derivative of carbamic acid used in the manufacture of herbicides, pesticides and anthelmintics, was tested for carcinogenicity in female ICR/Ha Swiss mice by application to skin (2 mg, three times weekly) and by s.c. injection (5 mg, once weekly). After one yr, 68% of the animals treated by skin application had tumors; of these 46% were papillomas and 22% were carcinomas. S.c. injection produced a 72% incidence of local sarcomas. A low incidence of papillary tumors of the lung

was observed at autopsy in the animals given DCC by topical application (8% incidence) and by s.c. injection (4% incidence). No lung tumors were seen in the control groups. It is suggested that DCC is a direct-acting acylating agent whose active form is its cation and that it may constitute a potential occupational hazard.

- 3648 TRACE ELEMENTS THAT ACT TO INHIBIT NEOPLASTIC GROWTH. (E.) Pories, W. J. (Case Western Reserve U. Sch. Med., Cleveland, Ohio), E. G. Mansour and W. H. Strain. *Ann NY Acad Sci* 199:265-273, 1972.

Several trace elements have been reported to inhibit neoplastic growth by a number of mechanisms. Arsenic has been shown to decrease significantly the incidence of adenomas and carcinomas of the lung in mice. Several reports suggest that copper inhibits chemically induced carcinogenesis and that it potentiates the anticancer effects of various alkylating agents. Iodine has proven so far to have the most practical application to anti-tumor technology. In small amounts it prevents goiter and in larger amounts, the growth of tumor. Platinum compounds have the ability to stop cell division and have been reported to act synergistically with alkylating agents. Experiments have suggested that platinum may have a broad antitumor spectrum. Selenium is able to inhibit chemically induced carcinogenesis in rats. In addition, human cancer death rates are apparently higher in areas with low selenium levels. Zinc, which is essential for normal proliferative processes, also plays an important role in tumor growth. The survival of Walker 256 carcinosarcoma, Lewis lung tumor and leukemia-bearing rats and mice fed a zinc-deficient diet was significantly increased and the growth of tumors was decreased compared with that of the controls. Radioactive zinc is localized preferentially in various mouse cancers, possibly due to a relatively slower turnover compared with normal body tissues, and this fact has provided one successful approach to antitumor therapy in animals. Although the role of zinc in human cancers has not been explored, low serum levels have been reported in leukemia, Hodgkins disease, bronchial carcinomas and a variety of other tumors.

- 3649 EFFECT OF AFLATOXIN ON COMPLEMENT ACTIVITY IN GUINEA PIGS. (E.) Thurston, J. R. (Veterinary Sci. Res. Div., U.S. Dept. Agriculture, Ames, Iowa), J. L. Richard, S. J. Cysewski, A. C. Pier and C. K. Graham. *Proc Soc Exp Biol Med* 139(1):300-303, 1972.

Eleven groups of guinea pigs were dosed once daily with partially purified aflatoxin in measured amounts per os for 20 days. Blood samples were obtained from each animal prior to treatment and on day 21; complement titrations were done within 48 hr after collection. All animals were sacrificed after the

second blood sampling and histological examination carried out on liver tissue. A daily dose of aflatoxin equivalent to 0.03 mg or greater of fraction B₁ resulted in significant depression of complement activity associated with changes in the liver. A daily intake equivalent to 0.015 mg or greater B₁ caused a significant reduction in weight, showing the general condition of guinea pigs was more responsive to aflatoxin than either complement activity or liver change. Considerable individual variations in complement titers, weights and liver changes were noted among the guinea pigs.

- 3650 EXCRETION OF AFLATOXIN BY FROGS AFTER IMPLANTATION WITH *ASPERGILLUS FLAVUS*. (E.)

Brewster, T. C. (Dept. Microbiol., Colorado State U., Fort Collins) and D. W. Grant. *J Infectious Dis* 125(1):66-68, 1972.

Results of 20 experiments designed to determine if aflatoxins are formed *in vivo* in *Rana pipiens* implanted with *Aspergillus flavus* are reported. Frogs implanted with viable mycelia of a toxigenic isolate of *A. flavus* excreted 50% more aflatoxin than control animals bearing autoclaved implants. The ratio of aflatoxin B to G in excretions from frogs implanted with live mycelia was approximately 1:2, while for controls it was close to 1:1. In both live and autoclaved mycelia, the ratio was the same before implantation. The elevated amounts of aflatoxin G excreted by frogs with live implants seemed to demonstrate *in vivo* formation. Experiments with ¹⁴C glucose provided evidence that partial or total synthesis of aflatoxin occurred during the parasitic existence of *A. flavus*. These findings suggest that *A. flavus* retains its ability to produce aflatoxin in frogs with simulated aspergillosis.

- 3651 LYMPHOMAS IN THE WISTAR RAT AFTER INTRA-PLEURAL INOCULATION OF SILICA. (E.)

Wagner, M. M. F. (Llandough Hosp., Penarth, Wales) and J. C. Wagner. *J Nat Cancer Inst* 49(1):81-91, 1972.

Standard and specific pathogen-free (SPF) Wistar rats received a single i.p. injection of alkaline-washed crystalline silica (<5μ diameter), and the subsequent development and distribution of silicotic nodules and tumors was studied. The distribution of nodules was the same in standard and SPF rats. Macroscopically, they were limited to the pleural cavity and were seen throughout the mediastinum, on the outer pericardial surface, surrounding the aorta and esophagus, and on the pleural surface of the diaphragm. Silica crystals were observed microscopically in the liver and spleen. Apart from those animals which developed malignancies, 21 standard and 30 SPF rats developed granulomas. Most tumors in both groups occurred between 300 and 1000 days after silica injection. Thirty nine of 96 SPF rats and 31 of 94 standard rats developed reticuloendothelial

tumors, most of which were composed of malignant histocytes. Five tumors among the SPF rats were malignant lymphomas. Spindle cell sarcomas were seen in both the standard and SPF groups. Malignant tumors were observed in the mediastinum, pericardium, diaphragm, lungs, liver and spleen. Early malignant change often occurred near silicotic nodules. Thymic involvement was never seen. The tumors occurring after silica inoculation differed histologically from those reported to occur after i.p. inoculation of asbestos.

- 3652 AIRCRAFT ENGINES AS A SOURCE OF CARCINOGENIC POLLUTION OF THE ENVIRONMENT (BENZO (a)PYRENE STUDIES). (E.) Shabad, L. M. (Inst. Exp. Clin. Oncology USSR Acad. Med. Sci., Moscow) and G. A. Smirnov. *Atmos Environ* 6:153-164, 1972.

Benzo(a)pyrene (BP) concentrations in soot and exhaust gases from turbojet and piston aircraft and in soil, vegetation and snow near airports were determined by spectrofluorescent techniques. The amount of BP emitted by the aircraft depended on engine working regime and the character of fuel combustion. Soot from a piston engine contained 250 µg/kg BP and that from a jet engine 350 µg/kg. BP concentrations in jet exhaust gases were 2-4 mg/min. Levels of BP in the atmosphere, soil, vegetation and snow ranged from 0.28 µg/kg to 182 µg/kg. The carcinogenicity of aircraft soot containing 0.1% BP was established in experiments with hybrid F₁ mice. Four groups of mice received applications of test materials three times a week in the following series: Group I (33 mice) treated with turbojet soot; Group II (33 mice) treated with piston engine soot; Group III (34 mice) treated with BP extract in benzol; and Controls (20 mice) treated with benzol alone. Tumors developed in all mice except controls 11-13 wk after onset of treatment. Nine months after the beginning of the experiment the surviving animals (29 in each test group and all controls) were sacrificed and their tissues examined. All mice except controls had epithelial tumors and the tumors were malignant in all but three animals. To control the possible action of carcinogenic aviation exhausts on man, consideration should be given to improving the efficiency of fuel combustion in aircraft engines.

- 3653 CARCINOGEN DIMETHYLNITROSAMINE PRODUCED *IN VIVO* FROM NITRITE AND AMINOPYRINE. (E.) Lijinsky, W. (U. Nebraska Med. Ctr., Omaha) and M. Greenblatt. *Nature New Biol* 236(67):177-178, 1972.

The *in vivo* production of dimethylnitrosamine (DMN) was studied in male MRC (Wistar-derived) rats. Groups of rats were given 35 mg of aminopyrine, 40 mg of sodium nitrite or aminopyrine plus sodium nitrite by gastric intubation. After 68 hr the livers of rats receiving aminopyrine or nitrite alone showed no changes, but the livers of rats

fed aminopyrine plus nitrite all showed severe centrilobular liver necrosis typical of the effect of DMN. Animals treated for three consecutive days with aminopyrine plus nitrite died one hr after the last feeding. On autopsy, the livers were swollen and dark red. Microscopically, blood ascites and severe liver necrosis was seen. Serum SGPT levels, an index of liver necrosis, were increased two- to four-fold in rats receiving the combined treatment. No significant hepatic alterations were noted in animals receiving aminopyrine or nitrite alone. These results indicate that a significant amount of DMN was formed *in vivo* in rats receiving aminopyrine plus nitrite. The lack of a necrotic liver response in animals fed nitrite plus dimethylamine indicates that the formation of DMN from aminopyrine and nitrite was not due to nitrosation of dimethylamine produced from aminopyrine by hydrolysis. These results suggest that the ingestion by humans of aminopyrine when nitrite is present in the stomach may constitute a hazard.

- 3654 THE HISTOCHEMICAL DEMONSTRATION OF POLYADENYLIC ACID HYDROLASES IN RAT LIVER DURING AZO DYE CARCINOGENESIS. (E.) Daoust, R. (Dept. Anatomy, U. Montreal, Canada). *J Histochem Cytochem* 20(7):536-541, 1972.

Films of polyadenylic acid (poly A) were exposed to liver sections from 4-dimethylaminoazobenzene (DAB)-fed male albino Wistar rats in order to determine whether the nucleases acting on these films, like the RNase previously reported, were depressed during carcinogenesis. Normal liver parenchyma gave a positive reaction for poly A hydrolases which was particularly intense in periportal areas. Livers from animals fed the basal control diet (without DAB) showed a similar distribution of enzyme activity but were generally more active than normal livers. In DAB-fed rats, the nodules of hepatic tissue gave intense reactions while the trabeculae of bile ducts and connective tissue, as well as the necrotic areas, were negative. The formation of hyperbasophilic foci at later stages of DAB feeding was accompanied by a loss of poly A hydrolase activity. The hepatomas, which were apparently derived from such foci, showed weak or negligible activity. Thus, the change in RNases, as previously reported, and in poly A hydrolases occurred at different stages of the carcinogenic process. The loss of RNase activity preceded the neoplastic transformation while the decrease in the activity of poly A hydrolases was closely associated with tumor formation; however, the induced tumors were deficient in both types of nuclease activity.

- 3655 THE EFFECT OF VARYING THE LENGTH OF THE NURSING PERIOD ON THE POSTPARTUM GROWTH OF CHEMICALLY INDUCED RAT MAMMARY TUMORS. (E.) McCormick, G. M., II (U. Tennessee Med. Units, Memphis). *Cancer Res* 32:1574-1576, 1972.

The effect of varying the length of the nursing period on the regression of 7,12-dimethylbenz(a)-anthracene (DMBA)-induced rat mammary carcinomas was studied. Virgin female Sprague-Dawley rats received 20 mg DMBA by gastric intubation. Eighteen days after DMBA feeding, the rats were allowed to breed. On the first day postpartum, all litters were adjusted to six pups, and the rats were divided into three groups which nursed 7, 14 and 21 days, resp. All rats developed single or multiple palpable mammary tumors during their pregnancy. The rate of tumor regression was inversely related to the duration of the nursing period. Six of 13 tumors regressed in animals which nursed for 21 days, while 10 of 14 tumors had regressed by the 21st day postpartum in animals nursing for 14 days and 13 of 15 had regressed in the animals which nursed for only seven days. In all instances, the remainder of the tumors which did not regress increased in size. When animals bearing multiple tumors nursed for only seven days, all tumors regressed. No regression was noted in multiple tumor-bearing animals nursing for 14 or 21 days. No tumors in any of the groups regressed during the first seven days. New tumors appeared in all groups following parturition, with the time of tumor appearance apparently related to the length of the nursing period. While two tumors appeared during the 21-day nursing period, no tumors appeared during the first 21 postpartum days in animals which nursed for seven or 14 days. These results further strengthen the concept that maintenance of growth of chemically induced mammary rat tumors during the postpartum period depends on the continual presence of the nursing stimulus.

- 3656 CELL FUNCTION: ITS IMPORTANCE IN CHEMICAL CARCINOGENESIS. (E.) Becker, F. F. (New York U. Sch. Med., New York). *Fed Proc* 30(6):1736-1741, 1971.

Cell function in relation to chemically produced neoplasms is reviewed with emphasis on experimental findings in the fields of hepatocarcinogenesis and plasma cell tumors. A hypothetical model of carcinogenesis is derived in which extreme functional demand interacts with chronic cell proliferation in a milieu of appropriate genetic susceptibility to produce malignant alteration. Hepatic nodules produced by ingestion of N-2-fluorenylacetamide (2-FAA) were studied as preneoplastic nodules. Immune electrophoresis radioautography showed clear suppression of protein synthesis in early nodules; levels of albumin and complement were greatly reduced or albumin was totally absent. Haptoglobulin was also frequently absent. Restoration toward the pattern of normal livers was seen in later nodules. Approximately 10% of the cells in early nodules had breaks or gaps in their chromosomes, while the chromosomes of later nodules were intact. Inbred BALB/c mice injected i.p. with mineral oil had a high incidence of functioning plasma cell tumors. The tumors showed three stages of development: 1) the initial response was formation of granulomatous structures

with normal-appearing plasma cells; 2) later abnormal plasma cells appeared in the granulomas, producing abnormal-type proteins within the tumor which were undetectable in the peripheral blood; and 3) the terminal stage was the proliferation and spread of the myeloma cells with their unique protein detectable in the peripheral blood. In germ-free BALB/c mice, the same procedure produced lymphoreticular sarcomas instead of plasma cell tumors. The hypothesis advanced emphasizes that although loss of cell function may be secondary to tumor progression and relatively unimportant in this sequence, an intense, prolonged functional demand may govern the carcinogenic evolution of selected tissues.

- 3657 MUTATIONS INDUCED IN *HAEMOPHILUS INFLUENZAE* BY TRANSFORMATION WITH NITROSOGUANIDINE-TREATED DNA. (E.) Kimball, R. F. (Oak Ridge Natl. Lab., Tenn.) and J. K. Setlow. *Mutat Res* 14(2):137-146, 1972.

DNA treated with *N*-methyl-*N'*-nitro-*N*-nitrosoguanidine (MNNG) was used to induce mutations in untreated *Haemophilus influenzae*. Two strains of bacteria were used: Rd (wild type) and Rd (DB112), a UV-sensitive excisionless strain obtained from transformation of Rd with DB112 DNA. Both strains were exposed to MNNG and tested for resistance to four drugs. The frequencies for mutation to kanamycin and viomycin resistance were one to two times higher than those to novobiocin and erythromycin resistance. Highly competent (63% transformation to streptomycin resistance) and exponentially growing cultures were exposed simultaneously to 1.9 mM MNNG for 3, 6, and 9 min, grown to A₆₇₅ of 0.8, frozen and tested for resistance to 0.8 µg/ml novobiocin. No clear difference existed between the induced mutation frequencies in the two cultures. When Rd (DB112) was the recipient no definite evidence for induced mutation at any locus was found. Experimental results showed that *H. influenzae* can be induced by incorporation of MNNG-treated DNA into the genome. Proof of mutation, although at a rather low level, was found for the two loci which are quite close to the streptomycin marker used in selection of transformants. The level of mutation when transforming DNA was treated with MNNG was low compared with mutation of whole cells under similar conditions.

- 3658 BIOCHEMICAL STUDY OF THE PASSAGE OF 3-METHYLCHOLANTHRENE, A CARCINOGEN, THROUGH THE PLACENTA IN MICE. (Fr.) Guibert, D. (Nat. Inst. Applied Sci., Lyon, France), B. Duperray, H. Pacheco, L. Tomatis and V. Turusov. *Therapie* 26(5):1027-1038, 1971.

The permeability of the placenta of mice to 3-methylcholanthrene (MCA), the distribution of MCA in mouse tissues, changes in MCA levels with time in the fetus, and the quantity of MCA metabolites in the fetus were studied. On the 17th day of

gestation, OF mice were given a total of 10 mg MCA in olive oil through an esophageal sound in three equal doses at six-hr intervals or single doses of 1 or 3.3 mg. Within 3-34 hr after the last dose was given, mice were anesthetized and the fetuses were removed and dissected, taking care that fetal tissues were not contaminated with blood from the mother. Tissues to be studied were extracted continuously with benzene, and MCA was determined quantitatively by thin-layer chromatography, gas chromatography, and radioactive labeling with ^{14}C -MCA. All operations were performed in the dark to prevent photochemical degradation. Offspring were found to contain about 1/1000 of the dose of nonmetabolized MCA administered to the mother. In both mothers and offspring the largest amounts of nonmetabolized MCA were found in the thymus, lungs, and liver. Less MCA was found in the offspring of mothers given 10 mg MCA than in those given smaller doses. This is accounted for by the less complete intestinal absorption of the last two doses of MCA. Determinations of MCA in the blood showed that six hr after administration of the last dose, 50% of MCA in the blood of mothers was nonmetabolized, while only 10% was nonmetabolized in the blood of the offspring.

- 3659 EFFECT OF CARCINOGENS ON DNA. ACTION OF 7-BROMOMETHYLBENZ(a)ANTHRACENE. (E.) Michelson, A. M. (Inst. Biol. Physico-Chem., Paris, France) and F. Pochon. *Biochimie* 54(1):17-24, 1972.

Reactions of 7-bromomethylbenz(a)anthracene (BMBA) with DNA, hybrid DNA-RNA and reovirus RNA-RNA, and DNA complexes with other molecules were investigated with regard to the nature of double helices and the products of cross-linking. The percentage of substitution in modified DNAs was determined by UV absorption methods. In the reaction of BMBA with DNA (*Micrococcus lysodeikticus*), an increase in salt concentration of the reaction mixture increased the extent of binding of the carcinogen. Thermally denatured DNA reacted with BMBA to a lesser degree than native DNA, with cross-linking by the DMBA almost disappearing. In contrast to DNA-DNA, hybrid DNA-RNA and reovirus RNA-RNA showed low reactivity with BMBA; the low reactions can be explained by differences in helical geometry of these polynucleotides. The experimental results indicate that the large groove of DNA is an important factor in the DNA-BMBA reaction. Covalent fixation of BMBA to DNA inhibited complex formation with polylysine, with a probable conformational change of the DNA occurring. No inhibition of actinomycin binding was observed with modified DNA compared with unmodified DNA. Cross-linking of DNA strands occurred upon reaction with BMBA; a large excess of BMBA produced a considerable increase in cross-linking. Irradiation of DNA-methylbenzanthracene at 365 nm in aqueous buffer at 5°C produced decreased resolution of the carcinogen absorption bands, partial degradation of the DNA, a 90% decrease in intensity of fluorescence, and an increase in the proportion of cross-linking.

- 3660 ENZYMATIC METABOLISM OF CYCLOPHOSPHAMIDE AND NICOTINE AND PRODUCTION OF A TOXIC CYCLOPHOSPHAMIDE METABOLITE. (E.) Hill, D. L. (Kettering-Meyer Lab., Southern Res. Inst., Birmingham, Ala.), W. R. Laster, Jr. and R. F. Struck. *Cancer Res* 32(4):658-665, 1972.

The enzymes involved in the conversion of cyclophosphamide to its major excretory metabolites were characterized; the metabolism of nicotine was studied as a model for cyclophosphamide conversion. Standard reaction mixtures for cyclophosphamide and nicotine oxidation were prepared containing liver microsomes from DBA/2 mice and TPNH. Cyclophosphamide was converted by mouse liver microsomes into two metabolites (A and C). Metabolite C was present at 15 to 20% of Metabolite A. A and C were converted into a secondary metabolite (B) by an enzyme in the soluble portion of mouse liver. Nicotine was likewise converted into two products (M and N); addition of the supernatant fraction to this system quantitatively converted Metabolite M to Metabolite O but had no effect on Metabolite N. The K_m for oxidation of cyclophosphamide (formation of Metabolite A) was 0.5 mM; carbon monoxide, nicotine, atropine, ephedrine, apomorphine, cocaine, tremorine, phenobarbital, cytochrome c, 2-diethylaminoethyl-2,2-diphenylvalerate and testosterone inhibit the reaction. The enzyme of the supernatant fraction responsible for conversion of cyclophosphamide Metabolites A and C to Metabolite B and for conversion of nicotine Metabolite M to O was selectively inhibited by aldehydes. The supernatant fraction could be replaced by purified rabbit liver aldehyde oxidase. Only liver and lung tissue homogenates could oxidize cyclophosphamide; lung tissue could not convert A to B. Lung homogenates catalyzed the formation of M from nicotine. The initial products of cyclophosphamide oxidation were toxic to tumor cells in *in vitro* tests. For inhibition of clone formation, the products were more than 300 times as effective as cyclophosphamide and about five times as toxic as Metabolite B. Metabolite A was identified as aldophosphamide; Metabolite B was identified as 2-carboxyethyl N,N-bis-(2-chloroethyl) phosphorodiamidate (carboxyphosphamide).

- 3661 SOME FACTORS DETERMINING THE SITE OF TUMORS AND RESISTANCE OF THE RAT STOMACH TO CARCINOGENIC HYDROCARBONS ENTERING THE STOMACH VIA THE DIGESTIVE SYSTEM. (Rus.) Arkhipov, G. N. (Inst. Nutr., Moscow, USSR). *Vestn Akad Med Nauk SSSR* 27(2): 27-30, 1972.

Experiments were carried out with three groups (32 in each group) of hybrid female rats. Group I was made up of intact animals. Methylcholanthrene (MA) in olive oil (0.05 mg/0.1 ml) was administered to Group II by catheter in the esophagus twice daily. Group III received the same carcinogen, but were fasted the day before administration of MA (0.1 mg/0.2 ml). MA was administered six times/wk for seven months to Group II and III. The animals were killed 14 months after the beginning of the experiment and were examined for tumors. Seven rats in Group I, three in Group II, and nine in Group III died before

the end of experiment. Tumors were induced in various organs and tissues, including the liver and mediastinum (2/Group III) and forestomach (3/Group II), while no tumors were observed in the gastric mucosa. Experiments on other rats showed that large amounts of spontaneous gastric secretion and special contractions of the fasted stomach were factors accelerating the evacuation of MA into the intestine, thereby inhibiting the tumor growth in the stomach, including the mucosa. This explains the occurrence of tumors in the forestomach in Group II and not in Group III. Tumors were not seen in the glandular stomach in either group.

3662 EVALUATION OF THE CARCINOGENIC ACTIVITY OF SOME ANTINEOPLASTIC AND IMMUNODEPRESSIVE AGENTS IN NEWBORN SWISS MICE. (It.) Brambilla, G. (Inst. Pharmacol., U. Genoa, Italy), C. E. Caraceni, M. Cavanna and S. Parodi. *Boll Soc Ital Biol Sper* 47(14):418-422, 1971.

Azathioprine (Az; 10 and 40 mg/kg/day), methotrexate (MTX; 0.275 and 0.550 mg/kg/day), 5-fluorouracil (FU; 8.4 and 14.0 mg/kg/day), and L-asparaginase (LA; 2500 I.U./kg/day) were injected i.p. into male and female random-bred Swiss mice. LA treatment began 24 hr after birth, while treatment with Az, MTX, and FU began 48-72 hr after birth. All agents were administered for four consecutive days. Moribund mice were sacrificed, and survivors were sacrificed after 6-7 months; all animals were autopsied. Lymphogenous leukemia developed in 1/119 and pulmonary adenomas in 10/119 controls. Only the larger dose of Az caused a significant increase in lymphogenous leukemia (4/20 rats), which was characterized by leukemic infiltration of the spleen, lymph nodes, liver, kidneys, and lungs. An increased incidence of pulmonary adenomas, which was not statistically significant, was observed in rats given 8.4 mg/kg/day FU. Neither MTX nor LA had any carcinogenic activity. A relationship between sex and carcinogenic activity was found with LA: adenomas developed in 7/23 males and in only 1/25 females. The absence of carcinogenic activity with MTX, FU, and LA may be due to the short duration of treatment. These findings do not rule out the possibility that these compounds may be carcinogenic when administered for longer periods.

3663 CONDITION OF SOME ENDOCRINE ORGANS IN PATIENTS WITH UTERINE CANCER. (Rus.) Slepov, M. I. (V. I. Lenin Inst. Postgrad. Med., Kazan, USSR). *Akush Ginekol* 47(9):42-46, 1971.

Urinary estrogens, function of the adrenal cortex and thyroid, and some liver function tests were investigated in 45 women, aged 43-72 yr, with stage I and II uterine cancer. Associated diseases included obesity (25/45), hypertension (20/45), diabetes (11/45), and hormonally-active ovarian

tumors (2/45). Although a few patients excreted abnormally large quantities of total estrogens (17.4-21.0 µg/day), which may be associated with obesity, there was no significant difference between excretion of total estrogens, estrone, and estriol in menopausal patients with uterine cancer and in normal women in menopause; urinary estradiol levels were significantly increased in cancer patients. Excretion of both total and free 17-hydroxyketosteroids varied within wide limits, but the means did not differ significantly from normal values; 17-ketosteroid excretion was significantly lower than in the control group. Serum sodium levels were normal, and serum potassium levels were in the upper normal range. ¹³¹I-uptake tests, performed on 20 patients with uterine cancer, were normal in 11 cases; six patients had hyperthyroidism and three had hypothyroidism. Basal metabolism was increased in 9/20 patients. Although total serum protein values were normal, albumin levels were reduced and all globulin fractions, particularly α₂- and α-globulins, were increased. The hippuric acid excretion test showed that liver detoxification was abnormal in more than half of the patients. These abnormalities in serum proteins and liver detoxification suggest that one of the reasons for hormone imbalance in patients with uterine cancer is disturbances in liver function. This is an important etiological factor in the development of hormone-dependent tumors.

3664 VASCULARIZATION AND TUMOR GROWTH DURING CHEMICAL CARCINOGENESIS IN THE HAMSTER CHEEK POUCH. STUDIES ON VASCULAR INJECTION AND GRAPHIC OR PLASTIC RECONSTITUTION METHODS. (Fr.) Delarue, J. (Dept. Path. Anat., Paris, France), J. Mignot, T. Caulet, J. Diebold, J. P. Camilleri, M. Reynes and J. Barge. *C R Soc Biol (Paris)* 165(5):998-1000, 1971.

The cheek pouch in adult hamsters was painted three times a week with a 0.5% solution of 9,10-dimethyl-1,2-benzanthracene (DMBA) in mineral oil. Intraepithelial carcinomas *in situ* developed eight weeks after treatment was begun. Examination of thick slices after intravascular injection of India ink showed that these circumscribed vascular nodules were provided with clusters of 6-15 capillary loops which were closely associated with elongated epidermal ridges. Graphic reconstruction of one of these lesions showed that the thick covering rested on four capillary loops, three of which were abnormal, with irregularities in their courses, angulations, and varicosities. Drainage was provided by a venule; the capillary loops formed from a precapillary sinus arteriole; and deformations in the capillary loops were not associated with proliferation. Within 90-160 days after institution of DMBA treatment these vascular nodules had become tumors consisting of sessile or pedunculate polypoid masses with clusters of distended capillaries. These tumors were made up of lobes, and changes in the vascular network involved all of the various tumor lobes. A plastic reconstruction of an invasive polypoid tumor showed that the vascular network

consisted of three groups of clearly defined loops. Each of these groups was made up of 6-10 principle loops and was fed *via* a precapillary arteriole; a large venous trunk reached deep into the sub-epithelium. The presence of three elementary units in these tumors could be accounted for either by subdivision of a primary unit or by the meeting of adjacent units. Although the mechanism involved in development of these tumors could not be determined from these findings, the asynchronous development of vascular clusters in different lobules of the same tumor suggests that adjacent angions coalesce.

- 3665 CHEMICAL INDUCTION OF FOCUS-FORMING VIRUS FROM NONPRODUCER CELLS TRANSFORMED BY MURINE SARCOMA VIRUS. (E.) Aaronson, S. A. (Natl. Cancer Inst., Bethesda, Md). *Proc Nat Acad Sci USA* 68(12):3069-3072, 1971.

Several nonproducer, viral antigen-negative cell lines cloned from murine sarcoma virus (MSV)-transformed cultures were induced to produce focus-forming virus by 5-bromodeoxyuridine (BrdU). Host ranges and serologic characteristics of the induced focus-forming viruses were similar to those of the endogenous helper virus and were independent of the MSV used originally to transform the cells. The induced virus was not able to replicate as a single, infectious virus. These results indicate that genetic information for both MSV and helper murine leukemia virus was present in nonproducer rat and mouse cells transformed by MSV. Several other chemicals also induced virus in nonproducer cells but at much lower titers than BrdU. The fact that virus could not be induced by some strongly mutagenic agents implies that the inducer effect is specific and that induction is not due merely to nonspecific cell toxicity.

- 3666 DIFFERENTIAL INACTIVATION OF TRANSFORMING DNA *IN VITRO* AND *IN VIVO* BY 4-HYDROXYAMINO-QUINOLINE 1-OXIDE. (E.) Ishii, Y. (Fac. Med., Osaka U., Japan) and S. Kondo. *Mutat Res* 13(3): 193-198, 1971.

An Hcr⁻ strain, deficient for the DNA pyrimidine dimer excision-repair mechanism, and an Hcr⁺ strain of *Bacillus subtilis* were compared for susceptibility to the carcinogen 4-hydroxyaminoquinoline 1-oxide (4HAQO). Both Hcr⁻ and Hcr⁺ cells showed the same sensitivity to inhibition of colony-forming ability by 4HAQO, 4-nitroquinoline 1-oxide (4NQO), and UV irradiation. No difference was observed *in vitro* between transforming activities of DNA assayed on Hcr⁻ or Hcr⁺ cells. However, *in vivo* residual transforming activity of 4HAQO-treated Hcr⁻ cells was greater on Hcr⁺ cells than on Hcr⁻ cells. These results indicate that (1) damage induced by 4HAQO is similar to that induced by 4NQO, with both types reparable by the excision-repair mechanism; and (2) DNA damage induced by 4HAQO *in vivo* but not

in vitro is reparable by the repair mechanism. It is hypothesized that DNA damage induced by 4HAQO and 4NQO might be effected by a metabolic product common to both chemicals.

- 3667 THE ACTION OF VITAMIN B₁₅ ON THE INDUCTION OF RAT MAMMARY TUMORS WITH 9,10-DIMETHYL-1,2-BENZANTHRACENE. (Rus.) Beskrovnnii, A. M. (Kharkov Res. Inst. Endocrinol. and Horm. Chem., USSR). *Vop Onkol* 17(7):78-79, 1971.

Vitamin "B₁₅" was administered to rats in an attempt to decrease liver damage from 9,10-dimethyl-1,2-benzanthracene (DMBA) during mammary tumor induction. Female Wistar rats received three 10 mg oral doses of DMBA at 10-12 day-intervals; doses of 10 mg/day vitamin "B₁₅" were also given orally to one group for two months. Mammary tumors were observed in 95.2% of the rats who survived in the group treated only with DMBA; the latent period was 36.6 ± 14.9 days. Tumors occurred in 73% of the group treated with both DMBA and vitamin "B₁₅", the average latent period was 52.1 ± 19.4 days. Vitamin "B₁₅" did not reduce the hepatotoxic action of the carcinogen, but it did reduce tumor frequency and increase the latent periods significantly. Apparently, vitamin "B₁₅" reduces the carcinogenic action of DMBA considerably.

- 3668 POSSIBLE ROLE OF RIBOFLAVIN DEFICIENCY IN EPITHELIAL NEOPLASIA. III. INDUCTION OF MICROSOMAL ARYL HYDROCARBON HYDROXYLASE. (E.) Chan, F. C. (Amer. Hlth. Fdn., New York, N.Y.), T. Okamoto and E. L. Wynder. *J Nat Cancer Inst* 48(5):1341-1345, 1972.

Female Swiss ICR/Ha mice maintained on a riboflavin (B₂)-deficient diet for four wk had decreased activity of aryl hydrocarbon hydroxylase (AHH) in the skin and liver, as determined by a fluorometric *in vitro* assay, when compared with mice on a B₂-supplemented diet. Upon injection of riboflavin to deficient mice, or upon feeding of a normal diet, AHH activity of skin increased above that in mice fed the control diet. Application of 7,12-dimethylbenz(a)-anthracene (DMBA) topically to deficient mice increased the induced AHH activity of skin to a higher level than that of control mice. However, induction of hepatic AHH was retarded in deficient mice receiving i.p. riboflavin injections and DMBA topically.

- 3669 INFILTRATING DUCT CARCINOMA OF THE MAMMARY GLAND OF A RHESUS MONKEY AFTER ADMINISTRATION OF AN ORAL CONTRACEPTIVE: A PRELIMINARY REPORT. (E.) Kirschstein, R. L. (Natl. Cancer Inst., Bethesda, Md.), A. S. Rabson and G. W. Rusten. *J Nat Cancer Inst* 48(2):551-556, 1972.

Six mature (six- to eight-years-old) female rhesus monkeys originally imported from India and fully quarantined were given daily doses of the oral

contraceptive Enovid (1 mg/day) in orange juice. Eighteen months after the start of the experiment, one animal went into respiratory distress and died. Autopsy revealed tumor masses in the left mammary region, in the axillary and internal mammary lymph nodes and in the lungs and liver. The primary mass was identified histologically as an infiltrating duct mammary adenocarcinoma. No pathologic changes were seen in the uterus, ovaries or tubes. The remaining five monkeys continued to receive the drug and after two yr showed no clinical evidence of disease. The extreme rarity of such tumors in untreated monkeys suggests that the carcinoma was induced by Enovid; however, the possibility of spontaneous origin can not be excluded.

- 3670 CARCINOGENICITY OF DIETHYLNITROSAMINE IN *MYSTROMYS ALBICAUDATUS* (AFRICAN WHITE-TAILED RAT). Yamamoto, R. S. (Nat'l. Cancer Inst., Bethesda, Md.), R. Kroes and J. J. Weisburger. *Proc Soc Exp Biol Med* 140(3):890-892, 1972.

Male and female weanling African white-tail rats received diethylnitrosamine (50,100/or 200 ppm) in their drinking water. When death appeared imminent, the animals were killed and autopsied and their organ sections examined by light microscopy. The liver and stomach showed the greatest involvement and both sexes were equally affected. No lesions were observed in controls. All three dosage levels produced well differentiated hepatomas, bile duct adenomas and carcinomas and some gastric squamous cell carcinomas with a latent period of 22 to 42 wk. Multiple hepatomas in the same animal were not uncommon. In a number of cases liver cirrhosis was present. Although this species tolerated relatively high doses of diethylnitrosamine, tumors developed after a longer latent period than in other laboratory rodent species used for bioassay of chemical carcinogens. These results suggest that white-tailed rats are not as suitable for bioassay of chemical carcinogens as currently used rodent species.

- 3671 STRUCTURE AND ACTIVITY IN CHEMICAL CARCINOGENESIS: STUDIES OF VARIOUSLY SUBSTITUTED 7-BROMOMETHYLBENZ[a]ANTHRACENES. (E.) Dipple, A. (Chester Beatty Res. Inst., London, England) and T. A. Slade. *Europ J Cancer* 7(5):473-476, 1971.

Four 7-bromomethylbenz(a)anthracene (BMBA) derivatives were synthesized and tested for their ability to initiate papilloma formation following topical application to female Swiss S mice. The four compounds (1-methyl-BMBA, 6-fluoro-BMBA, 4-bromo-BMBA and 4-chloro-BMBA) were each applied once. Beginning two wk after application of initiator, 10 µg of the carcinogen 12-myristoylphorbol-13-acetate was applied to the same site twice a week for 25 total applications. The incidence of papilloma formation was not as high as that previously reported for 7-bromomethyl-12-methylbenz(a)anthracene (4.1 papillomas

per mouse). 6-Fluoro-BMBA, 1-methyl-BMBA and the parent compound produced an incidence of 1.2 papillomas per mouse. The 4-chloro- and 4-bromo-derivatives were least active (1 papilloma per mouse). The chemical reactivities of these compounds were studied by observing the degree of color produced with time on reaction with 4-(p-nitrobenzyl) pyridine. All compounds, except the 6-fluoro derivative, showed a correlation between the tendency to react in chemical assay according to first order kinetics and the ability to initiate papillomas in mouse skin.

- 3672 THE BINDING OF POLYCYCLIC AROMATIC HYDROCARBONS TO THE DNA, RNA, AND PROTEINS OF TRANSFORMABLE CELLS IN CULTURE. (E.) Kuroki, T. (U. Wisconsin Med. Sch., Madison) and C. Heidelberger. *Cancer Res* 31:2168-2176, 1971.

Normal, transformed and revertant lines of C3H mouse prostate and C3H and Syrian hamster embryonic fibroblast cells were incubated with ³H-labeled polycyclic aromatic hydrocarbons (1 µg/ml) and the extent of binding to cellular DNA, RNA and protein fractions was measured. The extent of binding in the embryonic cells was very similar to that previously found with mouse skin *in vivo*. Chemically and spontaneously transformed cells bound five to ten times less hydrocarbon than did the parental non-transformed prostate cells, although less malignant variants obtained from highly malignant clones bound the hydrocarbons to two-thirds the extent of the nontransformed cells. The distribution of bound carcinogen among the three cellular constituents differed markedly for the individual hydrocarbons. Benzo(a)pyrene (BP) bound preferentially to proteins, while 7,12-dimethylbenz(a)anthracene (DMBA) bound primarily to nucleic acids. The weakly carcinogenic dibenz(a,h)anthracene (DBA) showed the second highest affinity for protein. BP and 3-methylcholanthrene bound to RNA with specific activities about one-half that of DMBA, and to DNA with specific activities about one-fourth that of DMBA. In all cells, the extent of binding of the weakly carcinogenic dibenz(a,c)anthracene to all macromolecules was greater than that of the isomeric and more carcinogenic DBA. There was no significant difference in the binding of hydrocarbons to exponentially growing and contact inhibited cells. This binding was stable and persisted up to five wk when there was no cell growth. Approximately 15% of the bound carcinogen was lost during one cell division in replicating cultures.

- 3673 STRUCTURE-ACTIVITY RELATIONSHIPS IN TOXICITY AND CARCINOGENICITY OF AFLATOXINS AND ANALOGS. (E.) Wogan, G. N. (Dept. Nutr. Food Sci., Massachusetts Inst. Technol., Cambridge), G. S. Edwards and P. M. Newberne. *Cancer Res* 31:1936-1942, 1971.

A study was conducted to determine the toxicity and carcinogenicity of a series of aflatoxins and aflatoxin analogs in rats and ducklings. When ad-

ministered as a single dose by gastric intubation, all four aflatoxins (B_1 , G_1 , B_2 and G_2) were lethal to ducklings. Only aflatoxins B_1 and G_1 were lethal under these conditions to rats. Aflatoxins B_2 and G_2 , tetrahydrodeoxy B_1 and three synthetic compounds containing the fused coumarin-cyclopentene systems of the aflatoxin B molecule were all nontoxic at doses 200 times greater than the effective level of aflatoxin B_1 . Aflatoxins B_1 and G_1 induced hepatocellular carcinomas when given intragastrically in high doses to rats. When given intragastrically or by i.p. injection using a multiple dose regimen, aflatoxin B_1 was more carcinogenic than aflatoxin B_2 . In a similar manner, multiple s.c. injections of aflatoxin B_1 induced sarcomas in all animals tested. Aflatoxin B_2 was noncarcinogenic under these conditions. Neither tetrahydrodeoxyaflatoxin B_1 nor any of the three synthetic compounds showed evidence of carcinogenic activity. Collectively, these results indicate that the furofuran moiety of the aflatoxin structure is essential for toxic and carcinogenic activity. Also, the presence of the double bond in the terminal furan ring is an important determinant of potency. Differences in potency of aflatoxins B_1 and G_1 illustrate the importance of the substituents on the lactone portion of the molecule.

- 3674 REACTION OF ALKYLATING MUTAGENS AND CARCINOGENS WITH NUCLEIC ACIDS: N-3 OF GUANINE AS A SITE OF ALKYLATION BY *N*-METHYL-*N*-NITROSOUREA AND DIMETHYL SULPHATE. (E.) Lawley, P. D. (Chester Beatty Res. Inst., Chalfont St. Giles, England), D. J. Orr and S. A. Shah. *Chem Biol Interact* 4:431-434, 1971/72.

The methylation of salmon sperm DNA by S_N2 and S_N1 type alkylating agents (represented by dimethyl sulfate and *N*-methyl-*N*-nitrosourea, resp.) was studied *in vitro* at neutral pH. Methylated bases were isolated from alkylated DNA hydrolysates and were identified by chromatography or UV absorbance spectroscopy using authentic methylated bases as standards. Incubation of salmon sperm DNA with *N*-methyl-*N*-nitrosourea produced a small quantity of 3-methylguanine in addition to 7-methyladenine, 7-methylguanine, 0⁶-methylguanine, 3-methyladenine and 1-methyladenine. Parallel experiments with dimethyl sulfate or methyl methanesulfonate gave similar results, except that an additional peak of 1,7-dimethylguanine was seen and no 0⁶-methylguanine was found. The formation of 3-methylguanine, a potentially miscoding base, provides another possible mechanism for the weakly mutagenic S_N2 alkylating agents.

- 3675 THE *IN VITRO* INTERACTION OF A METABOLITE OF *N*-ACETYL-4-AMINOBIIPHENYL WITH RAT LIVER MITOCHONDRIA. (E.) Hadler, H. I. (Dept. Chem. Biochem., Southern Illinois U., Carbondale) and B. G. Daniel. *Cancer Res* 32(5):1037-1041, 1972.

N-hydroxy-*N*-acetyl-4-aminobiphenyl (N-OH-AABIP) (30-

300 μ M), a metabolite of *N*-acetyl-4-aminobiphenyl, alone or in combination with showdomycin (300 μ M), was studied for its ability to induce an ATP-energized rat mitochondrial volume change by measuring the decrease in absorbance at 520 nm by spectrophotometry. Neither the thiol reagent, showdomycin, nor N-HO-AABIP alone produced a change in mitochondrial volume. N-HO-AABIP (300 μ M) and showdomycin (300 μ M) together induced marked mitochondrial swelling which could be inhibited by the further addition of oligomycin (0.33 μ g/ml). A very modest enhancement in mitochondrial swelling occurred when the pH was raised from 7.4 to 7.8. Mitochondrial volume change was dependent on the concentration of N-HO-AABIP. Showdomycin could be replaced by the classical thiol reagent NEMI (30 μ M). The parent carcinogen, AABIP, either alone or in combination with showdomycin did not induce mitochondrial volume change. Analysis of mitochondrial respiration by oxygen electrode showed that it was inhibited by N-OH-AABIP whether or not respiration had been uncoupled or had been stimulated by the addition of ADP. These results paralleled earlier observations, based on the same assay system, that *N*-hydroxy-*N*-acetyl-2-aminofluorene exposed a mitochondrial thiol group which participated in the process of oxidative phosphorylation while its parent compound did not. The ability to expose this thiol group may be related to the ability of the carcinogen to exert its effect.

- 3676 MECHANISMS OF MESOTHELIOMA INDUCTION WITH ASBESTOS AND FIBROUS GLASS. (E.) Stanton, M. F. (Nat'l. Cancer Inst., Bethesda, Md.) and C. Wrench. *J Nat Cancer Inst* 48(3):797-821, 1972.

In experiments with 1200 rats, samples of asbestos, fibrous glass, silica and metal particles were implanted in pleura of 11-16 wk old rats. Mesothelioma induction was observed over two yr. Of seven forms of asbestos given, amosite at the maximum dose (40 mg) was the first to produce a fatal mesothelioma (after 53 wk). Standard crocidolite, partially pulverized crocidolite, hand-milled and ball-milled crocidolite produced similar mesothelioma incidences (58-75%). A comparison of tumor induction by an excessively milled, partially pulverized crocidolite with submicroscopic fibrils with tumor induction by standard crocidolite showed that the smaller fibrils were associated with a reduced tumor incidence (20-32%). Mesothelioma incidence correlated with the number of glass or asbestos microfibers present in lesions. Nickel-chrome steel particles produced no mesotheliomas. Silica spheres of submicroscopic size induced one mesothelioma in 48 rats. Nickel particles induced two rare tumors, pituitary adenoma and kidney carcinoma. An intact fibrous glass vehicle did not produce tumors. However, when fibrous glass was reduced to short fibrous fragments (mean length = 5 μ , mean diameter = 0.06-3 μ) it caused small but significant numbers of mesotheliomas (eight in 54 rats). It is concluded that the carcinogenicity of asbestos and fibrous glass is related to the structural shape of these materials, and not to their physicochemical properties.

3677 NEOPLASTIC TRANSFORMATION AND CHROMOSOMAL ABERRATIONS INDUCED BY *N*-METHYL-*N'*-NITRO-*N*-NITROSOGUANIDINE IN HAMSTER LUNG CELLS IN TISSUE CULTURE. (E.) Inui, N. (Nat'l. Cancer Ctr. Res. Inst., Tokyo, Japan) and T. Sugimura. *J Nat Cancer Inst* 48(5):1409-1417, 1972.

Cultured hamster lung fibroblasts were treated with 6.8×10^{-5} or 6.8×10^{-6} M *N*-methyl-*N'*-nitro-*N*-nitrosoguanidine (MNNG) for 24 hr. After removal of MNNG, cells in the group given 6.8×10^{-5} M showed pyknosis of nuclei, cell necrosis and cytoplasmic disintegration. By 27-47 days, disordered arrangements of fusiform cells were seen and transformed foci appeared in which cells piled up to form dense felt-like layers. A criss-cross pattern of cells was seen in transformed cell foci. Transformed cells grew continuously in culture for more than 200 days. MNNG-transformed cells showed changes in chromosome numbers at 167 days after MNNG; modal chromosome numbers showed a variation between 36 and 121. Monosomies and trisomies were also seen in transformed cells. Transformed cells acquired chromosome modes of 46 soon after transformation, and the previous chromosomal changes did not recur. No marker chromosomes were seen in MNNG-transformed cells. Cells transformed by 6.8×10^{-5} M MNNG produced fibrosarcomas in a hamster inoculated with cells 160 days after MNNG transformation. Untreated hamster lung cells and cells given 6.8×10^{-6} M MNNG were not tumorigenic.

3678 THE ROLE OF ARL HYDROCARBON HYDROXYLASE IN 7,12-DIMETHYLBENZ(a)ANTHRACENE SKIN TUMORIGENESIS: ON THE MECHANISM OF 7,8-BENZOFLAVONE INHIBITION OF TUMORIGENESIS. (E.) Kinoshita, N. (Nat'l. Cancer Inst., Bethesda, Md.) and H. V. Gelboin. *Cancer Res* 32:1329-1339, 1972.

Aryl hydrocarbon hydroxylase (AHH) induction by topical application of 100 nmoles each of benz(a)anthracene (BA), 7,12-dimethylbenz(a)anthracene (DMBA) and 7,8-benzoflavone (7,8-BF) was observed in skin homogenates of NIH Swiss mice. BA showed the highest AHH induction; 7,8-BF was not an inducer. 7,8-BF at 10^{-4} M inhibited AHH in skin by 73-88%. Both BA and 7,8-BF inhibited the removal of 14 C-DMBA from mouse skin, indicating that the reported inhibition of DMBA skin tumorigenesis by 7,8-BF did not result from a more rapid rate of removal of the carcinogen from skin. However, 7,8-BF, applied simultaneously with DMBA to mouse skin, caused a diminution of the amount of DMBA bound to DNA, RNA and protein by 71, 52 and 51%, resp. 7,8-BF may, therefore, inhibit DMBA skin tumorigenesis by reducing the amount of carcinogen bound to macromolecules. In tests of tumorigenesis inhibition, mice were painted once with DMBA together with BA or 7,8-BF and followed up with weekly croton oil applications. BA and 7,8-BF inhibited DMBA tumorigenesis by 66 and 80%, resp., at ten wk after DMBA application. By wk 16, suppression of tumorigenesis by 7,8-BF was still in effect, while suppression by BA was no longer evident. 7,8-BF was also a potent inhibitor of

DMBA skin tumorigenesis when the carcinogen was applied repeatedly. 7,8-BF applied 12 hr before or 12 hr after DMBA did not inhibit tumorigenesis. It was concluded that DMBA requires metabolic activation by AHH for its carcinogenic effect. However, the levels of AHH and DMBA tumorigenesis vary in different mouse strains, indicating that DMBA metabolite formation profiles differ in genetically different mice, or that AHH activation is necessary but not sufficient for DMBA tumorigenesis.

3679 THE SHORT-TERM EFFECTS OF 4-NITROQUINOLINE 1-OXIDE ON THE IMMUNE RESPONSE IN MICE. (E.) Phillips, J. M. (Dept. Cancer Studies, U. Birmingham, England). *Int J Cancer* 9(1):39-47, 1972.

(C57BL x IF)₁ mice were given s.c. injections of 4-nitroquinoline 1-oxide (NQO) 24 hr prior to the injection of sheep red blood cells (SRBC). Four days after SRBC, the mice were killed, spleens were removed and antibody-forming cells in the spleen were counted by a hemolytic plaque technique ("localized hemolysis in gel assay"). NQO at 0.5 and 1.0 mg significantly depressed the number of plaque-forming cells (PFC) formed in mouse spleens in response to SRBC. When the non-carcinogenic analogs of NQO, 4-chloroquinoline 1-oxide and 4-nitropyridine 1-oxide, were given to mice in place of NQO 24 hr before SRBC, no effect on PFC response in spleen cells was seen. When NQO was given at various times before and after SRBC, it was found that PFC number in spleen cells was most depressed when NQO was given two days after SRBC. To determine whether NQO-induced immunodepression resulted from NQO acting specifically on bone marrow-derived or thymus-derived cells, normal bone marrow and thymus cells were injected along with spleen cells from NQO-treated mice into irradiated recipients. The results indicated that bone marrow cells were most affected by NQO, thymus cells remaining unaffected. No depression of cell-mediated immunity by NQO was found in tests of skin allograft rejection or in graft-versus-host reactions in NQO-treated mice. Furthermore, NQO did not appear to alter the time of appearance of 19S or 7S antibody response in mice, indicating that NQO-induced immunodepression was not caused by a delay in antibody production.

3680 ON THE PERSISTENCE OF TUMOUR INITIATION AND THE ACCELERATION OF TUMOUR PROGRESSION IN MOUSE SKIN TUMORIGENESIS. (E.) Roe, F. J. C. (Chester Beatty Res. Inst., London, England), R. L. Carter, B. C. V. Mitchley, R. Peto and E. Hecker. *Int J Cancer* 9(2):264-273, 1972.

The hypothesis that the effects of tumor initiation by 7,12-dimethylbenz(a)anthracene (DMBA) applied to mouse skin persist unchanged for long periods was tested using 12-O-tetradecanoyl-phorbol-13-acetate (TPA) as a tumor promoting agent. Urethane was administered i.p. to see if it favored development of malignant skin tumors in mice bearing benign

tumors as a result of treatment with DMBA and TPA. Female Swiss mice exposed twice weekly to 3.125 µg TPA for 15 weeks developed multiple papillomas when treatment was started three weeks after tumor initiation with 100 µg DMBA, but very few when the interval was 50 weeks. All tumors developing up to 20 weeks after treatment with DMBA and/or TPA were benign. Administration of urethane i.p. increased the risk of malignant skin tumor development in mice previously exposed to DMBA and TPA as compared with i.p. injections of distilled water. The possibility that the effect of urethane on the incidence of malignant tumor was related to its general toxicity rather than to its carcinogenicity is discussed.

- 3681 PROLIFERATIVE ENDOMETRIAL RESPONSE TO THECA-GRANULOSA CELL TUMORS. (E.) Gusberg, S. B. (Mount Sinai Sch. Med., New York, N.Y.) and P. Kardon. *Trans Amer Gynec Soc* 94:184-194, 1971.

A total of 115 patients with thecoma, granulosa cell tumor or theca-granulosa cell tumor of the ovary were examined for carcinoma or its precursors in the endometrium. It was assumed that the endometria of patients with feminizing ovarian tumors such as theca-granulosa cell tumors would be subject to continuous endogenous estrogen stimulation. It was found that 64.3% of patients harbored endometria with proliferative changes more advanced in malignant potential than cystic glandular hyperplasia. Adenocarcinoma was seen in 21% of patients, carcinoma *in situ* in 4.3% and adenomatous hyperplasia in 39%. The prevalence of cancer and its precursors was 46.75% in premenopausal patients and 70.8% in postmenopausal patients.

- 3682 γ-GLUTAMYL TRANSPEPTIDASE IN TRANSPLANTABLE, CHEMICALLY INDUCED RAT HEPATOMAS AND "SPONTANEOUS" MOUSE HEPATOMAS. (E.) Fiala, S. (VA Hosp., San Fernando, Calif.), A. E. Fiala and B. Dixon. *J Nat Cancer Inst* 48(5):1393-1401, 1972.

Four transplantable rat hepatomas, induced by chemical carcinogens including 3'-methyl-4-dimethylaminoazobenzene and N-2-fluorenylacetamide, were homogenized, centrifuged and subjected to polarographic and colorimetric assays for γ-glutamyl transpeptidase (glutathionase). The assays measured cysteinylglycine and L-cysteine, which are produced by glutathionase. High levels of glutathionase were seen in all hepatomas, but not in normal adult rat liver. Hepatoma extracts incubated for 60 min showed higher amounts of L-cysteine than unincubated extracts, indicating that L-cysteine was liberated by enzyme from some maternal compound. Glutathionase levels in fetal and normal neonatal rat liver were comparable to levels in hepatomas. The distribution of glutathionase among hepatoma fractions was as follows: 28% in nuclei; 27% in mitochondria; 45% in microsomes. Supernatants had no enzyme activity. Glutathionase activity was high in neonatal C3H x Y mouse liver and low in adult mouse and rat liver. Three of four spontaneous mouse hepatomas, however,

showed low enzyme levels comparable to levels in normal adult mouse and rat livers.

- 3683 THE FORMATION OF VARIANTS WITH A REVERSION OF PROPERTIES OF TRANSFORMED CELLS: VII. CHROMOSOME NUMBERS AND RE-REVERSION IN SUBTETRAPLOID VARIANTS. (E.) Hitotsumachi, S. (Weizmann Inst. Sci., Rehoveth, Israel), R. Schaki, B. Padeh, Z. Rabinowitz and L. Sachs. *Int J Cancer* 10:9-13, 1972.

Three variants, 1-1, 2T-1 and 3T-1, isolated from hamster cells transformed by polyoma virus were studied for saturation density, cloning efficiency in soft agar and liquid medium, percent of colonies formed at 41°C and tumorigenicity after s.c. inoculation into adult hamsters. Variant 1-1 was isolated from hamster embryo cells transformed *in vitro* by virus, while 2T-1 and 3T-1 were obtained from polyoma virus-induced tumors. The three variants were studied at three and 33 wk after clone isolation. At three wk, variant 1-1 showed reversion of both *in vitro* properties of transformed cells and reversion of ability to produce tumors. At 33 wk after isolation, 1-1 showed a considerable degree of reversion of the *in vitro* transformed properties and of ability to produce tumors. Reversion of tumorigenicity was not as complete in 2T-1 and 3T-1 variants at three wk after isolation as it was in 1-1 cells. Both variants 2T-1 and 3T-1, however, showed a considerable degree of re-reversion between three and 33 wk after isolation. All three variants were subtetraploid initially, and all three showed an increase in chromosome numbers between three and 33 wk after clone isolation.

- 3684 RECONSTITUTED TOBACCO--SMOKING AND HEALTH POSSIBILITIES. (E.) Halter, H. M. (AMF Inc., Richmond, Va.) and T. I. Ito. *J Nat Cancer Inst* 48(6):1869-1883, 1972.

Tumor initiation and promotion experiments were performed on the skin of female Ha/ICR mice using tars from machine-smoked cigarettes made of natural tobacco or of reconstituted tobacco sheet. In initiation experiments, mice were painted topically with tar from natural tobacco and reconstituted tobacco cigarettes; in promotion experiments, tar painting followed tumor induction by 7,12-dimethylbenz(a)-anthracene. Tars from reconstituted sheets produced fewer tumors than tar from natural tobacco cigarettes. Reconstituted tobacco tar and natural tobacco tar did not differ significantly as tumor promoters. Tar from reconstituted tobacco sheets processed using a nonaqueous solvent produced fewer tumors than either natural tobacco tar or tar from reconstituted sheet tobacco processed with an aqueous solvent. The nonaqueous solvent sheet tobacco tar, however, was a better tumor promoter than natural tobacco tar. Tar from special low-density reconstituted tobacco sheets produced fewer tumors, and was a poorer tumor promoter, than natural tobacco tar. Studies performed at the Cigarette Institute of Hamburg, Germany, indicate that some reconstituted

tobacco sheet types are superior to others in reducing tumorigenicity of tobacco tar.

- 3685 HISTOGENESIS OF SQUAMOUS METAPLASIA IN THE HAMSTER TRACHEAL EPITHELIUM CAUSED BY VITAMIN A DEFICIENCY OR BENZO(a)PYRENE-FERRIC OXIDE. (E.) Harris, C. C. (Nat'l. Cancer Inst., Bethesda, Md.), M. B. Sporn, D. G. Kaufman, J. M. Smith, F. E. Jackson and U. Saffiotti. *J Nat Cancer Inst* 48(3):743-761, 1972.

Male hamsters were given intratracheal instillations of 5 mg benzo(a)pyrene (BP) with ferric oxide as a carrier dust; another group of hamsters was maintained on a vitamin A-deficient diet. The development of metaplastic lesions in tracheas was observed. BP and ferric oxide and vitamin A deficiency caused similar squamous metaplastic lesions without cellular atypism in tracheal epithelium. In vitamin A-deficient hamsters, squamous cells developed from basal cells. In animals given BP and ferric oxide, epithelial hyperplasia appeared as squamous metaplasia with or without cellular atypism. Differentiated ciliated and mucous cells were replaced by pleomorphic cells. BP and ferric oxide, but not vitamin A deficiency, were associated with enlarged nucleoli, discontinuous basement membranes and electron-dense granules in neoplastic cells.

- 3686 EFFECTS OF PYRAN COPOLYMER ON ONCOGENIC VIRUS INFECTIONS IN IMMUNOSUPPRESSED HOSTS. (E.) Hirsch, M. S. (Harvard Med. Sch., Boston, Mass.), P. H. Black, M. L. Wood and A. P. Monaco. *J Immunol* 108(5):1312-1318, 1972.

Female CBA mice were immunosuppressed by thymectomy, injected with antilymphocyte serum, inoculated with pyran copolymer (125 mg/kg) and inoculated with polyoma virus preparation (2.5×10^6 TCID₅₀). Controls were immunosuppressed and virus-inoculated, but were not given pyran. By 470 days after virus, tumors, including sarcomas and adenocarcinomas, had developed in sites including breasts, parotid glands and bones of 19 of 21 immunosuppressed mice given virus but not pyran. Only two of 21 immunosuppressed and pyran-treated mice developed tumors by day 470. In other experiments, C3H/HeJ and A/He mice were immunosuppressed as above and given pyran (25 mg/kg) before inoculation with Rauscher leukemia virus. Controls were as above. Pyran prevented the development of Rauscher virus-induced erythroblastic splenomegaly. By two yr after virus, erythroblastic leukemia had developed in all of 68 mice infected with virus and immunosuppressed but not given pyran. Only three of seven pyran-treated mice had developed leukemia. The mechanisms of protection by pyran appeared to be secondary to macrophage activation and enhanced phagocytosis.

- 3687 TUMOR PROMOTERS IN TOBACCO AND CIGARETTE-SMOKE CONDENSATE. (E.) Bock, F. G. (Roswell Park Mem. Inst., Buffalo, N. Y.). *J Nat Cancer Inst* 48(6):1849-1853, 1972.

Studies on topical tumor initiation and promotion on mouse skin by fractions of extracts of unburned tobacco (TE) and cigarette smoke condensate (CSC) are reported. In tumor promotion experiments, mice were painted with 7,12-dimethylbenz(a)anthracene before painting with test tumor promoters. Crude TE contained at least two agents which acted together to promote tumorigenesis. One TE fraction of low molecular wt (<1200) was soluble in water, methanol and 1:1 methanol-benzene. Another, high molecular wt TE fraction (>1200) was water soluble but was not soluble in methanol. The high molecular wt TE fraction, being insoluble in organic solvents, probably could not persist in tobacco smoke. The low molecular wt TE fraction may persist in tobacco smoke. CSC contained at least five fractions exhibiting tumor-promoting activity, including the weakly polar materials fraction (WPN) containing polynuclear aromatic hydrocarbons, the weak acids fraction (WA) and the most polar neutral materials fraction (MPN). The WPN fraction was a complete carcinogen; the WA and MPN fractions were only tumor promoters. The remaining two fractions were not adequately tested for complete carcinogenic activity. The WA and WPN fractions were strongly synergistic as promoters. MPN, although active alone, did not add to the tumor-promoting activity of WA or WPN, or the two combined.

- 3688 EARLY STAGE IN THE METABOLISM OF AMINOAZO DYES IN THE LIVER OF RATS. (E.) Du Plooy, M. (South African Coun. Sci. Indust. Res., Pretoria) and J. Dijkstra. *Chem-Biol Interact* 4(3):163-173, 1971/72.

Male rats were given 25 mg *N,N*-dimethylaminoazobenzene (DAB)/100 g body wt by stomach tube and were also dosed with ³⁵S-methionine and ³⁵S-sulphate. The rats were killed after DAB administration and their livers were homogenized and the homogenates centrifuged. Early metabolites of DAB in liver were separated from unchanged DAB by thin-layer chromatography of centrifuge supernatants. The maximum concentration of early metabolites of DAB was found four hr after dosing with DAB. These metabolites had the same properties as the "early metabolites" of 3'-methyl-*N,N*-dimethylaminoazobenzene in that 75% of the dye extractable with trichloroacetic acid (TCA) was not soluble in ethyl ether. Dyes could also be extracted from liver by ethanol. The ethanol extract of DAB-dosed liver was fractionated into six components by paper electrophoresis. Ninety percent of TCA-soluble metabolites of DAB could be accounted for as the ethereal sulfates of 4'-hydroxy-*N*-monomethylaminoazobenzene and 4'-hydroxy-*N*-acetylaminoazobenzene. Besides these two major components, four minor components in the early metabolites of DAB were also sulphated.

- 3689 INHIBITION OF CARCINOGENIC AND TOXIC EFFECTS OF POLYCYCLIC HYDROCARBONS BY PHENOLIC ANTI-OXIDANTS AND ETHOXYQUIN. (E.) Wattenberg, L. W. (U. Minnesota Med. Sch., Minneapolis). *J Nat Cancer Inst* 48(5):1425-1430, 1972.

Female Ha/ICR mice were fed benzo(a) pyrene or 7,12-dimethylbenz(a)anthracene (DMBA) together with the antioxidants butylated hydroxyanisole (BHA), butylated hydroxytoluene (BHT), ethoxyquin or alpha-tocopherol. The development of tumors of the forestomach was observed. BHA, BHT and ethoxyquin decreased the number of mice with tumors and the number of tumors/mouse. Alpha-tocopherol had no significant effect on tumorigenesis. BHA also decreased the lethality of dietary DMBA (0.2 mg daily for 28 or 35 days). In related experiments, DMBA was given by oral intubation to female Sprague-Dawley rats pretreated with test antioxidants, and the production of mammary tumors was observed. Eighty percent of rats given DMBA but no antioxidant developed mammary tumors; in rats given BHA, BHT or ethoxyquin, tumor incidence was 39, 28 and 12%, resp. Alpha-tocopherol did not significantly depress DMBA mammary tumorigenesis. Ha/ICR mice were also treated topically with antioxidants and later with DMBA at the same site. Only BHA at high doses inhibited DMBA epidermal tumorigenesis, and the inhibition by BHA was not statistically significant. BHA, BHT and ethoxyquin, but not alpha-tocopherol, prevented adrenal necrosis in rats given 30 mg DMBA by oral intubation.

3690 ASCORBATE-NITRITE REACTION: POSSIBLE MEANS OF BLOCKING THE FORMATION OF CARCINOGENIC N-NITROSO COMPOUNDS. (E.) Mirvish, S. S. (Eppler Inst. Res. Cancer, Omaha, Nebr.), L. Wallcave, M. Eagen and P. Shubik. *Science* 177(4043):65-68, 1972.

Oxytetracycline, morpholine, piperazine, *N*-methylaniline, methylurea or dimethylamine were reacted with nitrous acid, and the formation of carcinogenic *N*-nitroso compounds (e.g., dimethylnitrosamine) by the nitrosation of the various compounds was observed in the presence or absence of ascorbic acid. Nitrosation of morpholine and piperazine was blocked by more than 98% by ascorbic acid. Blocking by ascorbic acid was only partial for *N*-methylaniline, but was fairly complete for methylurea and oxytetracycline. Ascorbic acid blocked nitrosation of dimethylamine at pH 3 and 4, but at pH 2 there was little effect, and at pH 1 ascorbic acid enhanced nitrosation. Urea was less effective as a blocking agent than ascorbic acid. Ammonium sulfamate was more effective than ascorbic acid at pH 1 and 2, but was relatively ineffective at pH 3 and 4. Ascorbic acid, it was concluded, might inhibit formation of carcinogenic *N*-nitroso compounds *in vivo*.

3691 LEUKEMIA INDUCED BY 7,8,12-TRIMETHYLBENZ(a)-ANTHRACENE IN RATS. II. CHANGES IN BONE MARROW. (E.) Bird, C. (Ben May Lab. Cancer Res., U. Chicago, Illinois). *J Nat Cancer Inst* 48(2):429-439, 1972.

Pulse doses of a 0.5% lipid emulsion of 7,8,12-trimethylbenz(a)anthracene (TMBA) were injected i.v. at 10-day intervals into random-bred male L-E rats. After initial severe hypoplasia of bone marrow, leukemia developed in high numbers, with involve-

ment of bone marrow, liver, spleen, lymph nodes and adrenal glands. The thymus, however, was rarely implicated. A characteristic osteopathy developed in leukemic rats. In long bones, bone marrow adjacent to the metaphysis was sclerosed and often contained irregular trabeculae of new woven bone, whereas the cortex of the shaft was usually thickened. After repeated TMBA treatment, the "physiological anemia" of weanling rats failed to regress, and this was ascribed to the severe reduction of erythropoiesis in the hypoplastic bone marrow. Alkaline and acid phosphatase, lactate dehydrogenase (LDH) and malate dehydrogenase (MDH) activities were determined by spectrophotometric techniques in bone marrow homogenates of control and leukemic rats. In bone marrow of normal rats, activity of LDH was 1.55 ± 0.29 times that of MDH. In leukemic rats, a significant increase in activity ($28 \pm 11\%$) was observed only in the case of LDH; MDH activity was unchanged. Both acid and alkaline phosphatase activity was increased slightly in leukemic rats, compared with controls; however, the relative proportion of activities was unchanged. In hypoplastic bone marrow, LDH and acid phosphatase activities were significantly reduced, but reduction in alkaline phosphatase activity was associated only with the most severe grades of marrow hypoplasia.

3692 HYDRAZINE, METHYLHYDRAZINE AND METHYLHYDRAZINE SULFATE CARCINOGENESIS IN SWISS MICE: FAILURE OF AMMONIUM HYDROXIDE TO INTERFERE IN THE DEVELOPMENT OF TUMORS. (E.) Toth, B. (U. Nebraska Coll. Med., Omaha). *Int J Cancer* 9(1):109-118, 1972.

Randomly bred Swiss mice were given hydrazine (H, 0.001% solution), methylhydrazine (MH, 0.01%), methylhydrazine sulfate (MHS, 0.001%) or ammonium hydroxide (AH, 0.3, 0.2 or 0.1%) in drinking water for life. In addition, C3H mice were given AH (0.1%) in drinking water for life. Tumor development was observed. Lung tumors developed in 54% of 27 females and in 48% of 24 males in mice given H. This represented a significant increase over tumor incidence in mice not given H. Malignant lymphomas and breast tumors were also seen in H-treated mice. Forty-six percent of 23 females and 46% of 23 males given MHS developed lung tumors, also a significant increase in lung tumor incidence for the MHS-treated group. Lung tumor incidence in female and male MH-treated mice was 24% and 22% resp. MH evidently enhanced the development of lung tumors by shortening their latent period in treated mice. AH in Swiss and C3H mice was without carcinogenic effect. However, 60% of C3H mice given AH developed breast tumors, indicating that AH does not inhibit the development of breast tumors which are characteristic of that strain.

3693 EFFECT OF SMOKING ON THE SURVIVAL OF PATIENTS WITH LUNG CANCER. (E.) Linden G. (California State Dept. Public Hlth.), J. E. Dunn, Jr., P. H. Hom and M. Mann. *Cancer* 30(2):325-328, 1972.

The histories of 460 male patients with lung cancer, on whom smoking information had been obtained prior to diagnosis of the disease, were studied to determine whether or not a relationship exists between cigarette smoking and length of survival. No significant differences in the survival rates among patients in the various smoking categories were observed and the stage of the disease at the time of diagnosis was found to be the main factor in determining the length of survival. Patients who smoked two or more packs of cigarettes per day had the largest percentage of squamous cell carcinomas, the highest percentage of localized cases (22%) and the best survival. The latter two findings either could be due to the fact that squamous cell carcinoma has a lower metastatic potential than adenocarcinoma, which was more prevalent in lighter smokers, or could be because the presence of respiratory symptoms caused the heavy smokers to seek medical care earlier.

- 3694 TUMORIGENICITY AND AGGLUTINATION BY CONCAVALIN A OF CHINESE HAMSTER CELLS AND THEIR HYBRIDS. (E.) De Micco, Ph. (Res. Unit I.N.S.E.R.M., Marseilles, France) and M. Berebbi. *Int J Cancer* 10(2):249-253, 1972.

The agglutinability of two Chinese hamster cell strains differing in tumorigenic ability was studied *in vitro* with concanavalin A. The DC-3F strain, which produced tumors in 100% of animals following inoculation into the cheek pouch, showed a high degree of agglutinability. The nontumorigenic DC-3F/ADX/Aza strain had a low degree of agglutinability. A hybrid strain, HyC, obtained by fusion of these two lines, was 78% tumorigenic and showed a degree of agglutinability which was intermediate between those of the DC-3F and DC-3F/ADX/Aza strains. A number of sublines cloned from the HyC hybrid line exhibited agglutinabilities which increased in relation to their tumorigenicity. Tumors resulting from inoculation to these clonal lines into hamster cheek pouches showed agglutinabilities which were, in general, much higher than those of the inocula.

- 3695 ULTRASTRUCTURAL CHANGES IN NUCLEI AND NUCLEOLI OF RAT LIVER CELLS TREATED WITH HEPATOCARCINOGENS. (E.) Sugihara, R. (Nara Med. U., Japan), Y. Hiasa and N. Ito. *Gann* 63(4):419-426, 1972.

Male Wistar rats were fed a diet containing 0.12% 3'-methyl-4-(dimethylamino)azobenzene, 0.05% N-2-fluorenylacetamide, or 0.5% DL-ethionine. The liver nodules and carcinomas which developed were studied by electron microscopy and their ultrastructures were compared with that of normal liver tissue from controls. Tumors developing from all three carcinogens were histologically similar. The cells of the hepatic cell carcinomas could be classified into three groups based on their nuclear structure: (1) cells with a structure similar to that of hyper-

plastic nodular cells, (2) cells with an intermediate structure, and (3) cells with the typical characteristics of cancer cells. The carcinoma cells which resembled nodular cells seemed to be derived from the nodular cells. These hepatocarcinoma cells contained small chromatin particles on the inner layer of the nuclear envelope (perinuclear chromatin) and in the peripheral part of the nucleolus (nucleolus-associated chromatin), in contrast to nodular cell nuclei in which all the chromatin fibrils were loose and dispersed in the nucleoplasm. The nodular-type carcinoma cells had round nucleoli with reticular nucleolonemas in contrast to nodular cells in which the nucleolonemas were deformed and contained an increased quantity of granular material.

- 3696 EXPERIMENTAL CANCER OF THE LUNG IN RABBITS INDUCED BY CHEMICAL CARCINOGENS. (E.) Hirao, F. (Osaka U. Med. Sch., Japan), T. Fujisawa, E. Tsubura and Y. Yamamura. *Cancer Res* 32(6):1209-1217, 1972.

The carcinogenic activities of 3-methylcholanthrene (MCA) and 4-nitroquinoline 1-oxide (NQO) were studied in male and female 50- and 100-day-old rabbits. In the first experiment, one group of animals received intrabronchial instillations every seven to ten days of a mixture of 40 mg MCA and 0.4 mg NQO suspended in rabbit plasma. The second group of rabbits received intrabronchial instillations of 40 mg MCA alone in distilled water. Altogether, lung cancer was induced in 80 of 173 rabbits that received more than four doses of carcinogens and survived for more than 30 days. Half were squamous cell carcinoma and one-quarter were adenocarcinoma. The remainder consisted of mixed squamous cell and adenocarcinoma, pleomorphic carcinoma, undifferentiated cell carcinoma and sarcoma. Metastases to other organs (paratracheal lymph nodes, kidneys, mediastinum and chest wall, diaphragm and collateral lung) occurred in 55 cases. The total doses of carcinogens required for 50% incidence of lung cancer were 1000 ± 100 mg MCA and 10 ± 1 mg NQO in group one, and 1330 ± 100 mg MCA in group two. In a second experiment, the superficial bronchial mucosa of adult rabbits was swabbed every one or two days with a solution of 10% MCA in Tween 60. Only two of the 65 rabbits that survived for over 60 days developed lung cancer. One was a pleomorphic and the other a poorly differentiated squamous cell carcinoma.

- 3697 THE INDUCTION OF ATP ENERGIZED MITOCHONDRIAL VOLUME CHANGES BY SHOWDOMYCIN WHEN COMBINED WITH 4',8'-DIHYDROXY-1,2,5,6-DIBENZ-9,10-ANTHRAQUINONE, A METABOLITE OF THE CARCINOGENIC POLYNUCLEAR HYDROCARBON DIBENZ(A,H) ANTHRACENE. (E.) Hadler, H. I. (Dept. Chem., Southern Illinois U., Carbondale), B. G. Daniel, J. Demetrius and R. C. Pratt. *J Antibiot* 24(12):835-845, 1971.

4',8'-dihydroxy-1,2,5,6-dibenz-9,10-anthraquinone

(DI-OH-DBAQ), and hydroxy quinone metabolite of dibenz(a,h)anthracene (DBA), was added to reaction mixtures containing mitochondrial protein prepared from rat liver; in some cases, showdomycin and/or DBA itself were included in reaction mixtures. ATP-energized mitochondrial volume changes were observed. Neither 3 μ M DI-OH-DBAQ nor 300 μ M showdomycin by themselves induced ATP-energized mitochondrial volume changes. However, DI-OH-DBAQ combined with showdomycin did induce an ATP-energized mitochondrial volume change. Oligomycin inhibited the effect induced by the two agents. The volume change induced by 300 μ M showdomycin was enhanced when the concentration of DI-OH-DBAQ was increased from 600 nM to 6 μ M. DBA (6 μ M) failed to induce an ATP-energized mitochondrial volume change when combined with showdomycin. The gramicidin-induced ATP-energized mitochondrial volume changes was progressively inhibited by increasing concentrations of DI-OH-DBAQ. The inhibition of the gramicidin system by DI-OH-DBAQ was relieved by further addition of showdomycin.

- 3698 STATISTICAL ANALYSIS OF THE BIOASSAY OF CONTINUOUS CARCINOGENS. (E.) Peto, R. (Regius Dept. Med., Oxford U., England), P. N. Lee and W. S. Paige. *Brit J Cancer* 26(4):258-261, 1972.

In an experiment consisting of the continuous application of various carcinogenic regimens to a pure strain of experimental animals for a long period, the cancer incidence rates so caused may be studied and compared by the fit of an appropriate class of statistical distributions. Two main families of distributions have appeared in the literature: the lognormal and the Weibull. Of these two, the Weibull distribution, which assumes a "latent period" for tumor development following application of carcinogen and which predicts that the age-specific cancer incidence rate rises as a power of time since first risk, is preferred. The Weibull distribution is suggested by human cancer incidence patterns and is predicted by most theoretical carcinogenesis models. The lognormal distribution is not physically plausible since it has a very eccentric hazard function. The rate-determining parameter for the Weibull distribution is much easier to compute than that for the lognormal distribution. Finally, the rate-determining parameter for the Weibull distribution depends only on the type and dose of carcinogen used and not on the administration regimen.

- 3699 THE CARCINOGENICITY OF TWO DIAZADIBENZOPYRENES. (E.) Zajdela, F. (Radium Inst., Orsay, France), N. P. Buu-Hoi, P. Jacquignon and M. Dufour. *Brit J Cancer* 26(4):262-264, 1972.

1,12-Diazadibenzo(a,i)pyrene (I), 4,11-diazadibenzo(a,h)pyrene (II), and 4,12-diazadibenzo(g,p)chrysene (III) were tested for carcinogenicity by s.c. injection into Swiss mice once a month for three months. The diaza counterpart (I) of dibenzo(a,i)pyrene was

considerably less active than its parent compound, yielding a 39% tumor incidence with a mean latency period of 154 days. However, the diaza counterpart (II) of dibenzo(a,h)pyrene was as active as the parent compound, producing a 93% tumor incidence with a latency period of 175 days. These results indicate that the introduction of two nitrogen atoms into the skeleton of carcinogenic dibenzopyrenes does not suppress their tumorigenic potency as long as the two K-regions remain intact. In contrast, compound III, which was devoid of meso-phenanthrenic region, had no carcinogenic activity.

- 3700 EXPERIMENTAL NEURINOMA IN TISSUE CULTURE. (E.) Cravioto, H. (New York U. Sch. Med. N.Y.), L. Palekar, E. Weiss and K. Bennett. *Acta Neuropath* 21:154-164, 1972.

Fifteen malignant peripheral nerve tumors produced in the offspring of pregnant inbred BD-IX and random-bred CGE rats that received a single i.v. injection of ethylnitrosourea (20 mg/kg body wt) were cultured *in vitro* and were studied with phase contrast optics including time-lapse cinematography. Three cell types were observed in cultures grown in Rose chambers. The most common type was spindle-shaped with a prominent nucleus and nucleolus and slender tapering cell processes. This type most closely resembled Schwann cells and it was therefore concluded that the experimental tumors were Schwann cell tumors. The second cell type was pyramidal-shaped. These cells had a prominent nucleus and exhibited a much lower mitotic activity than the spindle-shaped cells. The third cell type, which was kite-shaped (fibroblast), had the lowest mitotic rate. The predominant cell type in long term cultures maintained in plastic flasks was polygonal-shaped. These cells were subcultured and eventually became established lines. Transplantation of such cells into isologous hosts produced tumors which were similar in structure to the original tumors from which the cultures were established.

- 3701 INDUCTION OF HEMANGIOMATOUS LESIONS WITH DIMETHYLNITROSOAMINE: INFLUENCE OF ROUTE OF ADMINISTRATION AND STRAIN OF MICE. (E.) Kuwahara, A. (Sch. Med., Tokushima U., Japan), H. Otsuka and A. Nagamatsu. *Gann* 63(4):499-502, 1972.

A study was conducted to determine the incidence and localization of benign and malignant hemangiomatous tumors in male and female adult DDD, BALB/c, and SJL/J mice after administration of dimethylnitrosamine (DMN) by different routes. Animals received weekly s.c. or i.p. injections of 0.15 mg DMN or received 100 ppm DMN in the diet. Animals receiving s.c. or i.p. DMN injections showed an equally high incidence (64%) of hemangiomatous lesions which were mainly located in retroperitoneal soft tissue and in abdominal adipose tissue. Of the 91 tumors, 75 were diagnosed as hemangioendothelial sarcomas. The incidence of hemangiomatous tumors was 22.5% in

animals which received DMN orally. The incidence and distribution of the tumors did not for the most part depend on the strain of mouse. Hemangio-matous liver lesions developed most frequently in animals which received s.c. DMN, followed in order by oral and i.p. DMN administration. The few animals which developed spleen and kidney tumors were all DDD strain. A high incidence of epithelial adenomas and carcinomas of the lung was found in all groups irrespective of strain or route of administration. The incidence of soft tissue sarcomas was slightly higher after s.c. than after i.p. injection of DMN.

the tumors and the re-established cell lines contained virus-specific murine leukemia virus CF antigens, and electron microscopy revealed the presence of large numbers of C-type particles.

3704 CARCINOGENIC NITROSAMINES FORMED BY DRUG/NITRITE INTERACTIONS. (E.) Lijinsky, W. (Eppley Inst. Cancer Res., Omaha, Neb.), E. Conrad and R. Van de Bogart. *Nature* 239(5368): 165-167, 1972.

The formation of nitrosamine products, under varying conditions, from the interaction of nitrite with six tertiary nitrogen compounds was studied. Reactions were carried out *in vitro* for four hr at 37 C pH3.5-5.5. The nitrosamine products were extracted and identified by mass spectrometry or infrared spectrometry. All compounds tested gave measurable yields of nitrosamines. Two of the tertiary amines, oxytetracycline and aminopyrene, gave high yields of dimethylnitrosamine (DMN). The production of DMN from aminopyrene occurred over a wide range of pH with no dependence on nitrite concentration, whereas DMN production from oxytetracycline showed a marked dependence on pH (optimum at pH3) and nitrite concentration (maximum at low molar ratios). The dialkylamides (nikethamide, piperline and disulphiram) gave lower yields of diethylnitrosamine and nitrosopiperidine than did the two tertiary amines. These reactions were optimal at pH3. Tolazamide (a substituted urea and dialkylhydrazine) was rapidly converted to the potent liver carcinogen N-nitrosohexamethyleneimine.

3702 INTRANUCLEAR DISTRIBUTION OF THE INDUCING METAL IN PRIMARY RHABDOMYOSARCOMATA INDUCED IN THE RAT BY NICKEL, COBALT AND CADMIUM. (E.) Webb, M. (Strangeways Res. Lab., Cambridge, England), J. C. Heath and T. Hopkins. *Brit J Cancer* 26(4):274-278, 1972.

The binding of metal ions to subcellular fractions of rhabdomyosarcomas induced in rats by i.m. implantation of powdered metallic nickel, cobalt and cadmium was studied. The cell-bound cations were identified by atomic absorption spectrophotometry. Of the total amount of metal recovered in all fractions, 53% of the Ni^{++} , 52% of the Co^{++} and 72% of the Cd^{++} were recovered in the nucleoli. The remainder of each cation was distributed approximately equally between the chromatin and nuclear sap. Most of the nucleolus-associated metal ion, in each case, was bound to RNA.

3703 TRANSFORMATION OF MOUSE CELLS INFECTED WITH AKR LEUKAEMIA VIRUS INDUCED BY SMOG EXTRACTS. (E.) Rhim, J. S. (Microbiol. Assoc., Bethesda, Md.), H. Y. Cho, L. Rabstein, R. J. Gordon, R. J. Bryan, M. B. Gardner and R. J. Huebner. *Nature* 239(5367):103-107, 1972.

Three samples of city smog extracts collected at a location in central Los Angeles were studied for their ability to transform AKR leukemia virus-infected and uninfected mouse embryo (NIH-ME) cells *in vitro*. Chromatographic and UV spectrometric analysis revealed the presence of benz(a)-anthracene and chrysene in each of the extracts. Cell cultures were exposed for seven days to different concentrations of the smog extracts after which time they were subcultured into medium extract. After 14 to 21 days, the AKR leukemia virus-infected cells were transformed by smog concentrations up to 10 μ g/ml. Higher concentrations were lethal. After four subcultures, the transformed cells completely replaced the original fibroblast-like monolayers and were established as continuous lines. Either smog extract-treated uninfected cells nor untreated infected cells showed signs of transformation. S.c. inoculation of cells from two of the transformed lines produced sarcomas at the inoculation site in NIH Swiss mice, with an average latent period of five days. Cells from some of the sarcomas were re-established in tissue culture. Both

3705 MODIFICATION OF RIBONUCLEIC ACID BY CHEMICAL CARCINOGENS. IV. CIRCULAR DICHROISM AND PROTON MAGNETIC RESONANCE STUDIES OF OLIGONUCLEOTIDES MODIFIED WITH N-2-ACETYLAMINOFLUORENE. (E.) Nelson, J. H. (Coll. Physicians Surg., Columbia U., New York, N.Y.), D. Grunberger, C. R. Cantor and I. B. Weinstein. *J Mol Biol* 62(2):331-346, 1971.

Circular dichroism (CD), proton magnetic resonance (PMR) spectroscopy and computer generated molecular models were used to analyze N-2-acetylaminofluorene (AAF)-induced conformational changes of various synthetic mono- and oligonucleotides. Specific covalent attachment of AAF to the C-8 position of guanosine residues resulted in the appearance of a relatively intense negative band at 229 nm as determined by CD spectroscopy. This band was attributed to optical activity introduced into fluorene by its covalent linkage to guanosine. CD spectra were also changed by introduction of AAF into the guanosine residues of A-G, G-A, U-G and G-U. The changes suggested that AAF was possibly also interacting with the dinucleotide constituents other than guanosine. CD analysis of the interaction of AAF with trinucleotides indicated that, in some cases, bases two-removed from guanosine could influence AAF-guanosine interaction. Results obtained from proton magnetic resonance spectroscopic analysis of AAF-oligonucleotide interaction supported those from CD spectroscopy, suggesting

rotation of guanine around the glycosidic linkage and intramolecular stacking of fluorene with the adjacent base. Computer analysis based on the spectroscopic results indicated that severe steric hindrance between AAF and ribose would occur unless guanosine changed its orientation with respect to the glycosidic bond. It was suggested that similar conformational changes may result at localized sites of AAF binding to naturally occurring nucleic acids.

- 3706 UPTAKE OF $^{63}\text{Ni}^{2+}$ FROM ITS COMPLEXES WITH PROTEINS AND OTHER LIGANDS BY MOUSE DERMAL FIBROBLASTS *IN VITRO*. (E.) Webb, M. (Strangeways Res. Lab., Cambridge, England) and S. M. Weinzierl. *Brit J Cancer* 26(4):292-298, 1972.

Incubation of Ni^{2+} with horse serum or rat muscle homogenate results in binding of the metal to both large (proteins) and small (diffusable) molecular wt compounds. The uptake of $^{63}\text{Ni}^{2+}$ from these complexes into the C57S/IP line of mouse dermal fibroblasts was studied. Autoradiographic analysis showed that stationary cells incorporated $^{63}\text{Ni}^{2+}$ and that they did not concentrate the cation at any particular site. Fractionation of cells grown in medium containing the $^{63}\text{Ni}^{2+}$ complexes indicated that 60-70% of the incorporated $^{63}\text{Ni}^{2+}$ was associated with the nuclear and cell-sap fractions, with 50% of the nucleus-associated radioactivity being bound to the nucleolus. Twenty to 25% of the $^{63}\text{Ni}^{2+}$ was found in the mitochondrial fraction and 10% was associated with the microsomal fraction.

- 3707 CARCINOGENICITY EXAMINATION OF SOME EDIBLE PLANTS. (E.) Hirono, I. (Gifu U. Sch. Med., Japan), C. Shibuya, M. Shimizu, K. Fushimi, H. Mori and T. Miwa. *Gann* 63(3):383-386, 1972.

One hundred and thirty-five ACI rats were fed pellets containing preparations of food plants eaten by the Japanese; feeding periods ranged from 7-337 days. *Artemisia*, horsetail fern, osmund frond and a commercial preparation of osmund frond, and ginkgo nut kernels were among edible plants tested. The only tumors developed by test rats were a pituitary adenoma in an *artemisia*-fed rat, a glioma in an osmund frond-fed rat, and a mammary fibroadenoma in a rat fed a commercial preparation of dried osmund frond.

- 3708 CARCINOGENESIS AND ALKYLATION OF RAT LIVER NUCLEIC ACIDS BY NITROSOMETHYLUREA AND NITROSOETHYLUREA ADMINISTERED BY INTRAPORTAL INJECTION. (E.) Lijinsky, W. (U. Nebraska Med. Ctr., Omaha), H. Garcia, L. Keefer, J. Loo and A. E. Ross. *Cancer Res* 32(5):893-897, 1972.

Groups of 20 male and female 10-to-12-wk-old MRC rats received 5 ml 0.9% NaCl solution containing

either 10 mg nitrosomethylurea (NMU) or 30 mg nitrosoethylurea (NEU) injected into the hepatic portal vein. A control group of 20 rats received intraportal injections of NaCl solution only. The alkylation of nucleic acid guanine was studied in groups of similarly treated rats except that NMU- d_3 and NEU- d_3 were used instead of unlabeled material. The animals were killed five hr after the operation and the livers were removed. The nucleic acids were hydrolyzed and chromatographed on Dowex 50(H^+) columns. Material eluting in the 7-alkylguanine (7-methylguanine, 7-MG and 7-ethylguanine, 7-EG) fraction was further purified by paper chromatography and 7-MG and 7-EG quantities were determined by mass spectrometry. Electron microscopic studies were performed on liver from five hr postoperation rats. Histologic examination of organs from NMU- and NEU-treated and from control rats revealed that almost every animal treated with either NMU (12 rats) or NEU (13 rats), and surviving beyond the 40th week, developed one or more tumors. A variety of tumors was seen in many different organs of treated rats and the incidence was considerably higher than in controls (6 rats). Electron and light microscopic examination of liver sections of NMU- and NEU- treated and control rats revealed only minor alterations related to a minor degree of cellular damage. Mass spectroscopic analysis of DNA from treated rats showed no detectable alkylation of DNA. However, d_3 -labeled 7-MG was present in RNA of NMU-treated rats. No 7-EG was detected in RNA from NEU-treated animals. This difference in ability to alkylate nucleic acids could not be correlated with the similar tumorigenic activity of NMU and NEU. The identification of methyl- d_3 -guanine as the base formed from NMU- d_3 showed that diazomethane was not an intermediate in nucleic acid alkylation by NMU.

- 3709 BINDING OF K-REGION EPOXIDES AND OTHER DERIVATIVES OF BENZ(a)ANTHRACENE AND DIBENZ(a,h)ANTHRACENE TO DNA, RNA, AND PROTEINS OF TRANSFORMABLE CELLS. (E.) Kuroki, T. (McArdle Lab. Cancer Res., U. Wisconsin, Madison), E. Huberman, H. Marquardt, J. K. Selkirk, C. Heidelberger, P. L. Grover and P. Sims. *Chem-Biol Interact* 4(6):389-397, 1971/72.

Hamster embryo cells and C3H mouse prostate cells, both transformable by carcinogenic hydrocarbons and K-region epoxides, mutable hamster cells and C3H mouse prostate tumor cells were treated with benz(a)-anthracene (BA) or dibenz(a,h)anthracene (DBA) or their K-region epoxides, *cis*-dihydrodiols or phenols. Binding of these agents to DNA, RNA and protein of test cells was observed. The K-region epoxide of BA was bound to DNA, RNA and protein of hamster embryo cells to a much greater extent than was BA itself or the corresponding *cis*-dihydrodiol or phenol. At three hr, the epoxide was bound to DNA and RNA 20-25 times more, and to proteins 60 times more, than BA. The BA phenol was bound extensively to RNA and proteins, but not to DNA, with specific activities about one half those seen with the BA epoxide; the *cis*-dihydrodiol was bound less than

BA itself. Maximum binding of the BA epoxide to hamster embryo cell macromolecules was seen at three hr. The K-region epoxide of DBA was bound to RNA and proteins to a greater extent than other derivatives, but was bound to DNA to a slight extent only. The extent of binding of all compounds to macromolecules of transformable mouse prostate cells was less than to hamster embryo cells, and binding to mouse tumor cells was much less than to hamster embryo cells.

3710 RELATIONSHIPS BETWEEN COVALENT BINDING OF 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE TO LIVER PROTEIN AND INCREASES IN THE LEVEL OF HEPATIC AMP DEAMINASE. (E.) Smith, L. D. (Samuel Roberts Noble Fdn., Inc., Ardmore, Okla.), L. Holman and D. E. Kizer. *Chem-Biol Interact* 4(6):311-320, 1971/72.

Female rats were given 3'-methyl-4-dimethylaminoazobenzene (3'-Me-DAB) in diet (0.06%) or as an intra-abdominal injection (250 mg/kg body wt). Five days after injection, or after four wk of carcinogen feeding, rats were killed, livers were removed, and the binding of 3'-Me-DAB to the 105,000 x g liver supernatant proteins was investigated. 3'-Me-DAB metabolites were bound to supernatant proteins. When supernatant proteins were put through a procedure for purifying AMP deaminase, 3'-Me-DAB metabolites continued to bind to purified proteins. Application of the purification procedure, which increased AMP deaminase activity nine-fold, caused a three-fold enrichment of total azo-dye-protein conjugates, but did not cause enrichment of polar azo proteins. Evidently, some azo-proteins were lost during AMP deaminase purification. In a second experiment, mice were injected with 3'-Me-DAB-ring-¹⁴C and killed five days later. An aliquot of the 105,000 x g liver supernatant which contained the radioactive bound azo dye was subjected to sucrose gradient centrifugation. When gradients were fractionated and analyzed for AMP deaminase and radioactive bound azo dye, most radioactivity was associated with proteins of lower molecular wt than AMP deaminase. When aliquots of the 105,000 x g liver supernatant, which had undergone the AMP deaminase purification procedure, were reacted with antisera specific for AMP deaminase, or subjected to polyacrylamide disc gel electrophoresis, ¹⁴C-azo dye-protein conjugates were readily distinguishable from AMP deaminase proteins. Electrophoresis yielded one AMP deaminase fraction which was free of radioactive label from 3'-Me-DAB. AMP deaminase and the main azo proteins were thought to be distinct. It was concluded that interactions between 3'-Me-DAB and AMP deaminase do not occur, and do not explain the increase of this enzyme in precancerous rat liver.

3711 HEMANGIOENDOTHELIAL SARCOMAS OF THE LIVER IN RATS INDUCED BY DIETHYLNITROSAMINE. (E.) Hadjiolov, D. (Oncol. Res. Inst., Sofia, Bulgaria). *Neoplasma* 19(2):111-114, 1972.

Male Wistar rats were given 1 mg/rat/day of diethyl-

nitrosamine in drinking water, for a total dose of 134 mg/rat. After 22 wk of carcinogen feeding, diethylnitrosamine was discontinued and ten wk later rats were killed and liver tumors were examined. Twenty-three of 25 rats had developed liver tumors; there were nine hemangioendothelial sarcomas. These hemangioendothelial sarcomas showed primitive vascular spaces lined by bizarre tumor cells. Of particular interest for elucidation of the histogenesis of angioblastoma were large areas of tumor parenchyma in which the spongiocymal tumor tissue was replaced by solid cellular clusters consisting of a single type of tumor cell. These tumors appeared to originate from undifferentiated mesenchymal elements possessing specific potentialities for differentiation and formation of primitive vascular spaces.

3712 THE CONVERSION OF THE CARCINOGEN N-HYDROXY-2-FLUORENYL-ACETAMIDE TO o-AMIDOPHENOLS BY RAT LIVER *IN VITRO*: SUBSTRATE SPECIFICITY AND MECHANISM OF THE REACTION. (E.) Gutmann, H. R. (VA Hosp., Minneapolis, Minn.) and R. R. Erickson. *J Biol Chem* 247(3):660-666, 1972.

Previous work demonstrated that the carcinogenic arylhydroxamic acid N-hydroxy-2-fluorenylacetamide (N-hydroxy-2-FAA) was metabolized to the o-amidophenols, 1-hydroxy-2-FAA and 3-hydroxy-2-FAA by an inducible enzyme system associated with the microsomes of rat liver. The present experiments were conducted to define the stereochemistry and mechanism of this reaction. A 600xg supernatant fraction from a liver homogenate of male Holtzman albino rats pretreated with 3-methylcholanthrene, which served as the enzyme source, was incubated with ¹⁴C-labeled substrates and the radioactive reaction products were purified and identified by paper or thin-layer chromatography. Examination of the substrate specificity of the enzymatic rearrangement suggested that the reaction was restricted to arylhydroxamic acids in which the nitrogen was linked to an aromatic system capable of extended conjugation. Determinations of the isotope content of 1-hydroxy- and 3-hydroxy-2-FAA isolated after incubation of the induced enzyme with N-hydroxy-2-FAA, labeled with ¹⁸O in the hydroxy group, indicated that the hydroxyl group was transferred *in toto* from the nitrogen to the carbon atoms of the aromatic system located in a position ortho to the nitrogen. The data are compatible with an intramolecular rearrangement rather than with a previously suggested intermolecular mechanism involving addition of hydroxyl groups from the medium to the resonance forms of an amidonium ion.

3713 TYPE C RNA TUMOR VIRUSES AS DETERMINANTS OF CHEMICAL CARCINOGENESIS: EFFECTS OF SEQUENCE OF TREATMENT. (E.) Price, P. J. (Microbiol. Assoc., Bethesda, Md.), W. A. Suk and A. E. Freeman. *Science* 177(4053):1003-1004, 1972.

The relationship between viral infection and

transformation by chemical carcinogenesis was studied. Fischer rat embryo cell cultures were infected with Rauscher murine leukemia virus (RLV) and at timed intervals following infection, were treated with 3-methylcholanthrene (3MC). Treatment of cells with 0.1, 0.5, or 1.0 $\mu\text{g/ml}$ 3MC at two hr, one wk, two wk, or three wk after infection resulted in the appearance of transformed cell foci in the fourth to sixth subcultures. The transformation was dependent on the presence of virus at the time of 3MC treatment. Transformation was not seen in untreated controls, in cultures given RLV or 3MC alone, or in cultures treated first with 3MC and inoculated with RLV following removal of the carcinogen.

- 3714 CHANGE IN ACID PHOSPHATASE DURING AZO-DYE CARCINOGENESIS. (E.) Kaneko, A. (Sapporo Med. Coll., Japan), K. Dempo and T. Onoe. *Gann* 63(1):41-48, 1972.

Changes of acid phosphatase activity in the liver of male Wistar rats during feeding of 0.06% 3'-methyl-4-(dimethylamino)azobenzene (3'-Me-DAB) for 13 wk were determined. Liver tissue and hepatocyte homogenates were chromatographed on DEAE-cellulose, and acid phosphatase activity was measured using β -glycerophosphate (bGP) and phenyl phosphate (PhP) as substrates. Three liver fractions were examined: a soluble fraction, a protein fraction (Fraction I) which was not adsorbed by the DEAE-cellulose column and a second protein fraction (Fraction II). Three types of acid phosphatase, tentatively designated as A, B and C were found; both A and B types existed in the hepatocyte while type C was mainly derived from Fraction II. Type B was found in adult liver and type A in immature liver. In addition, types A and B were detected in Fraction I and type C in Fraction II. Types A and C had higher PhP/bGP activity ratios than type B. Acid phosphatase activity with bGP decreased markedly within four wk after dye feeding but that with PhP showed only a slight decrease. In the 4-8 wk phase, an activity peak at the sixth wk corresponded to the period of increase of small hepatocytes; a rise in the PhP/bGP value was seen at this time. After 9 wk of dye feeding, most of the small regenerated hepatocytes grew to adult size and the PhP/bGP ratio was higher than in previous weeks. Acid phosphatase activity returned to nearly level after 12 wk of dye feeding and then 8 wk of normal diet; however, the PhP/bGP ratio was still slightly higher than normal. The hepatocytes renewed during the dye feeding differed from regenerated hepatocytes after partial hepatectomy; the ratio of acid phosphate activity was elevated in the former and normal in the latter.

- 3715 QUANTITATIVE STUDY ON FOCI OF ALTERED LIVER CELLS INDUCED IN THE RAT BY A SINGLE DOSE OF DIETHYLNITROSAMINE AND PARTIAL HEPATECTOMY. (E.) Scherer, E. (The Netherlands Cancer Inst., Amsterdam), M. Hoffman, P. Emmelot,

and M. Friedrich-Freksa. *J Nat Cancer Inst* 49(1):93-106, 1972.

- 3716 SEX DIFFERENCES IN CELL PROLIFERATION AND *N*-HYDROXY-2-ACETYLAMINOFLUORENE SULFOTRANSFERASE LEVELS IN RAT LIVER DURING 2-ACETYLAMINOFLUORENE ADMINISTRATION. (E.) Jackson, C. D. (VA Hosp., Memphis, Tenn.) and C. C. Irving. *Cancer Res* 32:1590-1594, 1972.

- 3717 THE CELLULAR ANALYSIS OF LIVER CARCINOGENESIS. V. ULTRASTRUCTURAL ALTERATIONS WITHIN HEPATOCELLULAR CARCINOMA INDUCED BY ETHIONINE. (E.) Merkow, L. P. (Allegheny Gen. Hosp., Pittsburgh, Pa.), S. M. Epstein, M. Slifkin, E. Farl and M. Pardo. *Lab Invest* 26(3):300-305, 1972.

- 3718 CARCINOMA OF THE URINARY TRACT AND ANALGESIC ABUSE. (E.) Taylor, J. S. (Royal Newcastle Hosp., Australia). *Med J Aust* 1(9):407-409, 1972.

- 3719 THE COMBINED ACTION OF UV IRRADIATION AND 7,12-DIMETHYLBENZ(A)ANTHRACENE (DMBA) ON THE SKIN OF HAIRLESS MICE. (Rus.) Shabad, L. M. (Inst. Exp. Clin. Oncol., USSR Acad. Med. Sci., Moscow, USSR) and S. N. Litvinova. *Biull Eksp Biol Med* 73(2):84-85, 1972.

- 3720 THE QUESTION OF STANDARDIZING CANCEROGENIC SUBSTANCES IN THE AIR OF INDUSTRIAL PREMISES. (Rus.) Filatova, A. S. (Sverdlovsk Inst. Occup. Hyg. Dis., USSR) B. B. Kapitul'kiy and A. I. Kuz'minykh. *Gigiena i Sanitariia* 37(2):91-93, 1972.

- 3721 INTERRELATIONSHIP BETWEEN THE OCCURRENCE OF ESR SIGNAL OF FERRUM-CONTAINING COMPLEXES AND FREE RADICAL PROCESSES IN LIPIDS DURING CARCINOGENESIS. (Rus.) Polishchuk, R. F. (M. V. Lomonosov Moscow St. U., USSR) and Yu. P. Kozlov. *Biophysika* 17(12):334-336, 1972.

- 3722 ON THE EFFECT OF NAS ON THE LIVER IN SYRIAN HAMSTERS. (Rus.) Milievskaya, I. L. (USSR Acad. Med. Sci., Moscow) and N. S. Kiseleva. *Vop Onkol* 18(3):70-73, 1972.

- 3723 THE ACTION OF VARIOUS 1,4-DIHYDROPYRIDINE AND 1,6-DIHYDROPYRIDINE DERIVATIVES ON THE ENERGY METABOLISM OF HEPATIC AND TUMOUR CELLS. (Rus.) Kumsars, K. K. (Latvian SSR Acad. Sci., Riga, USSR), A. H. Velen, G. J. Duburs, J. R. Uldriks and A. A. Zidermane. *Biokhimiia* 36(6):1204-1209, 1971.

3724 HISTOCHEMICAL, ELECTRONMICROSCOPICAL AND
AUTORADIOGRAPHICAL INVESTIGATIONS ON EXPERI-
MENTALLY INDUCED NEPHROBLASTOMAS. (Ger.) Thomas, C.
(Inst. Path., Freiburg, Germany), W. Wessel and P.
Citoler. *Beitr Path Bd* 145:68-82, 1971.

See also:

- * (Rev): 3604, 3610, 3616, 3617, 3618, 3620,
3621, 3635, 3642
- * (Phys): 3735
- * (Viral): 3764, 3787
- * (Immun): 3836, 3838, 3848, 3907

3725 CHANGE IN VOLUME OF IRRADIATED HUMAN METASTASES: INVESTIGATION OF REPAIR OF SUBLETHAL DAMAGE AND TUMOUR REPOPULATION. (E.)

Malaise, E. P. (Inst. Gustave Roussy, Villejuif, France), A. Charbit, N. Chavaudra, P. F. Combes, J. Douchez and M. Tubiana. *Brit J Cancer* 26(1): 43-52, 1972.

Twenty-one patients with multiple pulmonary tumor metastases were exposed to Cobalt 60 irradiation, one lung of each patient receiving a single dose of 1000 rad and the other lung two doses of 500 rad separated by a three-hour interval. Tumors usually decreased in size after irradiation. The time taken by a tumor after irradiation to reach a volume equal to half its pre-irradiation volume ("half-regression time") was measured. In metastases exposed to one 1000 rad irradiation, the half-regression time was 14 days; in metastases exposed to two 500 rad irradiations, the half-regression time was 15.5 days. Growth rates of metastases recurring after irradiation were always more rapid than growth rates before irradiation; the regrowth doubling time (i.e., time taken by a tumor to double its size) of metastases averaged five times shorter than the initial, pre-irradiation doubling time. Growth rates of metastases before irradiation correlated significantly with the rate of decrease in tumor volume after irradiation; the rate of decrease was slower when tumor doubling time before irradiation was longer. For seven patients the simultaneous influence of 1000 rad and 500 rad twice was followed through the regrowth of ten metastases. The extrapolation number, n , of the survival curve of metastases cells was calculated for these patients by comparing in each patient the effects of the two types of exposure. The extrapolation number, n , is equal to the value of S_1/S_2 , where S_1 is the proportion of cells surviving an irradiation dose D and S_2 is the proportion of cells surviving an irradiation a dose $2D$. Values for n were not very high; six of seven n values fell between 0.8 and 2.1.

3726 CYTOLOGIC ASPECT OF RF RADIATION IN THE MONKEY. (E.) Prince, J. E. (USAF Sch.

Aerospace Med., Brooks Air Force Base, Texas), L. H. Mori, J. W. Frazer and J. C. Mitchell. *Aerospace Med* 43(7):759-761, 1972.

A circulating lymphocytoid (high nucleus-to-cytoplasm ratio) cell having a high mitotic potential was obtained from the blood of monkeys (Macaca mulatta) 71 hr after whole body exposure to 10.5, 19.7 or 26.6 MHz electromagnetic radiation for 30 min at a power density of 1.32 W/cm². Mitotic potential, estimated by the degree of response to phytohemagglutinin stimulation *in vitro*, was 7 to 11 times greater in lymphocytoid cells from the radiation-exposed animals than in cells from the same animals before exposure. These results indicate that electromagnetic radiation is able to transform certain races of lymphocytoid cells into blood-borne cells of high mitotic potential.

3727 REDUCED INCIDENCE OF X-RAY INDUCED LEUKEMIA AFTER TREATMENT WITH ANTI-LYMPHOCYTE SERUM.

(E.) Balner, H. (Radiobiological Inst. TNO, Rijswijk, Netherlands). *Rev Europe Etudes Clin Biol* 16(10):981-986, 1971.

The influence of antilymphocyte serum (ALS) on the development of X-ray induced leukemia in mice was investigated. Two types of antisera of about equal immunosuppressive potency were used, one raised in rabbits, the other in a horse. Lymphomas were induced with four doses of 150 R total body irradiation, given at weekly intervals; ALS treatment was started the week thereafter and continued for three months (0.5 or 1.0 ml per week, i.p.). Horse ALS did not affect incidence and latency periods of lymphomas but mice treated with rabbit sera failed to develop lymphomas. This unexpected result might be attributed to the presence of antibodies to murine leukemia virus in the rabbit ALS (for which preliminary evidence has been obtained). Alternatively, the rabbit ALS could have had a more pronounced cytotoxic effect than the horse serum on developing lymphoid tumor cells. As in previous experiments, prolonged ALS treatment did not affect incidence and latency periods of malignancies other than lymphomas.

3728 LATE-APPEARING (RADIATION-INDUCED) CARCINOMA: CARCINOMAS OF POSTCRICOID AND HYPOPHARYNGEAL REGIONS FOLLOWING SUCCESSFUL IRRADIATION THERAPY FOR LARYNGEAL CARCINOMA. (E.) Schindel, J. (U. Tel Aviv Med. Sch., Petah Tikva, Israel) and I. M. Castoriano. *Arch Otolaryng* 95(3):205-210, 1972.

Five cases of carcinoma in the postcricoid and hypopharyngeal regions following therapeutic irradiation of the laryngeal region are reported. Patients were all males, and ranged in age from 59-75 yrs. In all cases, carcinoma of one or both vocal cords was treated by irradiation; total radiation doses ranged from 4000 to 6480 rads. Postcricoid or hypopharyngeal carcinomas appeared between 7 and 12 yr after radiation, and were thought to have been caused by radiation.

3729 EFFECTS OF RADIATION ON SPECIFIC CELLULAR IMMUNITIES: BESNOITIOSIS AND A HERPESVIRUS INFECTION OF HAMSTERS. (E.) Frenkel, J. K. (U. Kansas Sch. Med., Kansas City) and H. R. Wilson. *J Infect Dis* 125(3):216-230, 1972.

Hamsters were exposed to gamma irradiation [$LD_{50} = 900-925$ röntgens (r)] before or after s.c. inoculation with *Besnoitia jellisoni*; sulfadiazine in drinking water was given beginning on the day of *Besnoitia* injection to protect against *Besnoitia* infection. Hamsters given 100-300 r survived *Besnoitia* infection, but a third of those given 400 r and all of those giving 500-800 r succumbed to besnoitiosis. The antibody response to *Besnoitia* was delayed or inhibited.

ited in hamsters given 400 or 500 r. Irradiation with 600 r, the maximally immunosuppressive dose, 22 days before to 28 days after infection impaired immunity to *Besnoitia*. However, antibody production was markedly impaired only by 600 r given four or 24 hr after *Besnoitia*. Relapse occurred in 33% of immune hamsters given radiation doses accumulating to 900 r or more. Relapse occurred in all irradiated hamsters treated with cortisone. Adoptive transfer of immunity to *Besnoitia* by means of immune donor cells was studied in normal and irradiated hamsters. Syngeneic immune cells protected most recipients against infection whether or not recipients had been irradiated; allogeneic immune cells protected only irradiated recipients. Allogeneic immune cells protected against infection when recipients were given 0 r but not 800-1000 r; 300-600 r partially facilitated protection. Lymphoid cells of donors given 0 or 100 r showed diminution or abolition of the capacity to transfer adoptive immunity to recipients. either 100 nor 1600 r released demonstrable cell immunity factors into plasma or serum of hamsters given these radiation doses. Irradiation did not effect transfer of immunity to hamsters later challenged with listeriosis or equine rhinopneumonitis.

3730 VITAMIN A AND THE RADIATION RESPONSE OF EXPERIMENTAL TUMORS: AN IMMUNE-MEDIATED EFFECT. (E.) Tannock, I. F. (M. D. Anderson Hosp. Tumor Inst., Houston, Texas), H. D. Suit and N. Marshall. *J Nat Cancer Inst* 48(3):731-741, 1972.

The TCD₅₀ values (i.e., the mean radiation dose yielding local tumor control in 50% of irradiated animals) were established for a transplanted fibrosarcoma in irradiated normal C3H/Bu mice, in irradiated mice actively sensitized to the fibrosarcoma by injections of lethally irradiated fibrosarcoma cells and in irradiated mice immunosuppressed by 0 rads whole-body irradiation. The fibrosarcoma was strongly antigenic in C3H/He mice. The effect of vitamin A injections on TCD₅₀ were observed. Vitamin A had no effect on TCD₅₀ of the fibrosarcoma in immunosuppressed mice, but caused a reduction of 0 rads (15-20% reduction) in the TCD₅₀ of tumors growing in normal mice. The TCD₅₀ for the fibrosarcoma in mice sensitized to their tumor before tumor transplantation was slightly higher than the TCD₅₀ of the tumor in normals. Vitamin A led to a 25% reduction in TCD₅₀ in sensitized mice. Vitamin A had no effect on the TCD₅₀ of a mammary carcinoma which was only weakly antigenic in C3H/He mice. The effect of vitamin A on the radiation response of two normal tissues was observed. Vitamin A did not affect the epilation response to radiation in skin cells or the regeneration response of irradiated intestinal crypt cells. Further, vitamin A did not affect the TD₅₀ (i.e., mean number of tumor cells required to generate tumors in 50% of mice) in a suspension of viable fibrosarcoma cells was injected into neonatal mice. However, injection of vitamin A into mice which had received an inoculum of mixed viable and lethally irradiated tumor cells led to a significantly higher TD₅₀ value than was seen in mice not given vitamin A.

3731 RADIATION-INDUCED DNA SYNTHESIS IN NUCLEI OF HEN ERYTHROCYTES REACTIVATED IN HETEROKARYONS. (E.) Darzynkiewicz, Z. (Boston Biomed. Res. Inst., Mass.). *Expt Cell Res* 69:477-481, 1972.

A study to determine if avian erythrocytes are able to effect DNA repair and whether this ability is altered during nuclear reactivation in heterokaryons is reported. Chicken embryo erythrocytes, whether non-irradiated or UV light-irradiated, incorporated negligible amounts of ³H-TdR into the nuclei. The presence of tritium in the cells - revealed by "dry" autoradiography - indicated that the precursor can penetrate the cells but is not incorporated into macromolecules. Erythrocyte nuclei reactivated in HeLa cells incorporated less ³H-TdR after UV light irradiation than nuclei reactivated in fibroblasts. Assuming that UV light-induced ³H-TdR incorporation reflects DNA repair replication, chicken embryo erythrocytes could not repair DNA. However, the ability to repair DNA was rapidly restored following reactivation of erythrocyte nuclei in the cytoplasm of rat or HeLa cells. The results indicate that cytoplasmic factors are significant in reactivation of dormant nuclei in heterokaryons, i.e., the enzymes that repair DNA may migrate from the active to the reactivated nuclei via the cytoplasm of the heterokaryon.

3732 THE ROLE OF MUTATIONS IN LIVER TUMOR INDUCTION IN MICE. (E.) Curtis, H. J. (Brookhaven Natl. Lab., Upton, N.Y.) and J. Tilley. *Radiat Res* 50(3):539-542, 1972.

Female LAF₁ mice were given whole-body neutron irradiation at ten wk of age; at 12 and 14 wk of age, mice were given 0.005 ml/g body wt CCl₄. In groups of mice given 0, 27.1, 64.0, 81.5 and 128 rads neutron radiation, resp., liver tumors developed in 10.0, 19.4, 33.3, 58.8 and 60.5% of cases, resp. It had been thought that the tumor induction process in this system proceeds in at least two steps, a mutation followed by a stimulus for cell division. The linear relation between tumor induction and neutron dose suggests that only one mutation is involved in the first step.

3733 TUMOR GROWTH IN ALLOGENEIC MICE BEARING A LUCITE CYLINDER. (E.) Saal, F. (Inst. Hematology Res., Buenos Aires, Argentina), M. E. M. Colmerauer, R. C. Braylan and C. D. Pasqualini. *J Nat Cancer Inst* 49(2):451-458, 1972.

3734 DIFFERING RESPONSES TO RADIATION OF MURINE BONE MARROW STEM CELLS IN RELATION TO THE CELL CYCLE. (E.) Chaffey, J. T. (Harvard Med. School, Boston, Mass.) and S. Hellman. *Cancer Res* 31:1613-1615, 1971.

3735 THYROID CARCINOGENESIS IN HAMSTERS AFTER TREATMENT WITH 131-IODINE AND METHYLTHIO-

URACIL. (E.) Christov, K. (Cancer Res. Inst., Sofia, Bulgaria) and R. Raichev. *Z Krebsforsch* 77(3):171-179, 1972.

See also:

* (Chem): 3719

3736 OSTEOGENIC SARCOMA OF HEAD AND NECK INDUCED BY RADIATION THERAPY. (E.) Arlen, M. (Mem. Hosp.-Sloan-Kettering Cancer Ctr., New York, N.Y.), I. C. Shah, N. Higinbotham and A. J. Huvos. *New York J Med* 72:929-934, 1972.

VIRAL CARCINOGENESIS

3737 ISOLATION OF A HERPES-LIKE VIRUS FROM LYMPHOSARCOMATOUS CATTLE. (E.)

Van Der Maaten, M. J. (Nat'l. Animal Dis. Lab., U.S. Dept. Agriculture, Ames, Iowa) and A. D. Boothe. *Arch Gesamte Virusforsch* 37:85-96, 1972.

Apparently identical herpes-like viruses were isolated from two lymphosarcomatous cows in a "multiple-incidence-lymphosarcoma" herd. The isolates induced syncytium formation in bovine embryonic spleen cultures, but electron microscopic studies and indirect immunofluorescence tests indicated that they were structurally and antigenically unrelated to a bovine syncytial virus previously isolated and described by others. The isolates also showed no antigenic relation to infectious bovine rhinotracheitis virus and pseudorabies virus. Inoculation of the isolates into guinea pigs, mice, hamsters, rabbits and calves failed to induce any pathogenicity; however, the herpes-like virus was reisolated from three inoculated calves. The herpes-like virus may be related to the bovine herpes mamillitis and Allerton viruses. There was no evidence directly associating the virus with the lymphoid neoplasms found in the cattle from which it was isolated.

3738 FACTOR-DEPENDENT BINDING OF RAUSCHER LEUKEMIA VIRUS RNA TO RIBOSOMES. (E.)

Lang, C. S. (Dept. Biol., U. Texas, Houston), R. Naso and R. B. Arlinghaus. *Biochem Biophys Res Commun* 47(6):1290-1298, 1972.

³H-labeled Rauscher leukemia virus (RLV) RNA was able to bind to structures which sedimented in sucrose gradients as dimeric through pentameric polyribosomes when incubated in a cell-free amino acid incorporation system derived from RLV-infected JLS-9 cells. The binding of RLV-RNA to ribosomes required the presence of a high-salt wash fraction obtained from JLS-V5 polyribosomes. A decrease in ³H-labeled RLV RNA in the polysome fractions beginning after an incubation period of 30 min paralleled a decrease in incorporation of ¹⁴C-amino acids into polyribosome-associated protein. Addition of aurintricarboxylic acid (ATA, 10⁻⁴ M) caused dissociation of ³H-labeled RLV RNA from the reformed polyribosome complex. The RLV RNA-polyribosome structures were also sensitive to EDTA and RNase treatment.

3739 CAMPTOTHECIN: MECHANISM OF INHIBITION OF ADENOVIRUS FORMATION. (E.) Horwitz, M.

(Albert Einstein Coll. Med., New York, N.Y.) and C. Brayton. *Virology* 48(3):690-698, 1972.

The mechanism of inhibition of adenovirus type 2 formation by the antineoplastic agent camptothecin was studied in infected HeLa cells. Virus formation was measured by the extent of ¹⁴C-thymidine incorporation into mature virions purified on CsCl gradients. Addition of camptothecin, at concentrations greater than 3.3x10⁻⁸ M, immediately following

virus adsorption completely inhibited the formation of adenovirus 12. The inhibition of morphogenesis was paralleled by an inhibition of ¹⁴C-thymidine incorporation into viral DNA purified on alkaline sucrose gradients. Pulse label experiments with ¹⁴C-valine and ¹⁴C-threonine showed that under conditions in which viral DNA synthesis was inhibited by camptothecin, protein synthesis was unaffected. Polyacrylamide gel electrophoresis indicated that all proteins made in the control culture were synthesized in the presence of the drug. These findings suggest that camptothecin acted directly upon DNA and did not inhibit its synthesis as a result of an inhibition of protein synthesis. Alkaline sucrose gradient centrifugation demonstrated that camptothecin could degrade prelabeled viral DNA from infected cells. No detectable degradation of DNA to acid soluble nucleotides was noted, and removal of the drug resulted in repair of intracellular DNA within 10-15 min. *De novo* synthesis of viral DNA also resumed at a reduced rate after removal of camptothecin from the incubation medium.

3740 YELLOW FEVER VACCINATION, AVIAN LEUKOSIS VIRUS, AND CANCER RISK IN MAN. (E.)

Waters, T. D. (U. Oklahoma Med. Ctr., Oklahoma City), P. S. Anderson, Jr., G. W. Beebe and R. W. Miller. *Science* 177(4043):76-77, 1972.

Veterans Administration death certificates of 2659 white males who died of cancer during the periods 1950-1954 or 1959-1963 were compared with those of a matched group of controls to determine whether immunization during World War II with vaccine against yellow fever played a role in cancer induction. Such vaccines, which were produced from chick embryos, were almost certainly contaminated with oncogenic avian leukosis-sarcoma viruses. Comparison of cases and controls according to history of vaccination, type of cancer, social history and medical history indicated that there was no association between yellow fever vaccination and cancer. Comparison of the two groups on the basis of date of death suggested that yellow fever vaccination had not influenced the risk of subsequent cancer. These results indicate that the avian leukosis-sarcoma viruses do not induce cancer in man.

3741 STUDIES OF SV40 DNA. III. DIFFERENCES IN DNA FROM VARIOUS STRAINS OF SV40. (E.)

Nathans, D. (Johns Hopkins U. Sch. Med., Baltimore, Md.) and K. J. Danna. *J Molec Biol* 64(2):515-518, 1972.

The DNA of different SV40 strains was analyzed by digestion with restriction endonuclease from *Hemophilus influenzae* followed by separation of the resulting DNA fragments on polyacrylamide gels. As previously reported, DNA from small plaque SV40 yielded 11 fragments (A through K) ranging from a molecular wt of 6.5x10⁵ daltons (A) to 7.4x10⁴ daltons (K). The same pattern was obtained from

digests of DNA from three different small plaque SV40 stocks whether the DNA was prepared from purified complete virions or from infected cells. "Fingerprints" from large plaque SV40 differed from those of small plaque virus in that the former had two well-separated fragments instead of a poorly resolved E + F peak. In the minute plaque DNA digest, fragment C was absent or considerably decreased and a new, smaller fragment migrating between F and G was present. The electrophoretic pattern of DNA fragments from SV68 was identical to that of minute plaque virus even though SV68 has a small-plaque phenotype. These specific differences may be due simply to the presence of small deletions in the DNA of some strains and their absence in others.

- 3742 REVERSE TRANSCRIPTASE, RNA TUMOUR VIRUS TRANSFORMATION AND DERIVATIVES OF RIFAMYCIN SV. (E.) Ting, R. C. (Bionetics Res. Labs., Bethesda, Md.), S. S. Yang and R. C. Gallo. *Nature New Biol* 236(67):163-166, 1972.

The effect of rifamycin derivatives on focus-forming ability and reverse transcriptase activity of murine sarcoma virus (MSV) and Rauscher leukemia virus (RLV) was studied. Normal rat kidney cell cultures were used as indicator cells in focus-forming assays. The rifamycin derivatives were divided into three classes based on their ability to inhibit viral reverse transcriptase. RLV or MSV were preincubated with inhibitors (100 µg/ml, 30 min) and washed virus lysates were assayed for reverse transcriptase activity. The ability of the rifamycin derivatives to inhibit reverse transcriptase correlated well with the degree of prevention of focus formation. No such correlation between loss of infectivity and inhibition of enzyme activity was observed with rifamycin-treated nononcogenic RNA viruses possessing an RNA-dependent RNA polymerase. These results suggest that reverse transcriptase is necessary for transformation by RNA tumor viruses.

- 3743 PROTEINS OF HELPER-DEPENDENT RSV. (E.) Scheele, C. M. (Public Hlth. Res. Inst. City New York, Inc., N.Y.) and H. Hanafusa. *Virology* 45(2):401-410, 1971.

Electrophoretic analysis of purified avian leukosis and sarcoma viruses is described. The viruses were cultured in chick cells containing or lacking a genetic element termed cell-associated helper factor (chf) which complements Bryan strain Rous sarcoma virus (RSV) with envelope structures. Differences in protein components of infectious and noninfectious RSV and avian leukosis virus in the presence and absence of chf were determined on the basis of viral glycoprotein structure. RAV-2, RAV-60 and SR-RSV each contained at least seven proteins, one of which was a major glycoprotein with low electrophoretic mobility. Bryan RSV differed

from SR-RSV and the avian leukosis viruses primarily in possessing multiple glycoproteins of low electrophoretic mobility. The heterogeneity of the carbohydrate-labeled material varied according to the growth of Bryan RSV in chf positive and chf negative cells. In the absence of chf, a major slowly migrating glycoprotein was missing from Bryan RSV. This observation supports the hypothesis that the failure of Bryan RSV to produce infectious progeny is due to its inability to synthesize antigenic component(s) of the viral envelope.

- 3744 EPSTEIN-BARR VIRUS ANTIBODY LEVELS IN CHILDREN FROM THE WEST NILE DISTRICT OF UGANDA. REPORT OF A FIELD STUDY. (E.) Kafuko, G. W. (East African Virus Res. Inst., Entebbe, Uganda), B. G. Kirya, B. E. Henderson, G. M. R. Munube, P. M. Tukey, N. E. Day, G. Henle, W. Henle, R. H. Morrow, M. C. Pike, P. G. Smith and E. H. Williams. *Lancet* (7753):706-709, 1972.

A pilot study to test the feasibility of a long-term cohort investigation into the relationship of Epstein-Barr (EB) virus to Burkitt's lymphoma was undertaken in the West Nile District of Uganda, where Burkitt's lymphoma is endemic. Antibodies to EB virus were assessed by the indirect immunofluorescence method using sera obtained in an initial study (November 1968) from 1122 children aged 15 and under. In both males and females, the proportion of positive titers was highest (90%) in the two to three yr age group and declined gradually for each additional yr of age to 75% at age 15. High titers were more common among young females than young males. The percentage of females with high titers, however, declined rapidly with age, and became comparable to that of males after age eight. In contrast, the proportion of high titers in boys between two and 13 yr was almost constant. Six months after the initial survey, a resurvey was conducted and 97% of the original registrants were still available. Eighteen months after the initial serum collection, a second collection was made from 447 children. Ten of the 378 (2.6%) initially positive children had negative titers at the second survey. Such reversion was most common in those who had had initially low titers. Twenty-two of 69 (32%) who had negative titers in the first survey had become positive. The antibody titers in the 378 initially positive children showed considerable stability with 57% remaining unchanged and 90% changing by not more than one dilution. Children aged three or under tended to have greater lability of titers. Thirty-nine of the 447 (8.7%) children had persistently high titers. Both labile and persistently high titers were independent of sex or age. Although there was geographical variation in the proportion of children with EB virus antibodies consistent with a recent epidemic of EB virus, the pattern of variation bore no apparent relationship to the time-space clustering of Burkitt's lymphoma previously reported in the West Nile.

- 3745 VIRAL RNA SUBUNITS IN CELLS TRANSFORMED BY RNA TUMOR VIRUSES. (E.) Tsuchida, N. (Saint Louis U. Sch. Med., Mo.), M. S. Robin and M. Green. *Science* 176(4042):1418-1420, 1972.

The size of the virus-specific RNA species present in cells transformed by murine sarcoma virus (MSV) was studied to determine the relation between the intracellular viral RNA and the 70S genome of RNA tumor viruses. The amount of virus-specific RNA was measured by the hybridization of 70S viral RNA with a ³H-DNA product prepared with purified MSV reverse transcriptase. Virus-specific RNA was detected in MSV-producing transformed rat and mouse cells and in "cryptic" nonvirus-producing transformed hamster cells and nonvirus-producing leukemic mouse spleen cells. From half-saturation curves it was estimated that the cryptic, nonvirus-producing transformed hamster and mouse cells contained only 1/15 the amount of virus-specific RNA as did the transformed virus-producing rat and mouse cells. Virus-specific RNA from the virus-producing cells sedimented in two distinct peaks (35S and 20S) in sucrose gradients. The cryptic nonvirus-producing hamster cells, however, contained only 35S virus-specific RNA. The 35S and 20S viral RNA species may serve either as precursors to the 70S viral RNA genome or as mRNAs in viral protein synthesis. The absence of 20S RNA in the nonvirus-producing hamster cells indicates that this RNA species may not be necessary for maintenance of transformed state.

- 3746 CHARACTERIZATION OF THE GROWTH OF HERPES SIMPLEX VIRUS IN HUMAN LYMPHOID CELLS. (E.) Mizrahi, A. (Roswell Park Memorial Inst., Buffalo, N.Y.), J. R. Mitchen, H. W. von Heyden, J. Minowada and G. E. Moore. *Appl Microbiol* 23(1):145-154, 1972.

Herpes simplex virus was grown in a six-liter suspended culture of an atypical permanent human lymphoid cell line, Roswell Park Memorial Institute no. 8226. The kinetics of virus replication virus replication were established by counting viruses by electron microscopy, plaque formation, and tissue culture infectivity. Levels of DNA polymerase activity were followed during the course of infection. The highest virus yields (10-15 PFU/cell) resulted when the RPMI 1701 medium supplemented with 1-2% fetal bovine serum, when pH was 6.7-7.0, and multiplicity of inoculum was 0.1. The total cells in the culture decreased slightly and an initial viability of 90% was reduced to 20% by 48 hr after the virus infection. DNA-dependent polymerase activity in cultures with high viability remained almost constant for 48 hr, but the enzyme activity decreased as the percentage of dead cells in the culture increased. After 24 and 48 hr crystalline virus patterns were observed in the nuclei of some cells. Most of the virus particles were hexagonal and none had an external envelope. In most mature particles a core of nucleic acid was present. Apparently the virus particles were enveloped as they passed

through the outer membrane of the nucleus since all virus-like particles in the cytoplasm and attached to the cell membrane had envelopes. The results indicate that HSV can replicate in human lymphoid cell lines without stimulation and that HSV infection is progressive although it is not synchronous.

- 3747 INCIDENCE OF HERPESVIRUS ANTIBODY AMONG LEUKEMIC AND NASOPHARYNGEAL CARCINOMA PATIENTS. (E.) Feorino, P. (U.S. Dept. Hlth., Education, Welfare, Atlanta, Ga.), E. L. Palmer and M. L. Martin. *Proc Soc Exp Biol Med* 139(3):913-915, 1972.

Sixty sera from patients with leukemia, 22 sera from patients with nasopharyngeal carcinoma (NPC), and 82 sera from controls were screened for antibodies to type 1 and 2 Herpes Simplex virus (HSV), varicella virus, cytomegalovirus and Epstein Barr virus (EBV). Complement fixation and fluorescent antibody titers to the herpes virus group in sera from leukemic patients were similar to those in their controls. However, patients with NPC had higher titers against HSV type 1, EBV, and varicella virus than their controls. These findings indicate that NPC patients are more susceptible to HSV infections. It is also possible that a latent HSV infection reactivated during NPC illness produces an antibody response to HSV and, in some cases, a concomitant response to varicella virus.

- 3748 SURFACE CHANGES OF HUMAN CELLS PRODUCTIVELY INFECTED WITH HUMAN ADENOVIRUSES. (E.) Salzberg, S. (Saint Louis U. Sch. Med., Mo.) and H. J. Raskas. *Virology* 48(3):631-637, 1972.

Surface membrane changes were detected in human embryonic kidney (HEK) cells productively infected with various human adenoviruses as an increased agglutination in the presence of concanavalin A (Con A). A significant increase in the agglutination of HEK cells by Con A was seen following infection with a group C adenovirus (type 2). The increase was detected as early as five hr after infection and reached a maximum after 40 hr. Viral DNA synthesis, or events dependent upon viral DNA synthesis, was necessary for this effect as treatment of cells with cytosine arabinoside from 8 to 18 hr post-infection (time of maximum viral DNA replication) considerably reduced the extent of agglutination. Infection of HEK cells with a group A adenovirus (type 12), an oncogenic strain, failed to increase agglutinability. However, two adenovirus 12 cytotidal mutants, which have lost the ability to transform permissive cells, did increase the agglutination of infected HEK cells. This result indicated that the ability to produce surface change during productive infection was not necessarily related to the oncogenicity of the virus.

- 3749 CUTANEOUS PAPILLOMAS ON AN OPOSSUM. (E.) Koller, L. D. (Natl. Inst. Environment Hlth. Sci., Research Triangle Park, N.C.). *J Nat Cancer Inst* 49(1):309-313, 1972.

Cutaneous papillomas developed on the left front leg and leg of a one-year-old opossum born and raised in captivity. A small papillomatous cluster was also found on the left ear. The papillomas began to regress six months after their initial appearance and had almost disappeared by one yr. The papillomatous projections had a hyperplastic stratified squamous epithelium and a connective tissue base and core composed primarily of collagen. Virus particles similar to those of the papova group and approximately 50 mμ in diameter were observed in electron micrographs of negatively stained suspensions of disrupted papilloma tissues. Virus-containing suspensions from the opossum wart and from human papillomas failed to produce papillomas in other opossums when inoculated intradermally or rubbed into scarified skin. Precipitation lines did not form in agar gel when the virus-containing suspension was diffused against serum from the tumor-bearing opossum. The possibility that the opossum papillomas originated from exposure to papillomas on the hand of an animal caretaker could not be excluded.

- 3750 SPONTANEOUS TRANSFORMATION OF HUMAN BRAIN CELLS GROWN *IN VITRO* AND DESCRIPTION OF ASSOCIATED VIRUS PARTICLES. (E.) Hooks, J. (Natl. Inst. Neurological Dis. Stroke, Bethesda, Md.), C. J. Gibbs, Jr., H. Choppra, M. Lewis and D. C. Gajdusek. *Science* 176(4042):1420-1422, 1972.

Brain cell cultures originating from a biopsy specimen from a patient with Creutzfeldt-Jakob disease underwent spontaneous transformation. After 60 days, foci of morphologically altered cells began to appear in primary cultures. These cells were epithelial in appearance; they grew rapidly and displayed loss of contact inhibition. Chromosome studies on two subcultures established that the cells were of human origin with a modal chromosome number of 75. One large acrocentric and one or two minute marker chromosomes were observed. Virus particles morphologically similar to known oncogenic RNA virus were observed in various stages of development in the cytoplasm, budding from the plasma membrane and in the extracellular spaces. The viruses closely resembled the Mason-Pfizer monkey virus and visna and foamy viruses. Attempts to infect various cultures of human, monkey and chimpanzee origin were unsuccessful. Radioimmune precipitation assays indicated that transformed cells did not contain group-specific antigen characteristic of the RNA tumor viruses. Transformed cells showed no fluorescence with conjugated antisera prepared against SV40 and polyoma T antigens.

- 3751 MORPHOLOGY OF THYMIC GRAFTS EXPOSED TO LYMPHOMAGENIC VIRUS. (E.) Hays, E. F.

(U. California Sch. Med., Los Angeles). *J Surg Oncol* 3(5):517-523, 1971.

Syngeneic thymic grafts in 48 AKR mice were exposed *in vitro* to lymphomagenic virus, grafted subcutaneously or under the kidney capsule and biopsied at intervals. At biopsy all but three grafts had the microscopic appearance of a normal thymus, yet 47 underwent subsequent transformation to lymphoma. Eight of nine remnant grafts developed lymphoma 71-81 days after grafting, while all 39 intact grafts were transformed after 52-180 days. In two of three intact grafts with lymphoma at biopsy, the lymphoma cells were localized in the cortex. Five lymphomas developed in 21 nonvirus-exposed grafts after a prolonged latent period. Neonatal thymic remnants exposed *in vitro* to virus also had a high incidence of lymphoma compared to nonvirus-exposed remnants. Again no specific prelymphomatous changes preceded initial lymphoma development in the thymic cortex. The effect of exposure to lymphomagenic virus on regeneration of syngeneic thymic epithelial reticular cell grafts was also studied. All grafts regenerated to normal thymus morphology with a characteristic sequence of cellular events. These results imply a direct transformation of cells in the thymic cortex by lymphomagenic virus independent of preceding structural organization. The presence of the virus in epithelial reticular cell grafts does not impair the ability of the cell to recruit precursors of thymic cortical lymphocytes from the host and direct their maturation.

- 3752 THE DEVELOPMENT OF CV-1 CELLS RESISTANT TO SV 40. (E.) Hahn, E. C. (German Cancer Res. Ctr., Heidelberg). *Arch Gesamte Virusforsch* 37:34-44, 1972.

Growing and stationary CV-1 cultures were infected with SV40. The infected, stationary cells were released from growth inhibition two hr after infection by trypsinization. During the first eight days after infection, most cells were destroyed and only small isolated colonies containing two to four cells remained. As the colonies grew, both the fraction of cells capable of producing infective centers and the amount of virus produced per cell decreased. Although less than half of the cells produced infective centers 26 days after infection, all surviving cells contained T antigen. The percentage of cells with V antigen was similar to the fraction of cells which registered as infective centers. By six wk after infection, the SV40-resistant CV-1 (SCV) strains showed altered morphology, a higher rate of proliferation and the ability to grow at low cell densities when compared with normal CV-1 cells. All six established SCV strains continued to produce small quantities of virus; however, the number of infected cells (i.e., those with V antigen) could not be increased by superinfection. The percentage of cells positive for T antigen varied between 10 and 50%. An isolated clone of SCV cells remained free of detectable virus for two months and then spontaneously

began to release SV40. Treatment with anti-SV40 serum decreased the concentration of extracellular virus but had no effect on the intracellular virus concentration. These results are consistent with the hypothesis that both T antigen-positive cells and cells which continued to release SV40 arose from T antigen-negative, abortively transformed cells in which the viral genome was unstably suppressed.

- 3753 STUDY OF INTERFERONOGENIC ACTIVITY OF HERPES SIMPLEX VIRUS. (E.) Rudneva, I. A. (Inst. Virology, USSR Acad. Med. Sci., Moscow), N. I. Korabelnikova, A. B. Germanov, M. I. Sokolov and L. L. Fadeeva. *Arch Ges Virusforsch* 37(1):1-5, 1972.

The interferon-inducing capacity of herpes simplex virus strains belonging to different antigenic groups was studied in chick fibroblast cultures. Interferon was assayed by the plaque-reduction technique using VSV as challenge virus. Only the initial variant of strain K and its plaque-forming clones (serotype 2) proved capable of inducing interferon. Strains ELA (serotype 1) and US (serotype 3) were inactive in this respect. The culture fluid showed the largest amount of interferon at 48 hr after infection with an input multiplicity of 1 PFU/cell. A reduction in multiplicity of infection resulted in a considerable decrease in interferon yield. Strain K clones, which normally form "opaque" plaques in chick fibroblast cultures at 37 C, produced "clear" plaques at 28 C and at 36 C (in the presence of BUDR). In both cases, the formation of clear plaques appeared to be associated with a reduction in interferonogenic activity.

- 3754 SELECTIVE INHIBITION OF NUCLEAR DNA SYNTHESIS BY 9- β -D-ARABINOFURANOSYL ADENINE IN RAT CELLS TRANSFORMED BY ROUS SARCOMA VIRUS. (E.) Shipman, C., Jr. (Dept. Oral Biol., U. Michigan, Ann Arbor), S. H. Smith and J. C. Drach. *Proc Nat Acad Sci USA* 69(7):1753-1757, 1972.

The effect of 9- β -D-Arabinofuranosyl adenine (ara-A) on the synthesis of covalently closed circular (extrachromosomal) DNA in Rous sarcoma virus-transformed B-mix K-44/6 rat cells was studied by addition of various concentrations of the drug to cells in medium containing ^3H -thymidine. After nearly all the nuclear DNA was pelleted by the Hirt procedure, the supernatant fractions were centrifuged to equilibrium in a CsCl-propidium diiodide gradient to isolate the covalent closed DNA. Ara-A significantly decreased incorporation of ^3H -thymidine into nuclear DNA (residual DNA in the Hirt supernatant fraction), while incorporation into extrachromosomal DNA was unaffected. The inhibition was linear with respect to ara-A concentration over the range of 37-600 μM . Total DNA synthesis per cell and mitosis were also depressed. On the basis of buoyant density and sedimentation velocity

centrifugation, the covalently closed circular DNA formed in the presence of the drug was indistinguishable from that formed in its absence. Treatment of B-mix K-44/6 cells with 600 μM hydroxyurea did not produce selective inhibition of linear DNA.

- 3755 VARIATION IN PROPERTIES OF SV40-TRANSFORMED SIMIAN CELL LINES DETECTED BY SUPERINFECTION WITH SV40 AND HUMAN ADENOVIRUSES. (E.) Butel, J. S. (Baylor Coll. Med., Houston, Texas), L. S. Richardson and J. L. Melnick. *Virology* 46(3):844-855, 1971.

The susceptibility to superinfection with SV40 of four cell lines already transformed by complete or defective SV40 was observed. The lines were: BSC-1-S monkey cells transformed *in vitro* by complete SV40; BGL-1-S baby green monkey lung cells transformed *in vitro* by complete SV40; T-22 green monkey kidney cells transformed *in vitro* by irradiated T antigen-forming particles of SV40; and H-5 green monkey kidney cells transformed *in vitro* by irradiated parental PARA adenovirus 7. When cells were superinfected with whole SV40, H-5 cells were susceptible to superinfection; infecting SV40 replicated well in H-5 cells. T-22 cells supported replication of SV40, but less effectively than H-5. BSC-1-S and BGL-1-S cells were refractory to SV40 superinfection. Cells of the four lines were superinfected with infectious SV40 DNA. BSC-1-S cells were not wholly resistant to infection with SV40 DNA, but BGL-1-S cells were. Cells of the four lines were superinfected with defective SV40 (PARA) and with a cytoplasmic mutant of PARA. Both parental and mutant PARA replicated in all four transformed cell lines. After infection with mutant PARA, more than 99% of cells in each line showed SV40 T antigen in an intranuclear location. The BGL-1-S line failed to support superinfection with human adenoviruses, but the other three SV40-transformed lines were susceptible to human adenoviruses.

- 3756 TRANSFORMATION OF GUINEA PIG EMBRYO CELLS BY A MURINE SARCOMA VIRUS. (E.) Rhim, J. S. (Microbiological Associates, Inc., Bethesda, Md.), C. F. Demoise, F. G. Duh and H. Y. Cho. *Virology* 48(3):841-843, 1972.

Experiments are reported which show that guinea pig embryo (GPE) cells can be transformed morphologically *in vitro* by the Kirsten mouse sarcoma virus (Ki-MSV). Approximately 15-20 days after infection of GPE cultures, foci of fusiform and rounded cells appeared which increased in size. The foci became quite distinct after one passage of the GPE culture. The foci were similar to those seen in Ki-MSV-transformed mouse and rat embryo cells and showed a multilayered pattern of growth. Transformed cells continuously released virus, and cell-free preparations of supernatant fluid from such cultures produced similar foci in cultured NIH Swiss mouse embryo, rat and GPE cells. The transformed cell contained high titers of the group-specific (gs) complement-

fixing antigen characteristic of the murine sarcoma-leukemia virus complex. Radiolabeled virus from supernatant fluids banded at a density of 1.15 g/cc in sucrose gradients. The ability of guinea pig cell-grown virus to transform GPE cells faster than the original virus indicates that the GPE cell grown virus may have acquired new properties. Other C type viruses, including the Moloney and Harvey isolates of MAV and the Theilen strain of feline sarcoma virus, were unable to transform GPE cells.

- 3757 FLUORESCENT ANTIBODY STUDIES ON HERPESVIRUSES FROM NEW-WORLD PRIMATES. (E.) Fraser, C. E. O. (Harvard Med. Sch., Southborough, Mass.), L. V. Melendez, M. D. Daniel and H. H. Barahona. *J Nat Cancer Inst* 49(1):291-294, 1972.

A study was undertaken to explore the extent to which fluorescent antibodies (FA) would be useful in identifying and differentiating several herpesviruses isolated from new-world primates. Virus from infected primates was used to infect owl monkey kidney, rabbit kidney or goat synovial bursa cell lines, which were then assayed by the indirect FA staining technique using virus-specific antisera. The results were compared with results from serum neutralization tests. The FA technique was as highly specific as the accepted neutralization antibody (NA) test in identifying the different herpesviruses. Poly I:C treatment of goats used to prepare the antisera had the effect of suppressing FA titers, but seemed not to suppress NA titers to any great extent. This result supports previously published data suggesting that FA are different from NA. It is concluded that FA techniques may be of value in supplementing NA tests for the identification and differentiation of herpesviruses.

- 3758 USE OF AN ESTABLISHED CAT CELL LINE FOR INVESTIGATION AND QUANTITATION OF FELINE ONCORNAVIRUSES. (E.) Lee, K. M. (New York State Vet. Coll., Cornell U., Ithaca), S. Nomura, R. H. Bassin and P. J. Fischinger. *J Nat Cancer Inst* 49(1):55-60, 1972.

Susceptibility of a continuous cat kidney cell line established by Crandell (CCC) to focus formation by a feline leukemia pseudotype of murine sarcoma virus [MSV(FeLV)] was compared to that of feline embryonic fibroblast (FEF) cultures. CCC was almost as susceptible to infection with MSV(FeLV) as FEF, the usual cell of choice in studies with feline oncornaviruses; virus titers on CCC were only three-fold lower than those of FEF. The MSV(FeLV) stock showed a characteristic "two-hit" titration pattern when assayed on both CCC and FEF or without addition of DEAE-dextran to the assay plates. In the presence of added FeLV, the number of foci formed by MSV(FeLV) was increased and the titration pattern became essentially "one-hit". Pretreatment of both CCC and

FEF cultures with DEAE-dextran enhanced by three-to four-fold the focus formation by MSV(FeLV) either alone or with exogenous FeLV. Preinfection of CCC cultures with FeLV or the Gardner-Arnstein strain of feline sarcoma virus induced resistance to challenge with MSV(FeLV). In addition, colonies of transformed cells were produced in semisolid agar suspension cultures after infection of CCC with MSV(FeLV).

- 3759 VIRUSES AND RENAL CARCINOMA OF *RANA PIPIENS*. XIII. TRANSMISSION OF THE LUCKE TUMOR BY HERPESVIRUS-CONTAINING ASCITIC FLUID FROM A TUMOR-BEARING FROG. (E.) Naegelé, R. F. (St. Jude Children's Res. Hosp., Memphis, Tenn.) and A. Granoff. *J Nat Cancer Inst* 49(1):299-303, 1972.

Undiluted herpesvirus-positive (by electron microscopy) ascitic fluid obtained from a Lucké tumor-bearing male *R. pipiens* was injected into the nephrogenic ridge of tailbud embryos. Cystic-papillary renal adenocarcinomas were detected in 7 of 87 animals examined between 72 and 99 days after inoculation. All lacked intranuclear inclusions. These results demonstrate that the etiologic agent of the Lucké adenocarcinoma was present in the ascitic fluid and support the hypothesis of vertical transmission of the tumor.

- 3760 SYNTHESIS OF VIRAL RNA BY HUMAN DIPLOID CELLS TRANSFORMED BY BLOOD FROM A PATIENT WITH HEMOCYTOBLASTOSIS. (Rus.) Andzhaparidze, O. G. (Moscow Res. Inst. Virus Prep., USSR), G. Ya. Solov'ev and L. G. Stepanova. *Vop Virusol* 16(4):460-462, 1971.

A culture of human diploid cells was inoculated with fluid from a T-9 cell line, transformed by blood from a patient with hemocytoblastosis. Portions of the inoculated cells were incubated with ³H-uridine and ¹⁴C-thymidine in a mixture of 68% Eagle's medium, 30% lactalbumin hydrolysate, and 2% calf serum for 0-24 or 48-72 hr and centrifuged in a sucrose density gradient. The sucrose density, and radioactivity distribution were measured after centrifugation. Particles having a flotation density of 1.17 g/ml in the sucrose gradient were separated on the 1st day of inoculation. Thymidine incorporation and detection of the tracer on the 1st day after inoculation are explained by the fact that there are two classes of particles: one class containing RNA (viruses) and the other containing DNA (mycoplasma). It is concluded that hemocytoblastosis is caused by the leukemia-like virus.

- 3761 SEROLOGICAL RELATIONSHIPS AMONG HERPESVIRUSES: CROSS-REACTION BETWEEN MAREK'S DISEASE VIRUS AND PSEUDORABIES VIRUS AS DETECTED BY IMMUNOFLOUORESCENCE. (E.) Sharma, J. M. (Coll. Vet. Med., Washington State

U., Pullman), D. Burger and S. G. Kenzy. *Infect Immunology* 5(3):406-411, 1972.

Sera from chickens with Marek's disease virus (MDV) cross-reacted with several pseudorabies virus (PRV)-infected cell systems by the fluorescent antibody test but not by gel diffusion, virus neutralization, or cross-protection tests. Herpesvirus of turkeys cross-reacted with MDV but not with PRV. Infectious laryngotracheitis virus, equine herpesvirus, and rabbit herpesvirus did not have cross-reactions. The observed cross-reaction of MDV and PRV is of interest because MDV is a cell-associated virus with restricted host range and has a DNA with a guanine-plus-cytosine content of 56 moles per hundred. In contrast, PRV has a wide host range, is readily released from infected cells into culture fluid, and has a DNA with a guanine-plus-cytosine content of 74 moles per hundred.

3762 INTERACTIONS BETWEEN MAREK'S DISEASE HERPESVIRUS AND AVIAN LEUCOSIS VIRUS IN TISSUE CULTURE. (E.) Frankel, J. W. (Life Sci., Inc., St. Petersburg, Florida) and V. Groupe. *Nature New Biol* 234(47):125-126, 1971.

Experimental data are presented showing that Marek's disease herpesvirus (MDHV) infection of chicken embryo fibroblast cell cultures, previously infected with an avian leucosis virus (RAV-2), reduces the number of MDHV foci and increases the complement fixing avian leucosis antigen (COFAL) titer. MDHV superinfection of primary specific pathogen-free cell cultures, infected with 10^2 - 10^4 50% median tissue culture infective dose/ml of RAV-2, produced an 87-94% reduction in MDHV foci compared with cultures receiving only MDHV. No inhibition of plaque formation by herpes simplex and vesicular stomatitis viruses resulted from MDHV superinfection of primary and secondary RAV-2-infected cultures. COFAL titers were significantly higher in cultures infected with both RAV-2 and MDHV than in cultures infected only with RAV-2.

763 HERPES ZOSTER IN HODGKIN'S DISEASE: CLINICAL, HISTOLOGIC, AND IMMUNOLOGIC CORRELATIONS. (E.) Wilson, J. F. (Nat'l. Cancer Inst., Bethesda, Md.), G. W. Marsa and R. E. Johnson. *Cancer* 29(2):461-465, 1972.

The hundred and sixty-three patients with Stages I-III Hodgkin's disease received radiation therapy. Eighty-three percent (136 patients) had localized disease (Stages I-II) when treatment was initiated. Herpes zoster was observed in 31 patients (19%). One patient gave a history of prior shingles; most had histories of childhood varicella. The incidence of zoster was increased in patients with mixed cellularity Stage III disease, and in those patients with early stages treated with extensive irradiation. Shingles occurred within six months of primary

treatment with nearly equal frequency in both sexes, but the mean age of zoster patients was significantly higher than those not developing the infection. Post-treatment lymphocyte counts at the first three month follow-up visit were evaluated in all 163 patients to compare the degree of immunosuppression resulting from the three radiation regimens; progressive lymphopenia was noted with increasing amounts of irradiation. In the 31 patients developing herpes zoster, recurrent Hodgkin's disease was detected in 16 and multiple myeloma in another. The interval between the completion of radiation therapy and the onset of herpes zoster is significant. If this interval exceeded six months, recurrent Hodgkin's disease followed shortly in ten of 13 patients. When the interval was less than six months, the patients exhibited no unusual morbidity. When zoster is activated after six months, it is reasonable to expect that active lymphoma is then directly involving neural tissue or has renewed the immunosuppression. However, those patients developing herpes zoster closer to the time of treatment reflect the cumulative immunosuppression of active disease and radical irradiation. In this situation, the herpes zoster fails as an ominous prognosticator when definite therapy eradicates Hodgkin's disease.

3764 ENHANCEMENT AND SUPPRESSION OF MURINE SARCOMA VIRUS INDUCED TUMORS BY POLYRIBOINOSINIC-POLYRIBOCYTIDYLIC ACID. (E.) Gazdar, A. F. (Nat'l. Cancer Inst., Bethesda, Md.), A. J. Weinstein, H. L. Sims and A. D. Steinberg. *Proc Soc Exp Biol Med* 139(1):279-285, 1972.

The effects of polyribonoinosinic-polyribocytidylic acid (rI·rC) on the Moloney strain of murine sarcoma virus (MSV) in male and female weanling BALB/c and AL/N mice are reported. Complete suppression of tumor induction was produced in BALB/c mice by i.v. injection of toxic levels (200 µg) of rI·rC starting two hr prior to virus inoculation and continuing every second day. Similar results were obtained with multiple injections of rI·rC at the virus inoculation site. Tumor occurrence was suppressed in BALB/c mice by continuous treatment with rI·rC for 30 days; however, tumors developed shortly after cessation of the regimen. These findings suggest that the tumor suppressive action of rI·rC was more likely mediated by its toxic or chemotherapeutic effects than by direct antiviral action. Pretreatment with a single subtoxic dose of rI·rC and MSV resulted in enhancement of tumor induction in AL/N mice at all virus dilutions tested. The enhancement was a specific action of rI·rC as it could be prevented by prior immunization with double-stranded viral RNA. It is concluded that the relationship between rI·rC and MSV tumor induction is highly complex, depending on multiple factors including the strain of mouse, dose and time of administration of rI·rC, number of injections of rI·rC, site of injection of rI·rC, and dose of MSV.

3765 INDUCTION OF OSTEOSARCOMAS AND OTHER MESENCHYMAL TUMORS BY CELL-FREE EXTRACTS

FROM MICE WITH RADIATION-INDUCED LEUKEMIA. (Fr.) Chamorro, A. (Pasteur Inst., Radium Inst., Paris, France). *C R Acad Sci [D] Paris* 274(7):1121-1124, 1972.

Of 123 Swiss/L mice, aged 35 and 75 days, which were subjected to whole-body irradiation (4 doses of 150 r x-rays each at 8-day intervals), 79 survived and 29 of these developed leukemia (21 had lymphomas and eight had leukemias). The percentage of thymomas (40%) in 75-day-old mice was twice that in 35-day-old mice. Cell-free extracts were prepared from one mouse with a thymoma, one with generalized lymphoma, two with lymphogenous leukemia, and one with myelogenous leukemia. These extracts were then injected i.p. into 97 newborn Swiss mice. Of the 57 mice which survived, five developed lymphogenous leukemia, one developed myelogenous leukemia, while 12 developed mesenchymal tumors (one reticulum-cell sarcoma, seven sarcomas, one osteoma, and three osteogenic sarcomas). In addition, five mice developed leukemic splenomegaly with an elevated WBC; three cases were myeloid in nature. Although the percentage of mice which developed lymphogenous leukemia was not appreciably higher than that which occurs spontaneously, the incidence of leukemic splenomegaly and mesenchymal tumors, particularly osteomas, was significantly higher than would occur spontaneously. These findings suggest that x-rays reactive an oncogenic virus present in the latent state in Swiss/L mice.

3766 DNA POLYMERASES OF TUMOR VIRUS: SPECIFIC EFFECT OF ETHIDIUM BROMIDE ON THE USE OF DIFFERENT SYNTHETIC TEMPLATES. (E.) Fridlender, B. (Roche Inst. Molecular Biol., Nutley, N.J.) and A. Weissbach. *Proc Nat Acad Sci USA* 68(12):3116-3119, 1971.

The RNA-dependent DNA polymerase of avian myeloblastosis virus (AMV), Rauscher mouse leukemia virus (RMLV), Rous avian sarcoma virus (RASV), and feline sarcoma virus (FSV) were distinguished from each other according to degree of inhibition of the enzyme by ethidium bromide (EB) in the presence of specific synthetic primer-templates. With (dT)₉·poly(A) as primer-template, AMV, RMLV, and RASV, but not FSV, polymerases showed high activity. This difference was not apparent when using poly(dA-dT) as a primer-template. When activated salmon-sperm DNA was the primer-template, EB concentrations up to 25 μM inhibited all virus polymerases to the same extent; at 25 μM the inhibition reached 60-80%. With (dT)₉·poly(A) as primer-template, 2.5 μM EB inhibited FSV and RMLV polymerases by 85 and 95%, resp., but AMV and RASV enzymes by only 23 and 29%, resp. Similar though less pronounced differences were observed in enzyme response to EB in the presence of poly(dA-dT) primer-template. Differences in the response of the AMV and RASV enzymes to EB and that of FSV and RMLV polymerases were also noted with (dG)₁₂·poly(dC) and poly(dG·dC) primer-templates. In general, the avian virus enzymes showed up to 30% stimulation of activity and the mammalian viruses up to 50% inhibition.

3767 BINDING OF CONCAVALIN A TO THE ENVELOPE OF TWO MURINE RNA TUMOUR VIRUSES. (E.) Calafat, J. (Netherlands Cancer Inst., Amsterdam) and P. C. Hageman. *J Gen Virol* 14:103-106, 1972.

The binding of concanavalin A (Con A) to the envelope of two RNA tumor viruses that mature at the cell membrane was studied by electron microscopy. B particles of the mouse mammary tumor virus (MTV-s) were purified from mammary tumors of BALB/cDEAFC₃H/HeA or C₃H/HeA mice. C particles of Rauscher murine leukemia virus (RMLV) were purified from the spleens of infected BALB/cDEA mice. Particles were fixed and incubated with 125-5000 μg/ml Con A for 10, 30, or 60 min at room temperature. The particle-Con A complexes were stained with 1% PTA. Both B and C particles were agglutinated in groups by Con A, and there was a thick layer of electron-dense, fairly homogeneous precipitate along the virus membrane. When 0.1 M α-methyl-D-glucoside, a sugar that competes with Con A for binding sites, was added, practically no agglutination or precipitate was seen. Virus treated with peroxidase alone followed by the diaminobenzidine reaction showed no attached precipitate. After negative staining, Con A was seen attached to virus particles. B particles incubated with anti-B particle serum also agglutinated, with antibody covering the virus envelope, indicating that RNA tumor viruses themselves may contribute to the surface changes in tumor cells.

3768 SYNTHESIS AND ASSEMBLY OF SIMIAN VIRUS 40. II. SYNTHESIS OF THE MAJOR CAPSID PROTEIN AND ITS INCORPORATION INTO VIRAL PARTICLES. (E.) Ozer, H. L. (Nat'l. Cancer Inst., Bethesda, Md.) and P. Tegtmeyer. *J Virol* 9(1):52-60, 1972.

African green monkey kidney (Vero) cells infected by SV40 were analyzed for the presence of the major capsid protein (capsid protein I) by immunological and radiolabeling techniques. Antisera with different specificities were prepared by immunization with intact or denatured viral particles. Antisera prepared against intact virus reacted by complement fixation with viral particles and with an 8S subunit containing the capsid protein I. Antisera prepared against denatured viral particles reacted with unassembled capsid proteins as well as with viral particles. Extracts of infected cells were analyzed for viral components using guinea pig antiserum to viral capsid proteins. The soluble antigen pool of the 100,000 x g supernatant was found to be small during infection with wild-type virus or a temperature-sensitive mutant of SV40 deficient in the synthesis of viral particles. SDS polyacrylamide gel electrophoresis of pulse-chase labeled viral capsid proteins purified from the 100,000 x g cell fraction on CsCl cushions was performed. The fact that only a minor increase in the total radioactivity of the capsid protein in viral particles was seen following a two hr pulse after infection at a high multiplicity of infection also indicated a small pool of nonparticle capsid protein I. In the same pulse-chase experiments, capsid protein I

was incorporated preferentially into empty shells during the pulse with a shift in radioactivity to intact virions during the chase period, indicating a possible precursor relationship between the two types of virus particles.

3769 SYNTHESIS OF DNA COMPLEMENTS OF NATURAL RNAs: A GENERAL APPROACH. (E.)

Spiegelman, S. (Coll. Physicians Surg., Columbia U., New York, N.Y.), K. F. Watson and D. L. Kacian. *Proc Nat Acad Sci USA* 68(11):2843-2845, 1971.

The usefulness of purified avian myeloblastosis virus (AMV) RNA-dependent DNA polymerase (reverse transcriptase) as a general tool for synthesizing DNA complements of a wide variety of natural RNAs was investigated. Selective hybridization of product DNA to homologous natural RNA was the criterion for actual synthesis of complementary DNA. AMV reverse transcriptase was able to direct synthesis of DNA complementary to Maloney sarcoma virus and to QB bacteriophage RNAs. In each case the product hybridized to the RNA that was added as template, and not to heterologous RNA. AMV reverse transcriptase is thus able to use various natural RNA templates to synthesize complementary DNA.

3770 EFFECT OF POLYCATIONS ON SENSITIVITY OF BALB/3T3 CELLS TO MURINE LEUKEMIA AND SARCOMA VIRUS INFECTIVITY. (E.) Manning, J. S. (Sch. Public Hlth., U. California, Berkeley), A. J. Lockett and N. B. Darby, Jr. *Appl Microbiol* 22(6):1162-1163, 1971.

The sensitivity of BALB/3T3 cells to infection by murine leukemia virus (MuLV) and murine sarcoma virus (MSV) was markedly increased by the inclusion of 2 µg/ml or more of polybrene in the virus inoculum. Toxic effects were not apparent and the size of plaques or foci was not altered. Inclusion of diethylaminoethyl dextran (DEAE-D) in the virus inoculum significantly enhanced MSV focus formation, but 20 µg/ml was required for the maximum effect. Toxic cellular effects of DEAE-D were eliminated by diluting the reagent-virus inoculum 50-fold immediately after the adsorption period. This procedure, which eliminates the necessity of polycation pretreatment and subsequent extensive washing, may be applicable to *in vitro* viral assay systems other than MuLV and MSV.

3771 DISTINCTIVE EFFECTS OF INHIBITORS OF MITOCHONDRIAL FUNCTION ON ROUS SARCOMA VIRUS REPLICATION AND MALIGNANT TRANSFORMATION. (E.) Schert, N. J. (U. Rochester Sch. Med. Dentistry, New York) and J. D. Hare. *Biochem Biophys Res Commun* 46(1):5-10, 1972.

The effects of chloramphenicol (CAP) and ethidium bromide (EB) on virus replication and oncogenic

transformation was studied in cultured chick embryo fibroblast cultures infected with Bryan high-titer strain of Rous sarcoma virus (RSV). Treatment of chick cells with 5-75 µg/ml CAP for 24 hr from 1-4 days after RSV infection caused minimal suppression of focus formation, but significantly inhibited virus production. The inhibition was directly proportional to CAP concentration. EB at µg/ml permanently prevented focus formation of RSV-infected cells when administered 24 hr prior to infection or within 48 hr after infection. The possibility of a nonspecific effect by EB on cell division was eliminated; EB had no effect on virus production. These results suggest that RSV replication in, and oncogenic transformation of, infected chick embryo fibroblasts depends on a function(s) mediated by mitochondria.

3772 TRANSFORMATION OF A RAT EPITHELIAL-LIKE CELL LINE BY MURINE SARCOMA VIRUS. (E.)

Bomford, R. (Imperial Cancer Res. Fund Labs., London, England) and I. B. Weinstein. *J Nat Cancer Inst* 49(2):379-386, 1972.

The transformation of a stable epithelial-like Sprague-Dawley rat liver cell line (RL) by the Harvey strain of murine sarcoma virus (MSV-H) was studied. Two to three days after infection, cells began to round up and detach from the culture surface. The remaining cells assumed a fibroblastic appearance and grew in piled-up foci. After two transfers, transformed cells were cloned in soft agar. Four clonal lines were established consisting of two types of cells: one releasing virus immunologically similar to MSV-H, and the other releasing no virus that could be detected by virus focus assay or by ³H-uridine labeling. The sarcoma virus genome could, however, be rescued from nonvirus-producing cells by superinfection with Moloney leukemia virus. Progressively growing, metastasizing sarcomas were produced by s.c. injection of nonvirus-producing cells into newborn Sprague-Dawley rats. Nonvirus-producing cells had an unaltered karyotype and were negative in immunodiffusion tests for murine leukemia virus antigens.

3773 DUAL INFECTION OF A HUMAN LYMPHOBLASTOID CELL LINE WITH EPSTEIN-BARR VIRUS AND RAUSCHER LEUKEMIA VIRUS. (E.) Niyoshi, I. (Okayama U. Med. Sch., Japan), H. Hasegawa, T. Tsubota, S. Irino and K. Hiraki. *Gann* 63(3):395, Plate XLIII, 1971.

A lymphoblastoid cell line (OUMS-11a) established from a patient with a neurologic disorder was infected in the 59th passage with Rauscher leukemia spleen extract. Examination of cells by electron microscopy at 71, 104, and 147 days (14th, 22nd and 32nd passages, resp.) revealed numerous immature and mature C-type particles in extracellular spaces, in intracytoplasmic vacuoles and budding from cell membranes. In addition, passage 32 cells also had

intracytoplasmic immature Epstein-Barr virus particles. Both infected and uninfected cultures contained Epstein-Barr virus capsid antigen-positive cells as shown by indirect immunofluorescence. I.p. inoculation of infected culture materials into newborn and weanling BALB/c mice failed to produce signs of illness. These results show that persistent infection of Epstein-Barr virus-bearing lymphoblastoid cells with Rauscher leukemia virus does not result in disappearance of the Epstein-Barr particles, as previously reported.

- 3774 PRESENCE IN HUMAN BREAST CANCER OF RNA HOMOLOGOUS TO MOUSE MAMMARY TUMOUR VIRUS RNA. (E.) Axel, R. (Inst. Cancer Res., Coll. Phys. Surg., Columbia U., New York, N.Y.), J. Schlom and S. Spiegelman. *Nature* 235(5332):32-36, 1972.

Hybridization experiments were conducted using purified mouse mammary tumor virus (MMTV)-directed DNA and purified RNA from human breast neoplasms. DNA-RNA hybrids were detected by isopycnic separation in Cs_2SO_4 gradients. Six to 17% of MMTV ^3H -DNA hybridized to RNA from human malignant breast tumors. Attempts to anneal MMTV-DNA to RNA from normal breast tissue or from fibrocystic disease tissue were unsuccessful. Of the 29 malignant breast tumors tested, 67% gave significantly positive responses. Hybridization of MMTV-DNA was specific for RNA from breast malignancies. No positive results were obtained with any human leukemias or sarcomas. Breast tumor RNA was likewise specific for MMTV-DNA; no annealing occurred with avian myeloblastosis virus-directed DNA.

- 3775 CHRONOLOGICAL APPEARANCE OF ALKALINE PHOSPHATASE ACTIVITY IN VIRUS-INDUCED THYMIC LYMPHOMAS OF C57BL/6 MICE. (E.) Wilson, K. J. (Dept. Biophys., Weizmann Inst. Sci., Rehovot, Israel), H. Neumann and N. Haran-Ghera. *Cancer Res* 31:1702-1705, 1971.

Homogenates of thymus, mesenteric lymph nodes, spleen, liver and kidney were assayed by a spectrophotometric procedure for alkaline phosphatase (APase) activity at different times during leukemogenesis in male C57BL/6 mice. Mice received intrathymic injection of one of two radiation leukemia viruses: a virus that produces a lymphoma incidence of 80-100% after inoculation when followed by whole body x-irradiation (Passage 127) and a virus that induces lymphatic leukemia in 80-100% of inoculated mice without irradiation (Passage 136). Increased APase levels were observed only in thymic homogenates prior to lymphoma development (at about nine wk). APase activity did not increase in the other tissues until after dissemination of the disease. APase activity did not increase if animals were inoculated with Passage 127 without further exposure to x-irradiation. Passage 127 virus remained viable in thymic tissue for several months suggesting that neoplastic transformation of

thymocytes or the proliferation of neoplastic cells was directly responsible for the increased enzyme activity.

- 3776 SPECIFIC ORIGIN IN SV40 DNA REPLICATION. (E.) Nathans, D. (Johns Hopkins U. Sch. Med., Baltimore, Md.) and K. J. Danna. *Nature New Biol* 236(68):200-202, 1972.

A model which predicts that replication of SV40 DNA begins at a specific site was tested by analyzing ^3H -thymidine pulse-labeled SV40 DNA segments by polyacrylamide gel electrophoresis. Labeled replicating SV40 DNA and newly completed DNA were reproducibly digested into 11 fragments by *H. influenzae* restriction nuclease, and the extent of label in each fragment was measured. The results conformed to the predictions of the model and indicated that SV40 DNA synthesis began at or near fragment C and ended at or near fragments G and B. It was estimated that less than five minutes was required to replicate a complete molecule of SV40 DNA. These "completed" DNA molecules sedimented as mature covalently closed, circular 21S particles in neutral sucrose gradients, indicating that there was not a long delay in the maturation of SV40 DNA.

- 3777 EARLY STIMULATION OF DNA SYNTHESIS IN CHICK FIBROBLASTS INFECTED BY AVIAN MYELOBLASTOSIS VIRUS. (E.) Harel, J. (Inst. Gustave-Roussy, Villej France), F. Lacour and T. Huynh. *Virology* 47(1):244-246, 1972.

^3H -thymidine incorporation into DNA of avian myeloblastosis virus (AMV)-infected chick fibroblast cultures was analyzed by CsCl equilibrium centrifugation. In the early period after incubation of cells with AMV from blood plasma of infected chicks, incorporation of ^3H -thymidine into DNA was 1.92 to 3.37 times the incorporation into DNA of noninfected cells. This difference became relatively negligible after labeling for 24 hr. The stimulation of incorporation into DNA was attributed to AMV per se since purified virus had a similar effect, and heat-inactivated virus had practically no effect. DNA from cells newly infected with AMV and the same buoyant density as and contained a percentage of total cellular radioactivity comparable to that of noninfected cells. It was concluded that a transitory enhancement of cellular DNA synthesis is one of the preliminary events in the course of AMV infection of chick fibroblasts.

- 3778 DETECTION OF AVIAN TUMOR VIRUS-SPECIFIC NUCLEOTIDE SEQUENCES IN AVIAN CELL DNAs. (E.) Yarmus, H. E. (U. California, Sch. Med., San Francisco), R. A. Weiss, R. R. Friis, W. Levinson and J. M. Bishop. *Proc Nat Acad Sci* 69(1):20-24, 1972.

The effect of chick embryo DNA on reassociation

kinetics of labeled double-stranded DNA produced by RNA-dependent DNA polymerase from Rous sarcoma virus (RSV) was used to measure virus-specific nucleotide sequences in normal and transformed cells. Fifty percent reassociation (half-Cot) values indicated the presence of multiple copies of viral nucleotide sequences in DNA from normal chick embryos, RS-induced chicken wing sarcomas and *in vitro* RSV-transformed cells. Multiple copies were also detected in DNA from cells harboring Rous associated virus (RAV-O) and in cells positive for viral group-specific antigen (gs⁺); they were not present in HeLa cells or salmon-sperm DNA. There were no significant differences between viral nucleotide sequences in transformed and untransformed cells or between sequences in gs⁺ and gs⁻ cells. Quail embryo cells, which were not gs⁺ and lacked RAV-O, also contained nucleotide sequences homologous to RSV, DNA and RAV-O DNA. The results suggest that viral genes may be present in normal cells.

3779 CHROMOSOMAL STUDIES OF SELECTED CELLS: THE V- CELL OF RAUSCHER'S MURINE LEUKEMIA.

(E.) Egozcue, E. (Inst. Biol. Fund., Autonomous U. Barcelona, Spain). *Ann Genet (Paris)* 15(1):25-28, 1972.

Chromosome studies were conducted on lymphocytic virus-induced cells (V-cells) obtained from blood samples from leukemic mice infected with Rauscher virus. Most of the 155 V-cell metaphase figures observed had a normal complement of 40 chromosomes. Only 6.6% were aneuploid. No structural anomalies were seen and the karyotype of the V-cells was consistent with the normal mouse karyotype. The number of gaps was within normal limits. These results do not agree with previously published findings indicating a significant percentage of aneuploidy and abnormal karyotypes in mouse leukemic spleen cells.

780 CELL FREE TRANSMISSION OF A PLASMOCYTOMA TO VARIOUS STRAINS OF ADULT MICE. (E.)

edio, G. (Inst. Path. Anatomy, U. Zurich, Switzerland) and J. R. Ruttner. *Europ J Cancer* 7(5):389-396, 1971.

A new "double inoculation" method is described for the production of a potent cell-free extract capable of transmitting the mesenteric HIPA-plasmacytoma. It is based on the assumption that HIPA ascites tumor is a more susceptible substrate for virus replication than normal tissue. Initially, tumor cells were inoculated i.p. into BALB/c mice. This was followed in two days by i.p. injection of cell-free HIPA tumor ultracentrifugate. After five to seven days, an ultracentrifugate prepared from the ascites cells of these mice was injected into other preinoculated mice. This procedure was repeated a total of seven times and resulted in an increased oncogenic potency of the ultracentrifugates in isogenic BALB/c mice. Tumor ultracentrifugates prepared from "double inoculated" mice were used to start two serial cell-free plasmacytoma cell lines in BALB/c mice. Tumors

developed after a latent period of three to five wk in 62 to 85% of the animals. Examination of these plasmacytomas by electron microscopy revealed the presence of intracellular type A and extracellular type C particles. The ultracentrifugates retained their oncogenic potential after freeze-thawing but lost it following millipore filtration. Ultracentrifugates of the two cell-free transmission lines produced mesenteric plasmacytomas following i.p. injection into allogenic adult C57Bl, ICR, C3H, DBA and AKR mice. Xenogenic transmission to rats and hamsters was unsuccessful.

3781 HERPESVIRUSES FROM THE OWL MONKEY (*AOTUS TRIVIRGATUS*). (E.) Barahona, H. H.

(Harvard Med. Sch., Southborough, Mass.), M. D. Daniel, L. V. Melendez, N. W. King, C. E. O. Fraser and F. G. Garcia. *J Nat Cancer Inst* 49(1):219-224, 1972.

Seven viral isolates obtained from cultured owl monkey cells which produced Cowdry type-A intranuclear inclusions in cultures stained with H and E were studied. Five came from animals that had never been used in experiments. Of the other two, one originated from a monkey inoculated with an *H. saimiri* filtrate and the second from a monkey inoculated with a squirrel monkey isolate which was not neutralized by *H. saimiri* antisera. None of the cultures infected with these viruses showed any type of cytoplasmic inclusion. Primate cell cultures were most susceptible to these viruses. Most of the isolates grew best in kidney cultures from owl monkey, Central American squirrel monkey and cebus monkey. Only two isolates multiplied in whole human embryo, rabbit kidney or goat cells. Acridine orange staining of infected cells and studies using 5-bromodeoxyuridine indicated that all seven viruses contained DNA. Electron microscopic observations revealed typical herpesvirus particles in infected cells. Preliminary serological studies indicated that, with one exception, the isolates were not related antigenically to known members of the herpesvirus group. The seventh isolate proved to be a strain of *H. tamarinus*. The isolates did not appear to be antigenically related to one another; however, potent antisera against some of these isolates were difficult to prepare. After preliminary grouping of these isolates, it was concluded that the owl monkey is the reservoir host for two or possibly three herpesviruses of its own.

3782 RIFAMYCIN DERIVATIVES STRONGLY INHIBITING RNA+DNA POLYMERASE (REVERSE TRANSCRIPTASE) OF MURINE SARCOMA VIRUSES. (E.) Gurgo, C. (St.

Louis U. Sch. Med., Mo.), R. Ray and M. Green. *J Nat Cancer Inst* 49(1):61-80, 1972.

One hundred and eighty rifamycin SV and B derivatives were screened for their ability to inhibit RNA+DNA polymerase (reverse transcriptase) of murine sarcoma viruses--Moloney and Harvey (MSV-M and MSV-H). Incorporation of ³H-TTP into acid insoluble material

in an *in vitro* assay mixture was used to determine enzyme activity. Sixteen of the derivatives were moderately active, inhibiting viral enzyme at a concentration of 20 µg/ml. Nine compounds showed a high degree of inhibition at concentrations between 5-20 µg/ml. The inhibitory activity of all 3-substituted derivatives correlated well with the size of the substituted side chain. With one exception, 3,4 substituted and 4-deoxy 3,4-substituted rifamycin SV derivatives, rifamycin B 4-substituted derivatives and four streptovaracin derivatives were all inactive.

- 3783 OBSERVATIONS ON THE DETAILS OF ULTRASTRUCTURE OF A SERIES OF TYPE C VIRUSES. (E.) Dalton, A. J. (Natl. Cancer Inst., Bethesda, Md.). *Cancer Res* 32:1351-1353, 1972.

Budding type C virions of murine leukemia virus (Moloney or Rauscher; MLV-M or MLV-R) grown in mouse or human cells, and of feline leukemia virus (FLV) grown in cat or human cells were studied by high-resolution electron microscopy. The virions differed from those growing from ESP-I cells, the human line that produces C type virus. Budding virions in two ESP-I lines, whether fixed in chrome-osmium or in glutaraldehyde, were characterized by a clear distinction between the intermediate layer and the envelope, with no clear separation between the inner boundary of the intermediate layer and the inner part of the nucleoid. In contrast, budding MLV-M and MLV-R virions had an intermediate layer which was thick (about 100 Å) compared to that of virions in the ESP-I cells and which was obviously separate from both the envelope and the inner part of the nucleoid. The intermediate layer of FLV virions, although thinner (about 50 Å) than in mouse virions, was also clearly distinguishable from both the envelope and the inner part of the nucleoid. The use of chrome-osmium at some stage was necessary to demonstrate these differences. These results support the view that the structure and interrelationships of the intermediate layer of developing type C virions are specific for the animal species in which they originate and are viral-genome directed. They also support the view, based on biochemical evidence and contradicted by immunological evidence, that the virions of ESP-I are not of mouse origin.

- 3784 DETECTION OF ANTIGENS OF THE MOUSE MAMMARY TUMOR (MTV) AND MURINE LEUKEMIA VIRUS (MuLV) IN CELLS OF CULTURES DERIVED FROM MAMMARY TUMORS OF MICE OF SEVERAL STRAINS. (E.) Hilgers, J. (U. Texas M.D. Anderson Hosp. Tumor Inst., Houston), W. C. Williams, B. Myers and L. Dmochowski. *Virology* 45(2):470-483, 1971.

Cultured cells from eight mammary tumors of BALB/c, (C57BL x Af)_{F1}, and RIII/Dm mice were reacted with each of three anti-mammary tumor virus (MTV) antisera prepared in rabbits, three anti-murine leukemia virus (MuLV) antisera prepared in rats, or one anti-

feline leukemia virus antiserum prepared in rabbits. Cells contained MTV particles (MTV+ cells) or MuLV particles (MuLV+ cells), or lacked either or both particles (MTV- or MuLV- cells). Indirect immunofluorescence (IF) tests were used to detect anti-MTV and anti-MuLV antigens within cells, and mixed hemadsorption reaction tests (MHA) were used to detect anti-viral surface antigens. MTV- mammary tumor cells showed weak reactions or no reaction with anti-MTV sera in IF and MHA tests. MTV+ cells showed MHA titers as high as 1:1024 with anti-MTV antisera. When anti-MTV sera were tested in IF with either MuLV+ or MuLV- cells, no staining was seen. Some MTV- cells were positive for MuLV antigens in MHA and IF. One line was positive for MTV as well as MuLV antigens in both MHA and IF tests. Of five cell lines from BALB/c mammary tumors, three were positive for anti-MuLV antigens in MHA as well as IF tests. Type C virus particles were seen in all these three cell lines. No MTV antigen was found by IF in one line with an anti-MTV serum, but MHA showed some cells of this line positive for MTV antigen with the same anti-MTV serum. IF reactions were localized in cell cytoplasm; no nuclear fluorescence for MuLV and MTV antigens was observed. The MuLV-gs3 antigen (an antigen shared by mammalian leukemia-sarcoma viruses) was found by IF in tumor cells producing C-type particles. MuLV-gs1 and MuLV-gs3 antigens were not seen in MTV+ cell lines which were MuLV-. Cell lines positive for MTV and/or MuLV antigens by IF were also positive by MHA. Anti-MuLV-gs1 and anti-MuLV-gs3 antisera gave positive IF reactions with MuLV+ cells but negative MHA reactions with an MuLV+ cell line which produced C-type particles.

- 3785 CYTOCHEMISTRY, CYTOGENETICS AND ULTRASTRUCTURE OF HAMSTER TUMOUR CELLS CARRYING MOUSE SARCOMA VIRAL GENOME (HT-1 CELLS). (E.) Karpas, A. (Dept. Med., U. Cambridge, England), J. Cawley, E. Tuckerman, R. Flemans and F. G. J. Hayhoe. *Brit J Cancer* 24(4):779-788, 1971.

An HT-1 cell line, derived from a hamster fibrosarcoma, was found to carry the murine sarcoma virus genome although it did not initially produce the virus. Cytochemical tests with periodic acid-Schiff staining indicated that the highly pleomorphic HT-1 cells contained glycogen. HT-1 cells were positive for acid phosphatase, negative for alkaline phosphatase. Karyotype analyses revealed that HT-1 cells were aneuploid with chromosome numbers fluctuating around triploidy (though no true triploids could be found). Many cells contained a very large telocentric marker chromosome which was absent from normal hamster cells; more than half of tested HT-1 cells contained marker fragments or minute chromosomes. A clone was isolated which lacked these markers. No C-type virus particles were seen in HT-1 cells examined under an electron microscope, but some cells contained spiked, 700 Å particles which resembled viruses. Nuclei contained "dense bodies" or "nuclear bodies" such as had been observed in nuclei of virus-induced tumor cells. Some nuclei lacked chromatin aggregates.

- 3786 HERPES SIMPLEX INFECTIONS IN HEMATOLOGIC MALIGNANCIES. (E.) Muller, S. A. (Mayo Clin., Rochester, Minn.), E. C. Herrmann, Jr. and R. K. Winkelmann. *Amer J Med* 52(1):102-114, 1972.

Patients with hematologic malignancies are shown to be especially vulnerable to development of herpes simplex virus (HSV) infections affecting skin and mucous membranes. At the Mayo Clinic (1960-69) twenty patients (median age fifty-five) with various hematologic malignancies had HSV infections; the small number of cases reported probably being low because HSV infection is rarely considered. In eleven of thirteen patients so studied, HSV was isolated from skin and mucous membrane lesions, and HSV antibodies were found in serum of eight patients tested. Study of the serum gamma globulin and immunoglobulin levels showed no relation to severity of HSV infection. A chronic localized herpetic ulcer (herpes phagedena) seen as a large necrotic ulcer particularly around lips, nose and eyelids of patients not acutely ill was distinctive to the study; idoxuridine ointment (0.5%) topically applied was beneficial in healing the lesions, although it is not effective in treating common recurrent HSV infection.

- 3787 SPECIFIC INHIBITION OF DNA-POLYMERASES FROM RNA TUMOR VIRUSES BY SOME NEW DAUNOMYCIN DERIVATIVES. (E.) Chandra, P. (Inst. Therap. Biochem, U. Frankfurt, W. Germany), F. Zunino, A. Götz, D. Gericke and R. Thorbeck. *FEBS Letters* 21(3):264-268, 1972.

The effects of daunomycin, an anthracycline group antibiotic, and several of its structural analogues on the DNA-polymerase activity and tumorigenic ability of Friend leukemia virus (FLV), murine sarcoma virus-Moloney (MSV-M) and Rous sarcoma virus (RSV), were studied. Purified FLV and RSV suspensions were incubated (1 hr, 37 C) with antibiotic (50 µg/ml) and then injected i.p. into mice and chickens, resp. Daunomycin and adriamycin significantly prolonged the survival time of the infected mice and chickens. This effect was correlated with an inhibitory effect of both antibiotics on reverse transcriptase activity in MSV-M, FLV and RSV, as measured by incorporation of ³H-TMP into DNA. Dihydro daunomycin had an intermediate effect in both prolonging survival time and inhibiting reverse transcriptase. The derivatives substituted in the amino sugar moiety (N-guanidine- and N-acetyl-daunomycin) were ineffective in prolonging survival of both animals. The N-acetyl derivative was also ineffective in inhibiting reverse transcriptase in MSV-M and FLV, but did show moderate inhibition in RSV. Similar differences in inhibitory effects of daunomycin and its derivatives on reverse transcriptase were observed when synthetic templates were used. It is concluded that substitutions in the amino sugar moiety, especially N-acetylation, inhibit the antitumor activity of, and influence the inhibition of reverse transcriptase by, daunomycin.

- 3788 THE 3'-TERMINAL NUCLEOSIDES OF THE HIGH MOLECULAR WEIGHT RNA OF AVIAN MYELOBLASTOSIS

VIRUS. (E.) Stephenson, M. L. (Huntingdon Mem. Hosp., Harvard U., Boston, Mass), L. S. Wirthlin, J. F. Scott and P. C. Zamecnik. *Proc Nat Acad Sci USA* 69(5):1176-1180, 1972.

RNA was purified from avian myeloblastosis virus (AMV) BAI Strain A, isolated from chicken plasma from infected chicks and from myeloblast tissue cultures, and fractionated by sucrose density centrifugation. The 3'OH terminal nucleosides of various fractions were analyzed by thin-layer cellulose chromatography after periodate oxidation and tritiated borohydrate reduction of the RNA alkaline hydrolysates. The 3'OH-terminal nucleoside from 60-70S AMV-RNA, 35S AMV-RNA (obtained by heating 60-70S RNA), tRNA and 4S RNA (derived from heated 60-70S RNA) fractions was adenosine. By the borohydrate method, the molecular wts for the 60-70S and the 35S RNA fractions were similar (2×10^6), which was consistent with a suggested subunit structure for 60-70S material found by others.

- 3789 VIRUS PARTICLES IN SJL/J MOUSE DISEASE. (E.) Okano, H. (Fac. Med., Kyushu U., Fukuoka, Japan), M. Koga and H. Otsuka. *J Nat Cancer Inst* 49(2):485-491, 1972.

Lymphatic tissues from 26 strain SJL/J mice, 1-443 days old, were examined by electron microscopy. Virus particles were rare in newborn or young mice, which are apparently free from lymphomatous lesions. However, in the lymphatic tissues of animals older than 313 days, type C-virus particles were abundant, and lymphoid hyperplasia and reticulum cell neoplasia were seen (Dunn's type-B lesion). Characteristically, numerous type-C virus particles were localized between irregularly shaped cisternae in the cytoplasm of peculiarly shaped giant cells. Some budding and immature type-C particles, associated with mature type-C particles, were also in the cisternae. The presence of these abundant type-C virus particles within the lymph node may be closely related to reticulum cell neoplasia.

- 3790 RIFAMYCIN ANTIBIOTICS: INHIBITORS OF RAUSCHER MURINE LEUKEMIA VIRUS REVERSE TRANSCRIPTASE AND OF PURIFIED DNA POLYMERASES FROM HUMAN NORMAL AND LEUKEMIC LYMPHOBLASTS. (E.) Yang, S. S. (Bionetics Res. Labs., Bethesda, Md.), F. M. Herrera, R. G. Smith, M. S. Reitz, G. Lancini, R. C. Ting and R. C. Gallo. *J Nat Cancer Inst* 49(1):7-25, 1972.

Two hundred and one rifamycin derivatives were screened for inhibitory effects against partially purified human normal and leukemic lymphocyte and murine leukemia virus DNA polymerases using poly d(AT) and endogenous 70S RNA as templates, resp. The derivatives, obtained by substitution at position 3 and/or 4 of the naphthalene ring, were classified on the basis of structure into eight groups. Compounds producing greater than a 50% inhibition of incorporation of ³H-TTP into acid insoluble material (30 min, 250 µg/ml for leukemic and 50 µg/ml for viral polymerase) were

classified as active. Although few general correlations were found between structure and inhibitory capacity, most 3-hydrazonomethyl derivatives were active, whereas only one of 16 4-deoxy derivatives showed activity. Ten active compounds were further studied for selective activity against the endogenous reverse transcriptase activity of Rauscher leukemia virus. Under all conditions tested, 3-(2,4-dinitrophenylhydrazonomethyl) rifamycin SV and 3-piperazinoiminomethyl rifamycin SV (N-demethylrifamycin) inhibited viral polymerase to a greater extent than did cellular polymerase I or polymerase II. Both compounds inhibited normal polymerase I more strongly than polymerase II. Both preferentially inhibited leukemic cellular polymerase II over normal cellular polymerase II. Because these compounds preferentially inhibited viral reverse transcriptase and leukemic DNA polymerase II, they may be of clinical interest as potential antileukemic agents.

3791 SEQUENTIAL CHANGES IN SPLEEN CELL CHROMOSOMES DURING FRIEND VIRUS LEUKEMIA. (E.)

Elliott, S. C. (Dept. Biol., Drake U., Des Moines, Iowa), R. M. Helm and M. E. Myszewski. *Cancer Res* 32(4):776-780, 1972.

Sequential changes in spleen cell karyotype were studied in 76 female BALB/c mice at weekly intervals for five weeks following i.p. injection of serial dilutions of Friend leukemia virus (FLV). Uninfected mice served as controls. All infected mice exhibited hyperplasia of the erythroid elements of the spleen, with resultant progressive splenomegaly, which increased in proportion to virus dose. Although polyploid cells were found after infection with all doses of virus, their frequency did not correlate statistically with time after infection, virus dose, or an interaction of the two. A total of 0.9% of 2149 infected metaphase cells examined showed a hyperdiploid number of 41 chromosomes. This number was not clustered at any stage of the disease and was not higher than that of control mice. The number of abnormal cell configurations in infected animals did differ significantly from controls throughout the disease process, but no single abnormal diploid number predominated. A significant correlation was found between the number of secondary chromosomal constrictions and the progression of the disease. As spleen weight increased, the number of secondary constrictions per metaphase figure increased. There was an inverse relationship between increased spleen weight and the number of normal diploid cells lacking secondary constrictions. Since an increased number of these secondary constrictions appeared early in the disease process, even with low FLV doses, this change was considered to have significant mutational importance.

3792 REPLICATION OF VIRAL DEOXYRIBONUCLEIC ACID AND BREAKDOWN OF CELLULAR DEOXYRIBONUCLEIC ACID IN EPSTEIN-BARR VIRUS INFECTION. (E.)

Nonoyama, M. (U. North Carolina Sch. Med., Chapel Hill) and J. S. Pagano. *J Virol* 9(4):714-716, 1972.

Raji cells (a nonproductive line of Burkitt's lymphoma) were infected with Epstein-Barr virus (EBV). The replication of viral DNA, as followed by hybridization with EBV-specific complementary RNA, and the fate of cellular DNA was studied. Incorporation of ³H-thymidine into acid-insoluble material was significantly suppressed by 12 to 18 hr after infection. Viral DNA replication started around 12 hr and was most active between 18 and 30 hr. The quantity of EBV DNA formed reached 1,000 genome equivalents per cell. Nonetheless, little, if any, virus was formed, as based on the appearance of viral capsid antigen. Alkaline sucrose gradient centrifugation of DNA from cells prelabeled with ¹⁴C-thymidine, and then labeled with ³H-thymidine after virus infection, showed that about 80% of both preexisting and newly synthesized cellular DNA was degraded to 20-30S fragments. Results also indicated that EBV infection suppressed cellular DNA synthesis as compared with uninfected cells.

3793 EPIDERMODYPLASIA VERRUCIFORMIS AS A MODEL IN STUDIES ON THE ROLE OF PAPOVAVIRUSES IN ONCOGENESIS. (E.) Jablonska, S. (Warsaw Sch. Med., Poland), J. Dabrowski and K. Jakubowicz. *Cancer Res* 32(3):583-589, 1972.

Results of a study showing that papovavirus is a causative factor in the verrucous lesions in epidermodysplasia verruciformis (EV) and also in the initiation of the morbid process are reported. The study involved a 30-year-old female patient in whom lesions with evident papovavirus first developed at age five after contact with the crushed common wart of a brother. Histology of specimens from the dorsum of the patient's hands was typical of flat warts in EV; some but not all forehead specimens showed atypia (Bowen's disease, invasive Bowen's carcinoma, and changes of the senile keratosis type). The virus was demonstrable by electron microscopy as crystalloid structures in verrucous lesion nuclei. Bowen's disease type lesions from the forehead showed enlarged nuclei with abnormal distribution of chromatin and other atypical signs. In forearm lesions with virus-containing cells, chromatin was less abundant and showed peripheral distribution. Negative staining showed that the shape and size of the virus capsid were characteristic of papovaviruses. Heteroinoculation was successful in only one of eight test subjects. Transmission of the viral infection indicates that the virus is responsible for the verrucous lesions in EV and consequently is pathogenic.

3794 PRESENCE OF DNA IN ONCOGENIC RIBOVIRUSES. (Fr.) Emanoil-Ravicovitch, R. (Saint-Louis Hosp., Paris, France). *Pathol Biol (Paris)* 19(21-22):1003-1006, 1971.

In 1970 several research teams found DNA inside Rous

sarcoma virus in chickens, avian myeloblastosis virus in chickens, and Maloney mouse sarcoma by labeling with ^{14}C -uridine and ^3H -thymidine. It was ascertained that the DNA is almost certainly not an artefact, but a true constituent of the 3 viruses. The DNA was sensitive to pancreatic DNase, but resistant to RNase and hydrolysis. Although the sedimentation coefficient (7S), determined in a sucrose gradient, revealed a population which was relatively homogeneous in size, two distinct populations were isolated by density gradient. It is estimated that intraviral DNA accounts for approximately 2.5% of the total nucleic acids extracted from virions. Electrophoretic studies on polyacrylamide gel with nucleic acid labeled with ^3H -thymidine disclosed that DNA was not linked to RNA 65S by a covalent bond. The density of RNA 65S was between 1.61-1.64 g/cm³ and that of DNA, 1.423 g/cm³. This slight shift to a higher density indicates there is some complementarity between intraviral DNA and RNA, but whether DNA is necessary to render a virus infectious remains to be shown.

3795 MARKER BAND IN ONE CHROMOSOME 14 FROM BURKITT LYMPHOMAS. (E.) Manolov, G. (Inst. Genetics, U. Lund, Sweden) and Y. Manolova. *Nature* 237(5379):33-34, 1972.

Chromosome banding patterns were studied in preparations from six Burkitt lymphoma tumor biopsies and nine Burkitt lymphoma tumor lines stained with Giemsa or treated with quinacrine mustard (QM). Both staining techniques consistently revealed an extra band in one homologue of D group chromosome pair No. 14 in ten of the 12 tumors. In three tumors where both biopsies and cultures were examined, results were consistent in the two types of samples. The extra band was found at the end of the long arm and was similar to the normal fluorescing bright band (q7') also found in that area. The extra band, however, was often less luminescent with QM and more weakly-stained with Giemsa, as well as being somewhat narrower than the normal q7'. This marker was much more consistently present than were other markers (e.g., the secondary constriction on chromosome No. 10) normally associated with Burkitt lymphoma.

3796 GLYCOLIPID SYNTHESIS IN NORMAL AND VIRUS-TRANSFORMED HAMSTER CELL LINES. (E.) Takiyama, H. (Dept. Biol., Massachusetts Inst. Tech., Cambridge), S. K. Gross and P. W. Robbins. *Proc Nat Acad Sci USA* 69(4):872-876, 1972.

Glycolipid synthesis in several clones from the NIL embryonic hamster cell line, which differ in morphology, saturation density and glycolipid patterns, was studied. No correlation was found between saturation density and complexity of the glycolipid pattern. The clone with the highest saturation density was the only one to show the complete set of glycolipids [monohexosyl ceramide (GL-1), dihexosyl ceramide (GL-2), trihexosyl ceramide (GL-3), globoside (GL-4), Forssman antigen

(GL-5), and hematoside (G_{M3})] previously found in NIL 2 cells. All untransformed NIL clones showed density-dependent increases in GL-3, GL-4, GL-5 and G_{M3}, which had been prelabeled with ^{14}C -palmitate and identified by thin-layer chromatography. The high-saturation-density clone showed increases in GL-3, GL-4 and GL-5, but not G_{M3}. One line which contained only G_{M3} showed an increase in that moiety at confluence. Cells transformed by hamster sarcoma virus or polyoma virus contained only GL-1, GL-2, and G_{M3} and showed no density-dependent effect on these glycolipids. Chemical measurement of glycolipid changes during density-dependent inhibition confirmed the results obtained from the radioactive assays.

3797 VIRAL AND IMMUNOLOGIC STUDIES OF HUMAN NEOPLASMS. (E.) Malmgren, R. A. (No affiliation) and D. L. Morton. *Pathol Annu* 1:63-81, 1971.

The possible application of immunologic techniques to diagnostic or detection methods is reviewed. Evidence presented for a viral etiology of tumors includes discussion of transformation experiments which demonstrate a cancer proneness in individuals from whom fibroblasts are derived. Electron microscopic studies carried out in conjunction with immunologic techniques have enabled identification of a virus which permits clearer insight into the virus' relationship to a specific neoplasm. In addition, tumor specific antigens have been successfully demonstrated and distinguished from normal antigens in several cases. Cellular immunity, lymphocyte transformation, cell-mediated cytotoxicity, radio-immunodiffusion methods and immunotherapy are also discussed. The ultimate possibility of detecting a high cancer risk population through the use of currently developing laboratory procedures is seen as a reality in the near future.

3798 THE RESPONSE OF BHK21 CELLS TO INFECTION WITH TYPE 12 ADENOVIRUS: VI. SYNTHESIS OF VIRUS-SPECIFIC RNA. (E.) Raska, K., Jr. (Rutgers Med. Sch., New Brunswick, N.J.) and W. A. Strohl. *Virology* 47:734-742, 1972.

The sequences of adenovirus type 12 (Ad12) genomes transcribed during the abortive infection of GL-arrested BHK21 cells were studied. RNA-DNA hybridization-competition experiments demonstrated that newly synthesized specific RNA corresponded to as much as 60% of those "early" (synthesized in the presence of cytosine arabinoside 18-19 hr post-infection) mRNA sequences which were transcribed in productively infected human embryonic kidney (HEK) cells. No "late" (synthesized 23-24 hr post-infection) Ad12 mRNA was detected in BHK21 cells. Comparison of Ad12-specific RNA sequences transcribed in Ad12-infected BHK21 cells and in Ad12-induced hamster tumor cells (HT₂) by hybridization-competition showed that HT₂ cells did not contain significantly greater amounts of Ad12-

specific RNA sequences than those present in Ad12-infected G1-arrested BHK21 cells. Under conditions of minimal background cellular DNA synthesis, DNA-DNA hybridization experiments did not detect synthesis of viral DNA in Ad12-infected BHK21 cells. Immunofluorescent staining experiments indicated that Ad12 capsid protein synthesis occurred with a frequency of not more than one in 10^4 infected cells.

- 3799 RNA-DEPENDENT DNA POLYMERASE IN VIRUSES AND CELLS: VIEWS ON THE CURRENT STATE. (E.) Gallo, R. C. (Natl. Cancer Inst., Bethesda, Md.). *Blood* 39(1):117-137, 1972.

The presence of an RNA-dependent DNA polymerase or reverse transcriptase has been found in every RNA oncogenic virus investigated, with the exception of some mutant viruses that have lost the ability to infect or transform normal cells. It is assumed that the role of the enzyme is to convert viral 70S RNA to a DNA copy allowing the viral genome to be inserted into host cell DNA. Nononcogenic viruses either contain no polymerase activity or an RNA-dependent RNA polymerase with the exception of the Foamy viruses which have been shown to contain reverse transcriptase. However, it is thought that this type of virus may eventually be shown to be oncogenic. A demonstration of the presence of a true reverse transcriptase in an isolated particle would strongly support the notion that the particle is an RNA virus and potentially oncogenic. The presence of a true reverse transcriptase (catalyzing synthesis of DNA from *pure single stranded natural RNAs*) in cells is more difficult to establish. The use of some synthetic templates such as the RNA-DNA hybrids poly rA.dT to detect the presence of reverse transcriptase has led to some confusion. Although reverse transcriptase has great affinity for these templates *they lack specificity*, i.e., virtually any DNA polymerase will use them. Thus, activity with these templates does not in itself indicate that reverse transcriptase is present. At this time there is no published definitive information demonstrating the presence of this enzyme in any normal cell. An unequivocal demonstration of its presence in a human tumor tissue would, therefore, appear to indicate that information from an RNA oncogenic virus may be present.

- 3800 SPONTANEOUS APPEARANCE OF CYTOPATHOLOGY AND RAT C-TYPE VIRUS (WF-1) IN A RAT EMBRYO CELL LINE. (E.) Bergs, V. V. (U. Miami Sch. Med., Fla.), G. Pearson, H. C. Chopra and W. Turner. *Int J Cancer* 10:165-173, 1972.

After two yr of culture, the WF-1 line of fibroblastic rat embryo cells, initiated from apparently normal embryos, manifested cytopathological changes which became more pronounced when bovine amniotic fluid was removed from the culture medium. Cellular changes appeared four to seven days after seeding of cells in fresh vessels and disappeared if WF-1 cells

were subcultured at three to four day intervals. Cytopathological changes included the development of foci of altered rounded and fusiform cells with dark prominent nuclei. Most of these cells were viable, but failed to multiply in new medium. C-type virus particles were seen in WF-1 cells both before and after cytopathological alterations became evident; particles budded from cell plasma membranes and were also seen extracellularly. Extracts of altered WF-1 cells produced no changes in cultured REL rat embryo cells. When C-type viruses in WF-1 culture supernatants were concentrated and banded on a sucrose gradient (buoyant density = 1.16 g/cm^3), an infectious virus of one TCID₅₀/10⁴ virus particles was seen. Concentrated banded virus particles produced foci of viable rounded cells in REL cultures; these foci resembled foci previously formed in REL by a C-type virus (BV-1) isolated from a chemically induced rat mammary tumor. Immune BV-1 serum neutralized WF-1 virus cytopathic activity in REL. WF-1 cells were negative when tested for properties characteristic of murine leukemia viruses (MuLV) (e.g., mouse gs-1 and gs-3 antigens and capacity to induce an XC reaction characteristic of MuLV). Inocula of $1.1-3.5 \times 10^6$ WF-1 cells produced fibrosarcomas in 90-100% of W/FU rats within five wk of inoculation. Fibrosarcomas produced by inoculation of WF-1 cells contained C-type particles.

- 3801 PERSISTENCE OF ROUS SARCOMA VIRUS IN TRANSFORMED NON-PERMISSIVE CELLS: MECHANISM OF VIRUS INDUCTION BY ASSOCIATION WITH PERMISSIVE CELLS IN THE ABSENCE OF SENDAI VIRUS. (E.) Vigier, P. (Radium Inst., Fac. Sci., Orsay, France). *Int J Cancer* 9(1):150-161, 1972.

BHK-21 hamster cells were transformed with Schmidt-Ruppin Rous sarcoma virus (RSV) or Bryan (RAV) RSV. The resulting transformed but nonpermissive cells (TNP), called RS2 and RB12, were grown together with permissive chick embryo cells (CE) and production of free virus (FV) and appearance of infective centers (IC) were observed. FV was induced in irradiated and nonirradiated mixtures of RS2 cells and CE. Schmidt-Ruppin RSV and IC were not induced when an anti-RAV antiserum was added to the cell mixtures. Production of RSV by association of TNP and CE appeared to result from reinfection of CE cells by RSV produced by the IC's. RSV was also produced in all of 11 RS2-derived subclones tested, indicating that the TNP RS2 cells carried at least one complete viral genome. IC's and FV were also seen when RB12 cells were mixed with CE. Initial IC's were presumably formed by fusion of TNP cells and CE cells. Transformed chicken cells appeared later, and arose from secondary infection of chicken cells. The number of focus-forming IC's recovered from RS2 subclones was always less than one per 10^3 cells. No such IC's were seen in two RS2 subclones from which FV could be recovered after Sendai virus-mediated fusion with CE cells. Even heterokaryon formation failed to remove the block of virus production in these subclonal TNP cells. FV was induced only by association of TNP and permissive CE cells. The results are thought to eliminate the possibility that FV is induced in TNP

by transfer of subviral determinants from TNP cells to CE cells, since virus production and secondary infection of CE cells were prerequisites for induction of FV.

3802 RNA OF RNA TUMOUR VIRUSES CONTAINS POLY A. (E.) Gillespie, D. (Gerontology Res. Ctr., Baltimore, Md.), S. Marshall and R. C. Gallo. *Nature New Biol* 236(69):227-231, 1972.

An assay involving the hybridization of radioactive polyuridylic acid (poly U) to nonradioactive virus RNA at high temperatures (35-40 C) was used to detect the presence of poly A tracts in oncogenic and nononcogenic viruses. The poly A content of RNA preparations from oncogenic viruses from avian, murine and primate sources ranged between 1 and 3% of the viral 70S genome. Polyacrylamide gel electrophoresis of the ³H-poly U-viral RNA hybrids indicated that they were larger than hybrids formed with RNA prepared from human blood lymphocytes. It was estimated that the RNA molecules isolated from the RNA tumor viruses examined contained between 300-900 nucleotide equivalents of poly A (1-3 tracts). Poly A was also detected in RNA from leukemogenic viruses and in RNA from a virus associated with mammary adenocarcinoma. In contrast, RNA preparations from most nononcogenic RNA viruses contained 25 to 50 times less poly A than RNA from oncogenic RNA viruses. Polio virus, a member of the picorna group, did contain a significant level of poly A. In those cases where poly A was observed in RNA from nononcogenic viruses, the tracts could be distinguished from those of tumor virus RNA by polyacrylamide gel electrophoresis. Hybridization of viral RNA with polyribocytidylic acid showed that although low levels of poly G are present in several RNA viruses, there is no correlation between poly G content and tumorigenicity.

3803 DETECTION OF RNA-INSTRUCTED DNA POLYMERASE AND HIGH MOLECULAR WEIGHT RNA IN MALIGNANT TISSUE. (E.) Gulati, S. C. (Coll. Physicians Surgeons, Columbia U., New York, N.Y.), R. Axel and S. Spiegelman. *Proc Nat Acad Sci USA* 69(8):2020-2024, 1972.

An RNA-DNA hybridization technique has been used to detect 70S RNA-directed DNA synthesis in mouse mammary carcinomas. Breast tumors excised from tumor-bearing Paris RIII mice were homogenized and fractionated according to a procedure designed to eliminate cellular nucleases, polymerases and RNA. Glycerol gradient centrifugation of the *in vitro* acid-insoluble tumor homogenate polymerase assay product showed a distinct virus-specific peak with a sedimentation coefficient of 70S, indicating the presence of viral RNA-directed DNA polymerase. No such activity was detected in homogenates of normal lactating breast tissue from tumor-free NIH Swiss mice. The ability to hybridize the ³H-labeled DNA product specifically to purified mouse mammary tumor virus (MMTV) RNA proved that the RNA-directed

DNA polymerase was of MMTV origin. The ³H-DNA product of the MMTV polymerase could be used to detect virus specific RNA in polysomal fractions from mouse breast tumor homogenates. No virus-specific RNA was detected in polysomal fractions from livers of tumor-free NIH mice.

3804 DETECTION OF HIGH-MOLECULAR-WEIGHT RNA IN PARTICLES FROM HUMAN MILK. (E.) Schlom, J. (Coll. Phys. Surg., Columbia U., New York, N.Y.), S. Spiegelman and D. H. Moore. *Science* 175(4021):542-544, 1972.

An assay developed to permit the simultaneous detection of reverse transcriptase and the 60S to 70S high-molecular-wt RNA unique to the oncogenic RNA viruses (oncornaviruses) was applied to particles isolated from human milk. Milk preparations were clarified by EDTA treatment and centrifugation. The pellet was suspended in NP40 and dithiothreitol and an endogenous reverse transcriptase reaction was carried out using ³H-TTP incorporation into DNA. The nucleic acids were then extracted and subjected to Cs₂SO₄ equilibrium gradient centrifugation. Fractions were collected and analyzed for acid-insoluble radioactive material. Under these conditions, the presence of ³H-DNA which sedimented as 60S-70S material indicated the presence of both reverse transcriptase and 60S-70S RNA. Numerous preparations of human milks were assayed and RNA:³H-DNA complexes were observed sedimenting at 67S. One milk preparation from a woman with a family history of breast cancer showed an excessively high peak of radioactivity in the 60S to 70S region. Milks from different women varied in enzyme content and milks from individual women differed from day to day. These effects could be due either to actual variation in the amounts of milk particles or to the variable presence of inhibitors. Inhibitors were implicated in at least one case in which no ³H-DNA:RNA 60S to 70S complex was observed when RIII mouse milk containing mouse mammary tumor virus (MMTV) was mixed with human milk. RIII milk processed alone produced such a complex. ³H-DNA in the 35S region was also found in assayed milks from nine of 20 women. A similar 35S complex has been observed in the assay of MMTV and other oncogenic RNA viruses.

3805 AN EXPERIMENTAL STUDY OF VIRUS LEUKEMIA IN CATS. (E.) Mackey, L. J. (Animal Leukaemia Res. Unit, U. Glasgow, Scotland), W. F. H. Jarrett, O. Jarrett and H. M. Laird. *J Nat Cancer Inst* 48(6):1663-1670, 1972.

Thirty-seven newborn cats were inoculated with feline leukemia virus (FeLV) obtained from a spontaneous feline alimentary lymphosarcoma. By 3.5 yr after inoculation, 13 cats had developed hematopoietic neoplasms, 13 had died from other causes and 11 remained alive. Some tumor-free cats showed thymic atrophy and lymphoid depletion. Among cats with tumors, there were four alimentary lym-

phosarcomas (latent period, ≤ 16 months), two thymic lymphosarcomas (latent period, > 2 yr), two multicentric lymphosarcomas (latent period, ≤ 16 months), four lymphoid leukemias (latent period, 1-33 months) and three myeloid leukemias (latent period, > 2 yr). The overall tumor incidence in all cats given FeLV was approximately 50%. No uninoculated cats developed advanced neoplasms. As shown by electron microscopy, virtually all 37 cats inoculated neonatally became infected with FeLV; some cats remained infected until adulthood without developing tumors. All tumor-bearing cats contained replicating C-type virus.

- 3806 DEMONSTRATION OF *HERPESVIRUS SAIMIRI*-ASSOCIATED ANTIGENS IN PERIPHERAL LYMPHOCYTES FROM INFECTED MARMOSETS DURING *IN VITRO* CULTIVATION. (E.) Falk, L. A. (U. Illinois Med. Ctr., Chicago), L. G. Wolfe, J. Hoekstra and F. Deinhardt. *J Nat Cancer Inst* 48(2):523-530, 1972.

Marmosets were inoculated with cell-free *Herpesvirus saimiri* (HVS) or with tumor cells from HVS-infected marmosets. Femoral venous blood was collected from infected marmosets and lymphocytes were separated out on Ficoll-Hypaque gradients. Lymphocytes were grown on suspension cultures or on vero monkey cells. Lymphocytes in fixed smears from suspension cultures and in vero cell coverslip cultures were tested by the indirect fluorescent antibody method for HVS and HVS-associated antigens at intervals up to 120 hr after initiation of cultures. No lymphocyte smears made immediately after initiation of culture with HVS-infected blood lymphocytes showed antigenicity, but 1-5% of cells seen in smears taken after 24 hr incubation were HVS antigen-positive. Smears prepared 48 and 72 hr after incubation did not show an increase in the number of antigen-positive cells. No HVS was recovered from supernatants or cell-free extracts of lymphocyte suspensions after cultivation up to 120 hr. HVS was recovered, however, from lymphocyte and vero cell cultures. HVS antigens were seen in vero cell cultures 24 hr after incubation of vero cells with HVS infected blood lymphocytes. It appeared that by 24 hr the HVS genome had been transferred to vero cells from infected lymphocytes.

- 3807 EXPERIMENTAL STUDIES BY TISSUE CULTURE OF A NEW MURINE LEUKOSIS VIRUS (ML. V). (E.) Hamazaki, Y. (Okayama U. Med. Sch., Japan), T. Murao and T. Murao. *Arch Geschwulstforsch* 39(1):8-23, 1972.

Ingestion of human malignant neoplasms by mice led to the isolation of a murine leukemia virus (ML. V) in 28 of 85 experiments. The ML. V was cultured on HeLa and L cells and established virus-carrying cell lines were produced. On HeLa cells, no change in morphology was seen immediately after inoculation with ML. V. Chromosome numbers in ML. V-bearing HeLa cells had a wider range in virus-free HeLa cells. A kind of "cell clasping" or phagocytosis was seen

in a few ML. V-infected HeLa cells. Cytopathic effect (CPE) was not seen in ML. V-infected cells, but a specific CPE was seen three to four days after establishment of ML. V in culture in L cells. Nuclear inclusion bodies were often seen in ML. V-carrying L cells. Infiltration of myeloid cells was observed in mice and rats inoculated with ML. V; there was also severe reticuloendotheliosis with granuloma in liver and spleen. ML. V showed a specific hemagglutinin response against rat red blood cells.

- 3808 ANTIGENIC PROPERTIES OF MURINE SARCOMA VIRUS-TRANSFORMED BALB/3T3 NONPRODUCER CELLS. (E.) Stephenson, J. R. (Natl. Inst. Hlth., Bethesda, Md) and S. A. Aaronson. *J Exp Med* 135(3):503-515, 1972.

BALB/c mice were inoculated with cells of a Kirsten murine sarcoma virus (MSV)-transformed subclone of BALB/3T3 clone A31 cells (subclone K-234) or Rauscher murine leukemia virus (MuLV)-transformed K-234 cells (K-234(R)). K-234 cells produced no detectable virus while K-234(R) cells produced MSV and MuLV. K-234 cells were more tumorigenic in inoculated mice than K-234(R) cells, suggesting that K-234(R) cells were more antigenic than K-234 cells. This supposition was supported by the finding that irradiation had little effect on growth of K-234 cells in recipients but enhanced growth of K-234(R) cells. Mice immunized with repeated injections of K-234(R) cells before challenge with these cells had reduced tumor incidence. In contrast, preimmunization with K-234 cells was not effective in protecting against K-234 cell challenge. Preimmunization with sonicated K-234(R) cells also protected mice against challenge with K-234(R) cells, but preimmunization with sonicated K-234 cells did not induce resistance to challenge with K-234 cells. Immunization of mice with rat cells did not protect against challenge with K-234 cells; immunization with UV-irradiated Rauscher MuLV protected against K-234(R) challenge but not against K-234 cell challenge. Antisera prepared from mice immunized with K-234(R) cells were cytotoxic and positive by fluorescent antibody staining for K-234(R) target cells but were not cytotoxic or reactive with K-234 cells. Evidently, the nonproducer K-234 cells lacked transplantation antigens which K-234(R) cells possessed.

- 3809 STRUCTURE AND FUNCTION OF THE POLYPEPTIDES IN SIMIAN VIRUS 40: I. EXISTENCE OF SUBVIRAL DEOXYNUCLEOPROTEIN COMPLEXES. (E.) Huang, E.-S. (Sch. Med., U. North Carolina, Chapel Hill), M. K. Estes and J. S. Pagano. *J Virol* 9(6):923-929, 1972.

SV40 was purified from monkey kidney cells and degraded in dialysis against alkaline buffers at pH 10.5. Degradation products were separated by velocity centrifugation in a 5-20% sucrose gradient. Two components were resolved in sucrose gradients:

soluble protein containing the large viral polypeptides VP1 and VP2; and a deoxyribonucleoprotein complex (DNP-I) containing essentially all the viral DNA and at least three polypeptides (VP4, 5 and 6). DNP-I also contained all or a part of the VP3 polypeptide, some of which was bound to viral DNA. Dissociation of DNP-I by equilibrium centrifugation in cesium chloride yielded a complex (DNP-II) of viral DNA and residual, tightly bound polypeptides, including VP4 and 6 and contaminating VP1; VP5 was thought to be present in DNP-II though it was not resolved. VP3 was absent from DNP-II. Treatment of SV40 with β -mercaptoethanol indicated that there was disulfide bonding between VP1 and VP2. VP3, 4, 5 and 6 may have existed as a linear complex intertwined with viral DNA.

J. Minowada. *Cancer Res* 32:1218-1225, 1972.

Nine human hematopoietic cell lines were inoculated with herpes simplex virus (HSV) type 1. The cell lines included five lines derived from Burkitt lymphoma patients, one line from a myelogenous leukemia patient, one line from an infectious mononucleosis patient, and two lines from normals. Four Burkitt lymphoma cell lines and the two normal cell lines contained Epstein-Barr virus (EBV). The four EBV-positive Burkitt lymphoma cell lines were relatively resistant to HSV infection. Four other cell lines were sensitive to HSV infection. The one EBV-negative Burkitt lymphoma patient cell line was intermediate in HSV-sensitivity. In HSV-sensitive lines, cell viability declined and the incidence of chromosome aberrations increased sharply following HSV inoculation. Heated HSV did not produce impaired cell growth or early chromosome aberrations, but heated HSV decreased cell viability and increased late chromosome aberrations in three non-Burkitt lymphoma patient cell lines. In HSV-resistant lines, cell growth was unimpaired. The incidence of chromosomal aberrations was higher in HSV-resistant lines than in uninfected cell lines, but lower than in HSV-sensitive lines. In general, HSV replication was higher in HSV-sensitive than in HSV-resistant cell lines.

3810 PRESENCE OF VIRAL RNA-INSTRUCTED DNA POLYMERASE IN THE ONCOGENIC SUBVIRAL PARTICLES (VIROSOMES) ISOLATED FROM THE MITOCHONDRIA OF ROUS SARCOMA CELLS. (E.) Kara, J. (Inst. Exp. Biol. Genetics, Czechoslovak Acad. Sci., Prague), M. Dvorak and H. Cerna. *FEBS Letters* 25(1):33-37, 1972.

Rous sarcoma virus (RSV)-specific RNA-instructed DNA polymerase (reverse transcriptase) has been detected in virosomes isolated from the inner membrane and matrix (IM + matrix) fraction of mitochondria prepared from RSV-induced chicken tumors. The virosome fraction, which was isolated on sucrose gradients from the IM + matrix fraction, banded at a density of 1.28g/cm^3 , contained gs antigens, and exhibited cell-transforming ability. Reverse transcriptase activity was detected in the virosome fraction with denatured calf thymus DNA and poly(rA):oligo(dT) templates. The enzyme activity was inhibited by specific rabbit anti-RSV reverse transcriptase.

3813 VIRUS RECOVERY IN CHICKEN CELLS TESTED WITH ROUS SARCOMA CELL DNA. (E.)

Hill, M. (Gustave-Roussy Inst., Villejuif, France) and J. Hillova. *Nature New Biol* 237(71):35-39, 1972.

The ability of a foreign DNA to enter and be integrated into the genome of chicken embryo fibroblasts was studied. After each passage, cultured chick fibroblasts were treated with DEAE-dextran and then grown for 15 min in medium containing DNA purified from nonvirus-producing Rous sarcoma virus (RSV)-transformed rat XC cells. The DNA-treated chick fibroblasts became transformed and began to produce infectious virus particles 12 to 25 days after the first XC-DNA application. Virus recovered from these cultures was able to produce sarcomas when inoculated onto chick embryo chorio-allantoic membrane, and could produce foci of transformed cells typical of those produced by RSV when applied to secondary chicken fibroblast cultures. The rescued virus was antigenically the same as the virus which originally transformed the XC cells.

3811 NEOPLASTIC TRANSFORMATION OF HAMSTER CELLS *IN VITRO* BY BOVINE ADENOVIRUS TYPE-3. (E.) Motoi, M. (Okayama U. Med. Sch., Japan), H. Fukui and K. Ogawa. *Gann* 63(4):415-418, 1972.

Foci of transformed cells appeared in cultures of hamster embryo skin-muscle between 32 and 65 days after infection with adenovirus type 3. Most of the transformed cells were round or spindle-shaped. Bizarre giant cells were also observed. Inoculation of approximately 2×10^5 cells into one-wk-old hamsters by i.p. injection resulted in peritoneal tumors which were histologically similar to the primary virus-induced tumors. Although transformed cells did not release virus, 10-20% were positive for virus-specific T-antigen.

3814 EPSTEIN-BARR VIRUS ASSOCIATED ANTIBODY PATTERNS. (E.) Goldman, M. (Kimron Vet. Inst., Bet Dagon, Israel). *Int J Cancer* 9(2):452-453, 1972.

In an exchange of letters, the matching of controls with lymphocytic lymphoma (LL) patients for serum anti-Epstein-Barr virus (EBV) antibody titers is questioned and defended. EBV-associated serological reactions are more positive in older age groups. It is suggested that this invalidates a conclusion

3812 DIFFERENTIAL EFFECTS OF INFECTION WITH HERPES SIMPLEX VIRUS ON THE CHROMOSOMES OF HUMAN HEMATOPOIETIC CELL LINES. (E.) Huang, C. C. (Roswell Park Mem. Inst., Buffalo, N.Y.) and

that LL patients have significantly higher serum anti-EBV titers than controls, a conclusion based on a sample of LL patients from older age groups. In reply, it is claimed that the conclusion was valid because LL patients studied could be divided into two subgroups, those with well-differentiated and those with poorly-differentiated LL, each subgroup showing different EBV-associated serological reaction patterns.

- 3815 EFFECT OF HERPESVIRUS HOMINIS TYPE 2 ON HUMAN CERVICAL EPITHELIUM: SCANNING ELECTRON MICROSCOPIC OBSERVATIONS. (E.) Wilbanks, G. D. (Rush Med. Coll., Chicago, Ill.) and J. A. Campbell. *Amer J Obstet Gynec* 112(7):924-929, 1972.

Normal human cervical epithelial cells in culture were infected with herpes-virus hominis type 2 from a patient with a primary genital herpes infection. Infected cells were observed using the scanning microscope. By ten hr after infection, cells began to show nuclear changes and cellular coalescence leading to plaque formation. Nuclei showed the "ground glass" appearance of genital herpes infection. Striking changes were seen in the cell membrane. Cells formed clumps with large spaces devoid of cells. Most distinctive were the microvilli of infected cells; these were more numerous than microvilli of normal cells, and showed very variable length and spacing. Small bodies which may have been herpesvirus particles were also seen on cell surfaces.

- 3816 ACQUISITION OF SEQUENCES HOMOLOGOUS TO HOST DEOXYRIBONUCLEIC ACID BY CLOSED CIRCULAR SIMIAN VIRUS 40 DEOXYRIBONUCLEIC ACID. (E.) Lavi, S. (Weizmann Inst. Sci., Rehovot, Israel) and E. Winocour. *J Virol* 9(2):309-316, 1972.

BS-C-1 African green monkey cells were infected at varying multiplicities of infection (MOI) with SV40. Viral closed circular DNA was extracted from infected cells and the ability of viral DNA to hybridize with host cell DNA was studied. It was found that the production of closed circular SV40 DNA homologous to host cell DNA depended on the MOI of SV40 infection. At low MOI (0.032 or 0.16 plaque-forming U (PFU)/cell), the proportion of viral DNA which hybridized with host DNA was low, while at high MOI (4-3,000 PFU/cell), the proportion of viral DNA which hybridized with host cell DNA increased as the MOI increased. The same MOI effect was seen when closed circular SV40 DNA was extracted from purified virions rather than from the infected cell complex. When BS-C-1 cells were infected at high MOI with plaque-purified SV40, none of the SV40 DNA in infected cells was homologous with host cell DNA. However, when undiluted plaque-purified SV40 that had been through several cell passages was used for infection, the production of viral DNA homologous to host cell DNA was restored.

- 3817 EFFECT OF NORMAL SERUM AND ANTITHYMOCYTE SERUM ON FRIEND DISEASE IN MICE. (E.)

Larson, C. L. (Stella Duncan Mem. Inst., U. Montana, Missoula), R. N. Ushijima, R. E. Baker, M. B. Baker and C. A. Gillespie. *J Nat Cancer Inst* 48(5):1403-1407, 1972.

White Swiss mice were injected i.p. or i.v. with Friend disease virus (FDV) four hr after injection of 50 mg silica, a macrophage toxin. Silica markedly enhanced the progress of FDV infection in mice given FDV i.p., but did not affect FDV infection in mice given FDV i.v. In related experiments, FDV-infected mice were injected with anti-thymocyte serum (ATS) prepared in rabbits by injection of RML mouse thymocytes. ATS decreased resistance to infection with FDV injected i.v., to the extent that treated animals infected with 10^{-3} or 10^{-4} virus dilutions died at the same rate as untreated mice infected with 10^{-2} dilutions. Heated or unheated normal rabbit serum (NRS) also increased the susceptibility of mice to FDV infection. Fifty percent of mice given ATS died by 6.2 wk after FDV infection and 50% of mice given NRS died in 8.4-9.2 wk. In untreated mice, 50% mortality was not attained until 13.4 wk after FDV infection. The ability of ATS to enhance FDV infectivity decreased when ATS was absorbed with mouse red blood cells (MRBC) prior to injection; MRBC-absorbed ATS enhancement of FDV infectivity was further decreased by absorption with normal mouse immunoglobulin.

- 3818 POLYNUCLEOTIDE LIGASE IN MOUSE CELLS INFECTED BY POLYOMA VIRUS. (E.) Beard, P. (Imperial Cancer Res. Fund Lab., London, England). *Biochim Biophys Acta* 269(3):385-396, 1972.

Polynucleotide ligase was assayed in mouse embryo cells infected with polyoma virus and in uninfected cells. Two assays were used, one measuring the conversion of (5'- 32 P)phosphoryl end groups in double stranded poly(dA-T) to a phosphate-resistant form, and the other measuring the conversion of single-nick form II polyoma DNA to the covalently circular form. Infection of resting cells by polyoma virus increased ligase activity by 1.8-2.5-fold. Ligase activity began to increase 15-20 hr postinfection and was maximal at 30 hr, time when DNA synthesis was also maximal in infected cells. When infected cells were fractionated by differential centrifugation, 58% of ligase activity was found in cell nuclei and 39% in soluble cytoplasm. Nuclear ligase was in two fractions, one soluble and the other insoluble. Ligase from infected cells behaved similarly to ligase in uninfected cells in the course of a procedure which purified ligases by 160-250-fold. Both ligase from infected and from uninfected cells had molecular wts of 220,000 and pH optima of 7.2-7.8, and required Mg^{2+} and ATP ($K_m = 1.5 \times 10^{-6}M$). Temperature-sensitive mutants of polyoma virus induced the same stimulation of ligase in infected mouse cells as was induced by wild-type virus.

3819 VIRAL DNA SYNTHESIS IN ISOLATED NUCLEI FROM ADENOVIRUS-INFECTED KB CELLS. (E.)

Sussenbach, J. S. (Lab. Physiol. Chem., St. U. Utrecht, Netherlands) and P. C. van der Vliet. *FEBS Letters* 21(1):7-10, 1972.

Viral DNA was isolated from purified nuclei of KB cells 15 hr after infection with adenovirus 5 (Ad5). Isolated nuclei from Ad5-infected KB cells incorporated ^3H -TTP into acid-insoluble material at a linear rate for 30 min, then at a slower rate for at least 2 hr. Nuclei from uninfected cells incorporated much less ^3H -TTP than infected nuclei, with incorporation almost ceasing after 30 min. The new DNA synthesized in isolated nuclei from Ad5-infected cells was characterized by DNA-DNA hybridization, alkaline and neutral CsCl density centrifugation, and alkaline and neutral sucrose gradient centrifugation. New DNA hybridized to Ad5 DNA with the same efficiency as did DNA isolated from virions, but no significant hybridization with KB DNA was seen. Sucrose gradient centrifugation of new DNA showed, in addition to molecules co-sedimenting with 31S (Ad5 DNA) marker, the presence of material which sedimented both faster and slower than the marker. Three fractions from the preparative sucrose gradients were recentrifuged on CsCl gradients. Neutral CsCl centrifugation showed that slowly sedimenting material (III) consisted of 60% viral and 40% cellular DNA. Cellular DNA was less than 5% of total newly synthesized DNA. The "31S" fraction (II) mainly banded at the same position as Ad5 DNA. Fast sedimenting molecules (I) were much heavier (1.722 g/cm^3) than Ad5 DNA. Alkaline CsCl centrifugation indicated that fractions I and II had a viral origin. Neutral sucrose centrifugation confirmed the results seen with CsCl; alkaline sucrose centrifugation showed that new DNA in fraction I banded heterogeneously with a broad peak at 15S and contained no 34S (single Ad5 DNA strands) material. Fraction II was also heterogeneous with molecules ranging from 34S to very small fragments. Under alkaline conditions no DNA molecules larger than genome size were observed.

3820 GENETIC STUDIES WITH TUMORIGENIC ADENOVIRUSES. III. RECOMBINATION IN ADENOVIRUS TYPE 12. (E.)

Takemori, N. (California St. Dept. Public Hlth., Berkeley). *Virology* 47(1):157-167, 1972.

Eighteen nonreverting mutant adenovirus types were used to infect hamster embryo kidney (HEK) cells; the recombination of mutants to form viruses with nonmutant parental properties was observed. The mutants were type *cyt kb*, a class of cytotoxic mutants which failed to propagate in KB-1 cells. In recombination studies, pairs of mutants were used to infect HEK cells and the production of *cyt⁺kb⁺* recombinants (i.e., recombinants which multiplied in B cells) was observed by propagation of viruses in B-1 cells. Virus pairs recombined to form *cyt⁺kb⁺* forms in many cases. These recombinants usually produced a cytopathic effect (CPE) in KB-1 cells similar to the CPE produced by the *cyt⁺* parent virus. After plaque purification, recombinants tested

produced only CPE and plaques like those produced by *cyt⁺* virus. The *cyt⁺kb⁺* recombinants grew readily in KB-1 cells, with titers as high as those produced by parental viruses. The *cyt kb* mutants, however, titered 100-fold less than *cyt⁺kb⁺* recombinants. Production of hexon antigen was enhanced by *cyt⁺kb⁺* recombinants. Recombinants were tumorigenic in newborn hamsters. These results support the hypothesis that *cyt* function is necessary for the production of the characteristic adenovirus *cyt⁺* CPE and for the tumorigenicity of this virus.

3821 PROTEINS SPECIFIED BY HERPES SIMPLEX VIRUS. VI: VIRAL PROTEINS IN THE PLASMA MEMBRANE. (E.)

Heine, J. W. (Dept. Microbiol., U. Chicago, Illinois), P. G. Spear and B. Roizman. *J Virol* 9(1):431-439, 1972.

Previous work has shown that the surface membrane of herpes simplex virus (HSV)-infected cells acquire new immunological specificities and that purified cell membrane preparations contain new glycoproteins genetically determined by the virus. In the present report, purified plasma membranes of HSV-infected human epidermoid carcinoma no. 2 (HEp-2) cells were analyzed by polyacrylamide gel electrophoresis. Comparison of the absorbance tracings of the stained bands of plasma membrane proteins from infected cells with those of uninfected cells showed that the plasma membranes of infected cells contained two sets of protein bands, one characteristically present in uninfected cells and new proteins present only in HSV-infected HEp-2 cells. The synthesis of host plasma membrane proteins, measured by the extent of incorporation of ^{14}C -labeled amino acid precursors, ceased in infected cells; only new membrane proteins were made. After infection, however, no appreciable selective or nonselective loss of host proteins from membranes was observed. Electropherograms of plasma membrane proteins from infected cells indicated the presence of at least 12 virus-specific proteins ranging in molecular wt from 25×10^3 to 126×10^3 daltons. Of these, at least nine were glycosylated as determined by their ability to incorporate ^{14}C glucosamine. Proteins and glycoproteins with similar electrophoretic mobilities, but in somewhat different proportions, were also present in preparations of highly purified virions.

3822 TWO NEW HERPESVIRUSES FROM SPIDER MONKEYS (ATELES GEOFFROYI). (E.)

Melendez, L. V. (Harvard Med. Sch., Southborough, Mass.), H. Castellanos, H. H. Barahona, M. D. Daniel, R. D. Hunt, C. E. O. Fraser, F. G. Garcia and N. W. King. *J Nat Cancer Inst* 49(1):233-238, 1972.

3823 RECOVERY AND CHARACTERIZATION OF A NEW SIMIAN HERPESVIRUS FROM A FATALY INFECTED SPIDER MONKEY. (E.)

Hull, R. N. (Lilly Res. Labs., Indianapolis, Indiana), A. C. Dwyer, A. W. Holmes, E. Nowakowski, F. Deinhardt, E. H. Lennette

- and R. W. Emmons. *J Nat Cancer Inst* 49(1):225-231, 1972.
- 3824 PLAQUE CHARACTERIZATION OF VIRUSES FROM SOUTH AMERICAN NONHUMAN PRIMATES. (E.) Daniel, M. D. (Harvard Med. Sch., Southborough, Mass.), L. V. Melendez and H. H. Barahona. *J Nat Cancer Inst* 49(1):239-249, 1972.
- 3825 SEROLOGIC EVIDENCE OF VIRAL INFECTION IN SOUTH AMERICAN MONKEYS. (E.) Kalter, S. S. (Southwest Fdn. Res. Education, San Antonio, Texas) and R. L. Heberling. *J Nat Cancer Inst* 49(1):251-259, 1972.
- 3826 INTERFERING ACTIVITY OF "COLD" ADENOVIRUS TYPE 2 AND 4 STRAINS WITH ADENOVIRUS TYPE 12. (Rus.) Yurlova, T. I. (No affiliation), V. V. Lysov, T. P. Kovaleva, O. A. Aksenov and A. A. Selivanov. *Vop Virus* 17(1):72-75, 1972.
- 3827 ONCOGENIC DNA VIRUS REPLICATION. (Fr.) Bourgaux, P. (U. Hosp. Ctr. Sherbrooke, Canada). *Union Med Canada* 101(6):1103-1105, 1972.
- 3828 FEATURES OF THE INTRALYSOSOMAL ADENOVIRUS TYPE 7 SHORTLY AFTER ITS PENETRATION INTO THE HeLa CELL. (Fr.) Feroldi, Ch. (Natl. Res. Clin., Dept. Virol., Lyon, France) and Y. Chardonnet. *C R Acad Sci [D] (Paris)* 274(25):3476-3479, 1972.
- 3829 CARCINOGENICITY OF TUMOR CELL NUCLEIC ACIDS. (Rum.) Nastac, E. (St. S. Nicolau Inst. Virol. Bucharest, Rumania). *St Cerc Inframicrobiol* 22(4):365-375, 1971.
- 3830 ROLE OF THE CELLULAR FACTOR IN SV40-INDUCED TRANSFORMATION. (Rum.) Nachtigal, M. (St. S. Nicolau Inst. Virol., Bucharest, Rumania), N. Sachnazarov and N. Cajal. *St Cerc Inframicrobiol* 22(4):359-364, 1971.
- 3831 TUMORS IN GREY HAMSTERS INDUCED BY ROUS SARCOMA VIRUS. (Rus.) Ziljfy, V. N. (Armenian SSR Ministry Public Hlth., Erevan, USSR), B. S. Fichidjan and V. A. Kumkumadjan. *Vop Onkol* 18(3):57-59, 1972.
- 3832 VIRUSES FROM SOUTH AMERICAN MONKEYS: ULTRA-STRUCTURAL STUDIES. (E.) King, N. W. (Harvard Med. Sch., Southborough, Mass.), M. D. Daniel, H. H. Barahona and L. V. Melendez. *J Nat Cancer Inst* 49(1):273-290, 1972.
- 3833 INFECTIOUSNESS FOR THE MOUSE OF RNA EXTRACTED FROM A SARCOMA INDUCED IN FOWL BY THE CARR (ZILBER) STRAIN OF THE ROUS SARCOMA VIRUS (RSV RNA-CARR/ZILBER): II. HISTO-ENZYMATIC STUDY. (Fr.) Athanasiu, P. (Inst. Virol., Bucarest, Rumania) and M. Lungu. *Ann Histochem* 16(4):283-291, 1971.
- 3834 MOUSE LEUKEMIA: DEPRESSION OF SERUM INTERFERON PRODUCTION. (E.) De Maeyer-Guignard, J. (Curie Fdn., Orsay, France). *Science* 177(4051):797-799, 1972.

See also:

- * (Rev): 3602, 3605, 3606, 3612, 3632
 * (Chem): 3665, 3686, 3703, 3713
 * (Immun): 3848, 3852, 3857, 3864, 3867, 3869, 3870, 3871, 3875, 3876, 3880, 3884, 3886, 3903, 3919, 3920

- 3835 EXPRESSION OF FETAL ANTIGENS IN TUMOR CELLS. (E.) Ting, C.-C. (Natl. Cancer Inst., Bethesda, Md.), D. H. Lavrin, G. Shiu and R. B. Herberman. *Proc Nat Acad Sci USA* 69(7):1664-1668, 1972.

A study was conducted to determine the relation of fetal antigens to the specific antigens of mouse tumors induced by papova viruses and also the distribution of fetal antigens in various tumor cells. The activities of sera that reacted specifically with the specific cell-surface antigens of polyoma- or SV40-induced tumors could be inhibited only by absorption of the sera with tumor cells transformed by the specific virus; the activities could not be removed by absorption with cells from various fetal tissues or with cells from other tumors. In contrast, the antisera produced in male C3H/HeN mice by inoculation of X-irradiated, syngenic fetal tissue of one- to two-weeks gestation reacted with various tumor cells. The activities of these sera, when tested against cells from tumors induced by polyoma virus or SV40, could also be removed by absorption with cells from tumors induced by viruses other than polyoma or SV40, including leukemia cells induced by Gross virus, Rauscher virus and by dimethylbenzanthracene, and cells from mammary tumors, plasma-cell tumors, and fetal tissues. These results indicate that fetal antigens may be expressed in tumor cells and that the antigens differ from tumor-specific antigens which are specific for a particular tumor or for tumors induced by a particular virus.

- 3836 THE EFFECT OF CYCLIC ADENOSINE 3',5'-PHOSPHATE ON TUMOR IMMUNITY. (E.) Rigby, P. G. (U. Nebraska, Coll. Med., Omaha). *Cancer Res* 32(3):455-457, 1972.

Ten strain C3H/HeJ mice (male and female, 22-25 g) given 5×10^5 6C3HeD syngeneic live tumor (LT) cells were dead by 30 days, with a mean survival time of 19.5 days. Three of ten mice who were immunized with irradiated tumor cells (XTC) 14 and seven days prior to LT challenge survived longer than 25 days, with all mice dead by 35 days. Four 1.0 mg dose of cyclic 3'5'-adenosine phosphate (AMP) given i.p. after LT resulted in death in all cases within 25 days, as did similar treatment with 2.0 mg yeast RNA. Seven of ten mice given cyclic AMP (six doses) after (XTC) (LT) lived for approximately six months with no tumor evidence. Five of ten mice given RNA after (XTC) (LT) survived six months without tumors. A combination of RNA and cyclic AMP after (XTC) (LT) was effective in improving life span, but no more so than each separately. The results suggest that antigen recognition occurred since immunization was necessary for any prolongation of survival.

- 3837 RESPONSE OF PERIPHERAL BLOOD LYMPHOCYTES FROM NORMAL, HYPOGAMMAGLOBULINEMIC AND CHRONIC LYMPHOCYTIC LEUKEMIC PATIENTS. (E.) Rodey,

G. E. (Milwaukee Blood Ctr., Wisconsin), T. Davis and P. G. Quie. *J Immunol* 108(1):178-182, 1972.

Staphylococcal protein A (SPA) derived from Cowan I strain of *Staphylococcus aureus* was cultured *in vitro* with peripheral blood leucocytes of normal donors and of patients with various diseases. Cells from 17 of 18 normal donors proliferated in the presence of SPA. Maximum tritiated thymidine incorporation occurs with 25 to 50 μ g SPA per culture and when cultures are incubated 7 to 9 days. Removal of glass-adherent cells prior to culture greatly reduced the proliferative response to SPA. The highest response to SPA was seen in cells from three hypogammaglobulinemic patients. None of six patients with chronic lymphocytic leukemia responded to SPA. These findings suggest that the response to SPA is antigen-specific rather than nonselective and that responding lymphocytes are thymus-derived T cells. The failure of chronic lymphocytic leukemic cells to respond to SPA may indicate an abnormality of initial antigen-cell interaction rather than a quantitative deficiency of T-cells.

- 3838 SPECIFIC ANTIGENS OF A CHEMICALLY INDUCED TUMOR; DETECTION BY COMPLEMENT FIXATION. (E.) Albright, N. L. (Natl. Cancer Inst., Bethesda, Md.) and G. H. Myers, Jr. *J Nat Cancer Inst* 49(1):295-297, 1972.

Tumor antigens of a methylcholanthrene (MCA)-induced liposarcoma (MCA-A) previously shown to possess tumor-specific transplantation antigens (TSTA) were detected using the microcomplement fixation test. Adult female strain-2 guinea pigs were given repeated weekly intradermal injections of 10^6 viable MCA-A tumor cells. Sera collected from these animals beginning after the second injection contained a complement-fixing antibody which reacted only with antigens prepared from freshly excised MCA-A tumor or from the tissue culture MCA-A cell line and not with antigens from an MCA-induced osteosarcoma which possessed TSTA or from normal strain-2 guinea pig tissues.

- 3839 ADJUVANT INDUCED RESISTANCE TO TUMOR DEVELOPMENT IN MICE. (E.) Hibbs, J. B., Jr. (Palo Alto Med. Res. Fdn., Calif.), L. H. Lambert, Jr. and J. S. Remington. *Proc Soc Exp Biol Med* 139(3):1053-1056, 1972.

Ten days before *Listeria monocytogenes* challenge, female Swiss-Webster mice were pretreated with 0.1 ml i.p. and s.c. injections of complete Freund's adjuvant (CFA), incomplete Freund's adjuvant (ICFA) or Hank's balanced salt solution (HBSS). CFA stimulated marked resistance to *Listeria*, while ICFA and HBSS controls were not protected. Delayed time to death and/or increased survival was also noted in CFA pretreated mice following i.p. inoculation of 0.2 ml of a 10% suspension of Friend leukemia virus infected spleen cells and i.p. grafts of 1×10^6

Sarcoma 180 cells and 1×10^5 leukemia L1210 cells. In addition, CFA pretreatment caused a statistically significant delay in spontaneous mammary tumor development in C3H/HeJ mice and spontaneous leukemia in AKR mice. These results suggest that host resistance to intracellular infectious agents and neoplasia is related in a fundamental way and that the activated macrophage in resistant animals is a common effector arm for expression of this resistance *in vivo*.

- 3840 SURFACE PROPERTIES OF NON-TUMORIGENIC VARIANTS OF MOUSE MAMMARY CARCINOMA CELLS IN CULTURE. (E.) Hozumi, M. (Nat'l. Cancer Ctr. Res. Inst., Tokyo, Japan), S. Miyake, F. Mizunoe, T. Sugimura, R. F. Irie, K. Koyama, M. Tomita and T. Ukita. *Int J Cancer* 9(2):393-401, 1972.

Studies showing that nonmalignant cells have an increased number of membrane components reacting with phytohemagglutins and tumor-specific antisera are reported. Four mouse cell clones with different transplantabilities in C3H/He mice were used, all derived from mouse mammary tumor cell line FM3A/B. Low-tumorigenic (Cl 1-82) and nontumorigenic clones (Cl M-6) showed much higher agglutinability with plant agglutins than highly tumorigenic clones (Cl 1-614, FM3A/B). The agglutination with wheat germ and *Ricinus communis* was completely inhibited by N-acetyl-D-glucosamine or D-galactose, indicating that surface receptor sites for agglutinins are sugars. The localization of these sites was observed using fluorescent agglutinin: fluorescence on agglutinated nontumorigenic Cl M6 cells was clearly evident and localized on the cell membrane, while fluorescence on nonagglutinated tumorigenic FM3A/B cells was faint and evenly distributed over the cell surface. Surface antigens were detected by the immune adherence test with anti-Cl 1-82 cells, and their content was found to be much higher on Cl 1-82 cells than on Cl 1-614 cells. The increased antigen content was responsible for the induction of strong immunity in Cl 1-82 cells against malignant Cl 1-614 cells.

- 3841 *IN VITRO* DEMONSTRATION OF CELL-MEDIATED IMMUNITY TO HUMAN BRAIN TUMORS. (E.) Levy, N. L. (Duke U. Med. Ctr., Durham, N.C.), M. S. Mahaley, Jr. and E. D. Day. *Cancer Res* 32(3):477-482, 1972.

Several primary human intracranial tumors, both well differentiated and anaplastic, induced tumor-specific, cell-mediated immune responses in an autogenous host. Normal and neoplastic target cells were prepared by tissue culture on a modified Eagle's medium. The cells were dispersed by trypsinization. Peripheral blood lymphocytes were isolated from plasma, eluted with serum-free medium, treated with Tris-ammonium chloride and resuspended in modified Eagle's medium. Microcytotoxicity

studies showed significant inhibition of the neoplastic target cells by autogenous lymphocytes. Patient lymphocytes exerted a tumor-specific effect, while control lymphocytes effected equal reductions in both normal and neoplastic target cells. This nonspecific cytotoxic effect was eliminated by reducing lymphocyte number from 3×10^5 to 1×10^5 /well, using control donors with ABO types identical to those of target cell donors and substituting human AB serum for fetal bovine serum in lymphocyte suspensions. Lymphocytes from a glioblastoma patient were cytotoxic to his own tumor cells and those of another glioblastoma patient, although not reacting to the latter's normal glial cells. Lymphocytes from a melanoma patient reacted against his own tumor cells, glioblastoma cells, normal glial cells and ganglioglioma cells, but not against autogenous or allogenic fibroblasts. Well differentiated and anaplastic tumors were equally able to generate tumor-specific immune response in the host. Of four patients with intracranial tumors of extracerebral origin, three showed significant cell-mediated immunity to their tumors.

- 3842 PRIMARY CANCER OF THE LIVER ASSOCIATED WITH AUSTRALIA ANTIGEN. (Sp.) Velasco, M. (U. Chile, Salvador Hosp., Santiago, Chile), R. Soerensen, A. Daiber, A. Carmona and R. Katz. *Rev Med Chile* 99(9):631-633, 1971.

Australia antigen (Au 1) was detected in serum from three of five patients with primary liver carcinoma. Au 1 was not found in serum from 86 patients with various chronic liver diseases (30 with chronic hepatitis, 29 with alcoholic cirrhosis, 10 with intrahepatic bile duct cancer, 3 with primary biliary cirrhosis, 3 with metastatic cancer of the liver, and 11 with idiopathic jaundice during pregnancy). Patients with primary liver carcinoma did not have a history of hepatitis; all were α -fetoprotein-positive and carried high serum IgG levels. High serum IgM was found in a single case which appeared to be Au-1-negative. The possible role of viral infection in the etiology of liver cancer is discussed.

- 3843 MEASUREMENT OF TRANSFORMATION AND PROLIFERATION OF HUMAN LEUKOCYTES IN CULTURE. (Fr.) Brochier, J. (Antiquaille Hosp., Lyon, France). *Path Biol (Paris)* 19(19-20):833-846, 1971.

The extent to which lymphocytic transformation *in vivo* is affected by various factors: the purification of lymphocytes, the type of serum added to the culture medium, the cellular concentration, and the dose of stimulant used [phytohemagglutinin (PHA), antilymphocytic serum (ALS), tuberculin (PPD), candidin or streptokinase] was studied. Lymphocytes were isolated from venous blood samples by filtration through a nylon column and sedimentation in the presence of dextran. The proliferative response of the lymphocytes to mitogenic or antigenic stimu-

lants was measured by incorporation of tritiated thymidine (^3H -TdR) into the trichloroacetic acid-precipitable sediment. When appropriate concentrations and specific activities were chosen, incorporation during the 24-hr exposure to ^3H -TdR was linear with respect to the number of lymphocytes used in the culture. Certain sera (human AB, A or fetal cal) added to the culture medium appeared to depress or inhibit ^3H -TdR incorporation. A narrow range of concentrations of non-specific stimulants (PHA, ALS) and a 10- to 100-fold wider dose of specific stimulants (PPD, candidin, streptokinase) induced an optimal proliferative response. A kinetic study of the incorporation showed a latent period, followed by an exponential increase, reaching a maximum on day 3 with PHA or ALS and on days 5-7 for antigenic stimulation or a mixed lymphocyte reaction. With standardization of the above parameters, the lymphocyte transformation test is sufficiently reproducible for a tissue culture technique.

lose chromatography was further purified by sucrose gradient centrifugation. The most active fractions of light chain mRNA represented about 0.1% of the RNA originally extracted from the myeloma polysomes and sedimented as a 13S molecule, roughly corresponding to 850 bases. The protein product synthesized from the purified myeloma mRNA formed a specific immunoprecipitate with antibody directed against the MOPC-41 protein. The ability of the myeloma light-chain mRNA to bind selectively to oligo(dT)-cellulose indicates that it contains a region rich in adenylic acid residues. The results suggest that the light-chain mRNA is monocistronic and that it contains about 200 more bases than needed to code for a single light-chain molecule.

3846 DEMONSTRATION OF CARCINOEMBRYONIC ANTIGEN IN NORMAL HUMAN PLASMA. (E.) Chu, T. M. (Roswell Park Memorial Inst., Buffalo, N.Y.), G. Reynoso and H. J. Hansen. *Nature* 238(5360):152-153, 1972.

The presence of carcinoembryonic antigen (CEA), a tumor-specific antigen originally discovered in a tissue extract of human colon adenocarcinoma, was demonstrated (by radioimmunoassay and Sephadex G-200 column chromatography) in a perchloric acid (PCA) extract of pooled plasma from normal healthy individuals. Comparison of the immunoassay inhibition curves from the PCA extract with curves from "true" colonic CEA indicated that the two CEAs were qualitatively the same. CEA concentrations in normal plasma were extremely small compared with amounts found in certain patients with disseminated carcinomas.

3847 LYMPHOCYTE TRANSFORMATION AS AN IMMUNE REACTION IN CHILDREN WITH LEUKEMIA AND THE EFFECT OF ANTILYMPHOCYTE AND ANTIPARABLAST SERA ON LYMPHOCYTE TRANSFORMATION. (Ger.) Zintl, F. (Pediatric Clinic, Jena U., Germany), G. Aurich and W. Plenert. *Folia Haematol* 96(1):14-20, 1971.

Antilymphocyte and antiparablast sera were obtained by immunizing rabbits over a six month period with lymphocytes or "parablasts" in Freund's adjuvant. The effects of these whole sera and their globulin fractions were compared by the radial immunodiffusion method with human sera, the cytotoxicity index, and *in vitro* transformation of phytohemagglutinin of (PHA)-stimulated lymphocytes. While the antilymphocyte serum had approximately the same activity against lymphocytes and parablasts with all three methods, the antiparablast serum had a much stronger activity against parablasts than lymphocytes. PHA-stimulated lymphocyte transformation was markedly lower (40% after 72 hr) in cultures obtained from children with leukemia than those obtained from healthy children (82%). Addition of antilymphocyte and antiparablast sera in concentrations of 5% and 1% by volume significantly decreased lymphocyte transformation (0-12% transformation). The activity

3844 SYNTHESIS, ASSEMBLY, AND SECRETION OF γ GLOBULIN BY MOUSE MYELOMA CELLS. IV. ASSEMBLY OF IgA. (E.) Bargellesi, A. (Albert Einstein Coll. Med., Bronx, N.Y.), P. Periman and M. D. Scharff. *J Immunol* 108(1):126-134, 1972.

The synthesis and assembly of mouse IgA was examined in cultures of Adj-PC 6A myeloma and in MOPC 209B and MOPC 315 tumors. Pulse chain experiments indicated that the pathway of assembly of the IgA monomer in these tumors is $\text{H} + \text{H} \rightarrow \text{H}_2$; $\text{H}_2 + \text{L} + \text{L} \rightarrow \text{H}_2\text{L}_2$; $\text{H}_2\text{L}_2 + \text{H}_2\text{L}_2 \rightarrow (\text{H}_2\text{L}_2)_2$. Acrylamide gel analysis suggested that polymerization of 6A and 315 occurred close to the time of secretion, which began approximately 40 min after synthesis and continued for more than 180 min.

3845 PURIFICATION AND PROPERTIES OF BIOLOGICALLY ACTIVE MESSENGER RNA FOR A MYELOMA LIGHT CHAIN. (E.) Swan, D. (Lab. Molecular Genetics, Natl. Inst. Hlth., Bethesda, Md.), H. Aviv and P. Leder. *Proc Nat Acad Sci USA* 69(7):1967-1971, 1972.

Biologically active mRNA, which directs synthesis of mouse myeloma (MOPC-41) kappa chain, was purified from a microsomal fraction by oligothymidylate [oligo(dT)]-cellulose chromatography and sucrose gradient centrifugation. The mRNA was assayed in a cell-free Krebs II ascites tumor system and the radiolabeled protein products were compared with an authentic light-chain standard and with proteins synthesized endogenously on MOPC-41 membrane-bound polysomes. Tryptic peptide analysis by Dowex-1 column and cation exchange chromatography indicated that the *in vitro* protein products of purified mRNA contained all the MOPC-41 amino acid sequences. The major MOPC-41 mRNA-directed protein product comigrated with the authentic light-chain standard on SDS-polyacrylamide gels. The mRNA purified by oligo(dT)-cello-

of antilymphocyte sera was stronger since a decrease in transformation was still obtained with 0.5% by volume; this was not the case with antiparablast serum.

- 3848 RNA TUMOR VIRUS *gs* ANTIGEN AND TUMOR INDUCTION BY VARIOUS DOSES OF 3-METHYLCHOLANTHRENE IN VARIOUS STRAINS OF MICE TREATED AS WEANLINGS. (E.) Whitmire, C. E. (Microbiol. Assoc., Inc., Bethesda, Md.) and R. A. Salerno. *Cancer Res* 32(6):1129-1132, 1972.

The effect of various doses of 3-methylcholanthrene (MC) on s.c. tumor induction and the occurrence of the murine C-type RNA group-specific (*gs*) viral antigen in tumor tissue (detected by complement fixation) were studied in weanling mice of eight genotypically different strains. Tumor incidence was found to be related to the dose of MC. However, the incidence of *gs* antigen in the induced tumors was independent of the dose of MC and reflected the natural *gs* antigen expression of the mouse strain. Histopathological examination showed no relation of tumor type to carcinogen dosage or mouse strain. The majority of the tumors examined were sarcomas. These studies confirmed earlier findings, which suggested that the *gs* antigen expression induced in tumors was dependent on host-regulatory controls and that such controls of virogene (*gs* antigen) and oncogene (tumor induction) expressions of the C-type RNA viral genome were independently affected by a carcinogen.

- 3849 ISOLATION AND CHARACTERIZATION OF HUMAN FOETAL α_1 F GLOBULIN (α_1 F) FROM FOETAL AND HEPATOMA SERA. (E.) Adinolfi, A. (Guy's Hosp. Med. Sch., London, England), M. Adinolfi and S. Cohen. *Biochim Biophys Acta* 251(2):197-207, 1971.

The fetal protein α_1 F was isolated by the antigen-antibody method from the sera of ten fetuses and from the blood of a hepatocellular carcinoma patient. The protein was labeled with radioactive iodine and subjected to gel electrophoresis. The purified protein from either fetal or hepatoma sera eluted as a single peak from Sephadex G-200, indicating a single peptide chain. The labeled material was then collected, precipitated, and re-Sephadexed. The molecular weights of the labeled α_1 F isolated from fetal and hepatoma sera were 61,000 and 63,000 resp. Treatment with neuraminidase reduced the electrophoretic mobility of the α_1 F protein, indicating the presence of sialic acid in relation to the peptide chain.

- 3850 NEOPLASTIC ANTIGEN STUDIES. (It.) Barbieri, A. De (S. Belfanti Inst. Serum Ther. Milan, Italy) and G. C. Tassi. *Boll Ist Sieroter Milan* 50(4):243-249, 1971.

Human tumors (carcinomas of the breast, stomach, lungs, and sigmoid colon and malignant lymphogranuloma and melanoma) were homogenized, subjected to ultrasound, and centrifuged. The supernatant, which contained cell membranes, mitochondria, microsomes, and soluble cytoplasmic protein, was conjugated with acetylated rabbit α -globulin in the presence of 1-cyclohexyl-3(2-morpholinyl-4-ethyl)carbodiimide methoxyl-*p*-toluene sulfonate and dialyzed. After fractionation of Sephadex G-166, the tumor protein-acetylated immunoglobulin conjugate was concentrated and freeze-dried. These antigen conjugates were injected s.c. once a day for three days into patients with a variety of malignant neoplasms; a fourth injection was given 15 days after the first and a fifth injection followed one month later; thereafter, injections were given once a month. With each injection 40 mg of the conjugate was administered. Hemagglutination tests, run 1-2 months after immunotherapy was begun, showed that these patients developed antibodies to both the whole conjugate and the haptene. Autologous vaccine tended to produce higher antibody titers than homologous vaccine.

- 3851 COMPARISON OF AN IMMUNORESISTANT AND AN IMMUNOSUSCEPTIBLE ASCITES SUBLINE FROM MURINE TUMOR TA3. I. TRANSPLANTABILITY, MORPHOLOGY, AND SOME PHYSICOCHEMICAL CHARACTERISTICS. (E.) Friberg, S., Jr. (Karolinska Inst. Med. Sch., Stockholm, Sweden). *J Nat Cancer Inst* 48(5):1463-1476, 1972.

Cells of the TA3 spontaneous carcinoma of an A/HeHa mouse were injected i.p. into normal mice of nine strains; the cells were TA3 sublines TA3-Ha and TA3-St. TA3-St cells grew in five of 96 allogeneic mice and showed a preference for mice of the A/Sn strain. TA3-Ha transgressed all histoincompatibility barriers tested, even at small cell inocula (10^3 cells), and grew in 80 of 96 mice. TA3-Ha cells also grew in some rats and hamsters. Under the electron microscope, TA3-Ha cells showed a smoother surface structure than TA3-St cells. The TA3-St cells had a modal chromosome number of 66 and showed two or three biarmed chromosomes; the modal chromosome number for TA3-Ha cells was 41 and no marker chromosomes were seen. The TA3-Ha line grew slightly faster than the TA3-St line in A/Sn mice. The electrophoretic mobility (EPM) of TA3-Ha cells was higher than that of TA3-St cells (mean EPM of TA3-Ha = $1.56 \pm 0.010 \mu\text{sec}^{-1} \text{ volt}^{-1} \text{ cm}$, versus $1.27 \pm 0.012 \mu\text{sec}^{-1} \text{ volt}^{-1} \text{ cm}$ for TA3-St). This indicated that TA3-Ha cells had a 20% higher net-negative surface charge than TA3-St cells. TA3-Ha cells were not agglutinated by the plant lectin Con A, while TA3-St cells were readily agglutinated.

- 3852 THE ANTIBODY RESPONSE OF MICE TO MURINE LEUKEMIA VIRUS IN SPONTANEOUS INFECTION: ABSENCE OF CLASSICAL IMMUNOLOGIC TOLERANCE. (E.) Oldstone, M. B. A. (Scripps Clin. Res. Fdn., La Jolla,

Calif.), T. Aoki and F. J. Dixon. *Proc Nat Acad Sci* 69(1):134-138, 1972.

Gross murine leukemia virus (GMuLV)-infected male and female AKR mice were studied at three, six and nine months, using direct and indirect immunofluorescence to detect the presence of viral antigen, host immunoglobulin (Ig), third complement component (C3), albumin and fibrinogen. Assay of kidney tissue revealed an increasing number of mice positive for host IgG and C3 reaching a maximum of 95% positive mice at nine months. IgG and C3 were restricted to glomeruli. GMuLV antigens were detected in glomeruli, convoluted tubules, connective tissue and arterial endothelium, in addition to most tissues assayed. Viral antigens were present in highest amounts in thymus. Antibodies to GMuLV antigens were detected in AKR mice by indirect immunofluorescence, complement fixation and hybrid antibody assay. Antibody to GMuLV surface antigen was not detected in plasma of infected AKR mice. The detection of host Ig, C3 and GMuLV antigen in glomeruli suggested that circulating GMuLV antigen-anti-GMuLV antibody complexes probably occurred. AKR mice most likely produced at least two distinct antibodies to GMuLV: 1) complement-fixing antibodies immunologically related to internal viral components; and 2) antibody directed toward GMuLV surface antigens. *In utero* infection with GMuLV probably did not induce complete tolerance to Gross antigens in AKR mice.

3854 SPECIFIC INHIBITION OF RECEPTORS FOR CYTOPHILIC ANTIBODY ON MACROPHAGES BY ISOANTIBODY. (E.) Mitchell, M. S. (Yale U. Sch. Med., New Haven, Conn.) and M. B. Mokyr. *Cancer Res* 32(4):832-838, 1972.

Hyperimmune antibody-rich ascitic fluid against L1210 leukemia (Ab) was injected i.p. into C57BL/6J mice (0.4 ml) one day before the mice were challenged with L1210 cells i.p. Cytophilic antibody activity on peritoneal monocytes was assayed *in vivo* and *in vitro* by observing formation of macrophages and attachment of L1210 cells by macrophages. Ab-treated mice showed unvacuolated, quiescent-looking monocytes when assayed ten days after L1210 challenge; Ab-treated mice formed one-sixth to one-tenth the number of macrophages formed by control mice injected with normal ascites fluid or NaCl. Active acid phosphatase was lacking in monocytes from Ab-treated mice. Macrophages in these mice seemed not to attack or ingest L1210 cells. Addition of proven cytotoxic antibody to L1210 failed to restore the capacity of monocytes in Ab-treated mice to attack tumor cells. Treatment with Ab did not prevent the attachment of sheep erythrocytes (SRBC) by peritoneal monocytes of Ab-treated mice following addition of cytophilic antibody to SRBC. The suppressive activity of Ab was confined to its IgG fraction. These results indicated that receptor sites for cytophilic antibody on the surface of peritoneal monocytes are inhibited by Ab.

3853 RECEPTORS FOR IMMUNOGLOBULIN ON B LYMPHOCYTES AND CELLS OF A CULTURED PLASMA CELL TUMOR. (E.) Cline, M. J. (U. California Sch. Med., San Francisco), J. Sprent, N. L. Warner and A. W. Harris. *J Immunol* 108(4):1126-1128, 1972.

Thymocytes and thoracic duct lymphocytes, consisting of 65-99% θ C3H antigen-positive (T) cells, were taken from CBA/H/WEHI mice. Nonthymus or bone-marrow derived (B) lymphocytes were taken from thymectomized CBA mice. Cells from six mouse plasmacytomas, two thymomas and a peripheral lymphoma were also obtained. T cells, B cells, and tumor cells were incubated with sheep erythrocytes (SRBC) coated with IgM- and IgG-rich fractions of a mouse antiserum to SRBC. An F(ab')₂ fraction of the IgG antibody was also prepared and reacted with test lymphocytes and tumor cells. The proportion of cells bearing adherent SRBC (rosettes) was observed. Cells from one plasmacytoma (HPC-6, from an NZB mouse) and B lymphocytes formed rosettes with IgG-coated SRBC, while T cells did not. SRBC sensitized with IgM or F(ab')₂ were nonreactive. Binding of IgG to cells required an intact Fc piece, but was independent of complement. Cells from two other plasmacytomas reacted weakly with IgG-SRBC; the remaining three plasmacytoma cells and the thymoma and lymphoma cells did not show the type of binding characteristic of B lymphocytes and HPC-6 cells. The results are consistent with the hypothesis that the B lymphocyte is a progenitor of the plasma cell.

3855 IMMUNOLOGICAL COMPETENCE OF SPLEEN CELLS FROM RATS BEARING SYNGENEIC OR AUTOCHTHONOUS TUMOURS. (E.) Medzihradsky, J. (Slovak Acad. Sci., Bratislava, Czechoslovakia), E. Konikova and L. Novotna. *Neoplasma* 19(2):105-110, 1972.

F₁ hybrid rats were given footpad grafts of spleen cells from parent rats bearing grafted 3-methylcholanthrene-induced fibrosarcomas or primary fibrosarcomas induced by 3-methylcholanthrene injections. The ability of spleen cells from tumor-free and tumor-bearing donors to induce a graft-versus-host immune response (GVHR) in spleen cell recipients was measured by observing the enlargement of recipients' popliteal lymph nodes after spleen grafting. Significant reduction of GVHR-inducing activity of spleen cells from tumor-bearing rats was seen on the fifth and seventh days after spleen cell grafting. GVHR impairment had disappeared by day ten. This suggested that depressed donor cell proliferation may have caused the impairment of GVHR. Among recipients of spleen cells from primary methylcholanthrene-induced tumors, GVHR-reducing capacity of spleen cells was seen only when donors' tumors were small and without necrosis inside the tissue.

3856 CYTOPLASMIC IMMUNOFLUORESCENCE OF BLOOD CELLS FROM MYELOMA, HODGKIN'S DISEASE AND LYMPHOSARCOMA CASES. (E.) Bankole, R. O. (Metropolitan Med. Ctr., Minneapolis, Minn.), H. A.

Bates, W. R. Swaim and D. S. Amatzio. *Brit J Cancer* 26(1):10-14, 1972.

Peripheral blood was drawn from ten multiple myeloma, ten Hodgkin's disease and 11 lymphosarcoma patients; leukocytes were separated out by centrifugation and reacted in immunofluorescence tests with antisera prepared against Rauscher virus murine leukemia (AMR) and human stem leukemia plasma (AHS). Leukocytes from nine multiple myeloma, seven Hodgkin's disease and nine lymphosarcoma patients showed significant cytoplasmic fluorescence reactions with both AMR and AHS or with AHS alone. No positive reactions of leukocytes to AMR alone were seen. Absorption tests suggested that the observed cytoplasmic immunofluorescence reactions involved cellular isoantigens. Serial studies on seven cases including cases of each of the three conditions mentioned, indicated that a relationship existed between clinically active disease and the presence of fluorescing cells.

3857 EFFECT OF TRANSIENT IMMUNOSUPPRESSION ON HOST RESPONSE TO NEONATALLY INTRODUCED ONCOGENIC VIRUS. (E.) Blair, P. B. (Cancer Res. Genet. Lab., U. California, Berkeley). *Cancer Res* 32(2):356-359, 1972.

BALB/c female mice, which normally lack mammary tumor virus (MTV) were given immunosuppressive injections of either antithymocyte serum (ATS) or normal rabbit serum (NRS); C3H female mice, which normally carry MTV, were given globulin preparations of ATS (ATG) or globulin preparations of NRS (NRG). Some mice given the immunosuppressive treatments were inoculated with isogenic mammary tumor cells to test cell-mediated immune reactivity of serum. In C3H mice not given tumor inocula, none of those given NRG developed circulating anti-MTV antibodies in serum; 62% of C3H mice given ATG but no tumor cells developed serum antibodies. Both NRG- and ATG-treated C3H mice inoculated with mammary tumor cells showed serum anti-MTV antibody. More ATG-treated mice than NRG-treated mice developed antibody (83 vs 38%). In BALB/c mice, anti-MTV antibodies appeared earlier in ATS-treated than in NRS-treated animals.

3858 TWO KINDS OF ANTIGEN SUPPRESSION IN TUMOR CELLS REVEALED BY CELL FUSION. (E.) Klein, G. (Dept. Tumor Biol., Karolinska Inst., Stockholm, Sweden), S. Friberg, Jr. and H. Harris. *J Exp Med* 135(4):839-849, 1972.

The TA3/Ha subline of the TA3 mouse ascites mammary tumor was fused with ACA mouse embryo fibroblasts; antigenic typing was performed on nine hybrid clones and compared with the antigenic patterns of TA3 sublines TA3/Ha and TA3/St. The TA3/St line was high in H-2^a antigen, grew in 100% of syngeneic strain A mice on transplantation, and was regularly rejected by allogeneic transplant recipients.

The immuno-resistant TA3/Ha subline had drastically reduced antigen concentrations and grew in allogeneic, H-2-incompatible mice. ACA fibroblasts were normal diploid cells and contained H-2^f antigen. All the nine clones established from fusion of the TA3/Ha and ACA cells showed H-2^a antigen. Three hybrid clones exceeded TA3/Ha in H-2^a antigen expression but were not as expressive of the H-2^a as were TA3/St cells. Other hybrids exceeded TA3/St cells in H-2^a expression. Hybrid cells showed increased expression of the K-end antigens of the H-2^a complex introduced into hybrids by the TA3/Ha parent. ACA cells carried no H-2^d antigen and TA3/Ha cells contained little H-2^d antigen. However, all hybrid clones contained relatively high amounts of H-2^d. Neither TA3/St nor the parent TA3/Ha cells carried H-2^f antigen. However, all but one hybrid cell line carried this antigen, which was apparently contributed by the ACA parent. These results suggest that reduced antigen expression in TA3/Ha cells is due to some deficiency that can be compensated for by the ACA fibroblast.

3859 EFFECT OF TUMOR CELL INOCULATION ON CIRCULATING LYMPHOCYTES. (E.) Fisher, B. (U. Pittsburgh Sch. Med., Pa.), E. A. Saffer and E. R. Fisher. *Proc Soc Exp Biol Med* 139(3):787-792, 1972.

C3H mammary tumor cells, C3H kidney cells and methylcholanthrene (MC)-induced tumor cells were injected s.c. or i.v. into C3HeB/FeJ female mice that had (a) received no prior injection of normal or tumor tissue, (b) were harboring a 14-day C3H or MC tumor, (c) had a previously growing C3H tumor removed two wk prior the challenge injection or (d) had been injected two wk before with normal kidney cells. S.c. inoculation with C3H tumor cells profoundly depressed lymphocyte counts (18-22% of normal) in mice without prior treatment, in mice with a growing MC tumor and in mice previously injected with kidney cells. The depression was maximal two days postinjection. Similar s.c. injection of C3H tumor cells in mice with growing C3H tumors or in mice from which such tumors had been excised did not effect a significant decrease in lymphocyte count. Inoculation of C3H kidney cells depressed lymphocyte counts in normal mice but not in mice previously exposed to tumor or kidney cells. I.v. injection of C3H tumor cells produced results similar to those observed following s.c. injection. The effects of s.c. and i.v. injections of MC tumors paralleled those of C3H tumor injections. Administration of antilymphocyte serum prior to and during the presence of immunizing C3H tumors prevented lymphocyte counts from decreasing after subsequent tumor challenge.

3860 SMOOTH MUSCLE ANTIBODY IN MALIGNANT DISEASE. (E.) Whitehouse, J. M. A. (Chester Beatty Res. Inst., Sutton, England) and E. J. Holborow. *Brit Med J* 4(5786):511-513, 1971.

Smooth muscle (S.M.) antibody in sera from 80 patients

with malignant tumors and from 46 normal subjects was surveyed by the indirect "sandwich" method of fluorescent staining. - Sections containing serum (1/10 dilution) were examined for staining at five sites: smooth muscle fibers between gastric glands, muscularis mucosae, artery walls, liver cells and renal glomeruli. Positivity was assessed by a point system. S.M. antibody in sera from patients with malignant disease seemed identical to that in sera of hepatitis patients. Antinuclear factor incidence was 24% in cancer patients and absent in neuroblastoma and control subjects. A new IgG antibody was found in seven sera (one control, one malignant melanoma, five neuroblastoma). Staining patterns of both antibodies were closely related in liver, glomeruli and arterial wall sites, but the new antibody did not stain the gastric muscularis mucosae of smooth muscle fibers between gastric glands. While S.M. antigen titrated out at maximum dilution 1/40, the new antibody still stained strongly at 1/320 dilution. This antibody provides further evidence that autoantibodies against normal tissue components may be produced in malignant disease.

3861 RAPID *IN VITRO* DETECTION OF CELLULAR IMMUNITY IN MAN AGAINST FRESHLY EXPLANTED ALLOGENEIC CELLS. (E.) Wunderlich, J. R. (Nat'l. Cancer Inst., Bethesda, Md.), G. N. Rogentine, Jr. and R. A. Yankee. *Transplantation* 13(1):31-37, 1972.

Lymphocytes from blood of three multiply transfused patients with aplastic anemia, and normal blood lymphocytes, were reacted with selected allogeneic or autologous cells in ⁵¹Cr-release cytotoxicity tests. Normal lymphocytes were not cytotoxic to autologous normal lymphocytes or to allogeneic target cells. Lymphocytes from patient donors presensitized by transfusions showed cell-mediated immunity against allogeneic cells. These lymphocytes strongly lysed cells from HL-A-nonidentical donors as well as cells from HL-A-identical siblings. However, presensitized lymphocytes did not damage autologous target cells. Cytotoxicity of presensitized lymphocytes appeared to result directly from direct contact of immune lymphocytes and target cells; toxins were not found to be associated with the cytotoxicity reaction.

3862 TUMOR-ASSOCIATED IMMUNOGLOBULINS: ENHANCEMENT OF SYNGENEIC TUMORS BY IgG2-CONTAINING TUMOR ELUATES. (E.) Ran, M. (Dept. Microbiol. Tel Aviv U., Israel) and I. P. Witz. *Int J Cancer* (1):242-247, 1972.

Cells of transplantable methylcholanthrene- or benzo(a)pyrene-induced sarcomas were harvested from C3H mice and tumor cell eluates containing IgG2 were prepared by the pH 2.4 glycine method. C3H mice were injected i.m. with cells of the carcinogen-induced tumors after the cells had been preincubated with IgG2-containing eluates derived from tumors of the same line as those used

for challenge injection (autologous eluates); some mice were injected with tumor cells preincubated with IgG2-containing eluates derived from other tumors syngeneic with those used for challenge, or various other primary tumors. Preincubation of tumor cells with autologous eluates enhanced tumor production in injected mice more than preincubation of tumor cells with isologous eluates; 63 tumors were produced in 93 inoculated mice given tumor cells preincubated with autologous eluates while 69 tumors developed in 126 mice given tumor cells preincubated with isologous eluates. Of 149 mice injected with tumor cells not incubated with any eluate, 55 developed tumors. Inoculation of tumor cells mixed with autologous eluates caused a slightly earlier appearance of tumors than inoculation of tumor cells mixed with isologous eluates, or inoculation of tumor cells alone. On the whole, the differences were not statistically significant.

3863 SUPPRESSED ACTIVITY OF THYMUS-DERIVED CELL IN TUMOR-BEARING HOST. (E.) Takatsu, K. (Osaka U. Med. Sch., Japan), T. Hamaoka, U. Yamashita and M. Kitagawa. *Gann* 63(2):273-275, 1972.

Strain dd0 albino mice were inoculated s.c. with Ehrlich ascites tumor cells; later, tumor-bearing and uninoculated, tumor-free mice were immunized s.c. and i.p. with bacterial α -amylase and dinitrophenyl-Taka-amylase. Lymph node and spleen cells were prepared from α -amylase-immunized normal or tumor-bearing mice (carrier-primed cell donors) and from dinitrophenyl-Taka-amylase-immunized normal or tumor-bearing mice (hapten-primed donors); lymph node and spleen cells from the respective donors were combined in the presence of dinitrophenyl-bacterial α -amylase and then transferred i.v. into 600 R X-irradiated recipient mice. Anti-hapten plaque-forming cells in recipients' spleens were assayed. Plaque-forming cells decreased significantly in recipients of carrier-primed or hapten-primed cells from tumor-bearing donors as compared to recipients of primed cells from tumor-free mice. Evidently, helper activity was suppressed in tumor bearing carrier-primed donors. Anti-hapten antibody titers were also reduced in recipients of carrier-primed cells from tumor-bearing donors as compared to recipients of carrier-primed cells from tumor-free donors. It was concluded that the immunological activity of thymus-derived cells is impaired in tumor-bearing donors.

3864 OCCURRENCE OF HERPES- AND ADENOVIRUS ANTIBODIES IN PATIENTS WITH CARCINOMA OF THE CERVIX UTERI: MEASUREMENT OF ANTIBODIES TO HERPESVIRUS HUMANUS (TYPES 1 AND 2), CYTOMEGALOVIRUS, EB-VIRUS, AND ADENOVIRUS. (E.) Vestergaard, B. F. (Inst. Med. Microbiol., Copenhagen, Denmark), A. Hornsleth and S. N. Pedersen. *Cancer* 30(1):68-74, 1972.

One hundred thirty-five sera from patients with newly

diagnosed, untreated cervical cancer and 115 sera from healthy women matched for age and socioeconomic background were examined for antibodies to *Herpesvirus hominis* (types 1 and 2), cytomegalovirus, EB-virus and adenovirus. No difference was observed in the incidence of *Herpesvirus hominis* type 1. Eighty-five per cent of the patients with cervical cancer had antibodies to *Herpesvirus hominis* type 2 compared to 47% in the control group. The incidences of antibodies to cytomegalovirus and EB-virus were significantly greater in the sera from patients with cervical cancer than in control sera. The incidence of antibodies to adenovirus was the same for both groups. The incidences of antibodies were not correlated to the clinical stages of the disease. In the control group, antibodies to *Herpesvirus hominis* type 2 and EB-virus were found with higher incidence among women with low socioeconomic background than in women from higher social classes. Such a correlation was not seen in patients with cervical cancer.

3865 ULTRASTRUCTURAL SURVEY OF PRIMARY LIVER CELL CARCINOMAS FROM UGANDA. (E.)

O'Connor, G. T. (Natl. Cancer Inst., Bethesda, Md.), T. S. Tralka, E. Henson and C. L. Vogel. *J Nat Cancer Inst* 48(3):587-603, 1972.

Seventeen surgical biopsy specimens of primary liver cell carcinoma from Ugandans were examined under the electron microscope. The fine structural features of these specimens were similar to those reported in other studies, suggesting that there are no essential difference between the fine structure of liver cancers in Africans and Caucasians. The most important general characteristic of the liver cell cancers was the loss of orderly arrangement and organization of cytoplasmic components as compared with normal liver cells. Mitochondria showed considerable pleomorphism. All specimens except one were of intermediate differentiation; there were no highly anaplastic tumors. No morphologic correlation with serum α -feto-protein or with Australia antigen was found. A search for virus or virus-like particles in the liver cancer specimens produced negative results.

3866 THE IMMUNOCAPACITY OF THE AKR MOUSE. (E.) Hargis, B. J. (Children's Cancer Res. Fdn., Inc., Boston, Mass.) and S. Malkiel. *Cancer Res* 32(2):291-297, 1972.

Mice of the high leukemic AKR strain were examined for anaphylaxis and for the capacity of their spleen cells to cause a graft-vs-host reaction (GVH) when implanted in CFW mice. AKR mice develop leukemia in 85% of cases between six and eight months of age. The splenic index and the thymic index of CFW mice given spleen transplants from AKR mice aged one to 11 months indicated that AKR spleen cells elicited a GVH reaction. The leukocyte counts in spleen-grafted CFW mice showed considerable variation; the leukopenia expected to attend GVH reactions was not

seen in all cases. A 35% mortality from anaphylaxis was seen in two-month-old AKR mice; the anaphylaxis mortality rose to 87% in mice seven months old or older.

3867 IMMUNOLOGICAL RELATIONSHIPS OF REVERSE TRANSCRIPTASES FROM RIBONUCLEIC ACID TUMOR VIRUSES. (E.) Parks, W. P. (Natl. Cancer Inst., Bethesda, Md.), E. M. Scolnick, J. Ross, G. J. Todaro and S. A. Aaronson. *J Virol* 9(1):110-115, 1972.

RNA-dependent DNA polymerase from the C-type Rauscher murine leukemia virus (R-MuLV) and Schmidt-Ruppin Rous sarcoma virus (SR-RSV), and from the Mason Pfizer monkey virus (MS-MV) was partially purified by gel filtration and phosphocellulose chromatography. DNA polymerase was injected into New Zealand rabbits to produce anti-DNA polymerase antiserum, which was used to inhibit viral DNA polymerase. Anti-R-MuLV antisera reduced R-MuLV DNA polymerase by more than 50% but did not affect SR-RSV polymerase. Conversely, antiserum to the SR-RSV (avian) DNA polymerase inhibited SR-RSV polymerase by 90% but did not affect the R-MuLV (murine) polymerase. Purified IgG isolated from anti-DNA polymerase antisera had a higher specific activity for enzyme inhibition than whole serum. The effect of avian and murine C-type virus polymerase antisera on the DNA polymerase of other RNA-containing viruses was studied. IgG from anti-SR-RSV polymerase antiserum inhibited this enzyme in other avian viruses but not in viper C-type or in any mammalian viruses. Antiserum which inhibited R-MuLV polymerase failed to inhibit DNA polymerase in rat and feline leukemia viruses, visna virus, MP-MV or simian "foamy" virus type 3. IgG from anti-R-MuLV polymerase antisera inhibited R-MuLV polymerase with each of four DNA polymerase templates tested.

3868 TUMOR-SPECIFIC, CELL-MEDIATED IMMUNE RESISTANCE TO AUTOCHTHONOUS TUMORS. (E.) Kikuchi, K. (New York U. Med. Ctr., N.Y.), Y. Kikuchi, M. E. Phillips and C. M. Southam. *Cancer Res* 32(3):516-521, 1972.

Tumor-specific, cell-mediated immune reactions in the autochthonous tumor-host system of Lewis rats were studied *in vitro* using time-lapse cinemicrography and the ^{51}Cr release cytotoxic test. A Millipore filter technique was used to investigate immunocyte-mediated target cell destruction. Methylcholanthrene-induced rat tumors were transplanted into syngeneic rats, with strangulation of the remaining tumor in the original rat. The original rats were then tested for transplantation resistance to their own tumor by transplanting the tumor from the syngeneic host to which it had been passed. Peritoneal, spleen and lymph node cells were then harvested. Cell lines from 6 tumors were highly antigenic, 13 moderately so and 23 of low antigenicity. Fifteen autochthonous hosts were used as sources of immunocytes and serum for the *in vitro* cytotoxicity tests. There was no significant increase in

net release of ^{51}Cr by labeled tumor cells admixed with nonimmune syngeneic peritoneal cells, yet a high release of label occurred with highly and moderately antigenic cells admixed with autochthonous peritoneal cells. Autologous spleen and lymph node cells seldom released more chromate than their corresponding syngeneic, nonimmune cells. Cross reaction studies by the ^{51}Cr release technique suggested specificity of the cytotoxic reaction against the autochthonous tumor. The ^{51}Cr studies also showed a direct relationship between *in vivo* transplantation resistance and *in vitro* cytotoxicity of autochthonous peritoneal cells. Time-lapse, phase-contrast cinemicrography of a highly antigenic tumor showed tumor cell population decreasing during incubation with autochthonous peritoneal cells, the decrease first evident at 12 hrs and very marked at 24 hrs. Tumor cells in two of five tumor lines were destroyed by autogenous peritoneal cells acting through a Millipore membrane barrier, suggesting production of a diffusible cytotoxic substance by immunocytes of the primary host.

an electron microscope. The three H-2 antigens were distributed similarly on leukemia cell surfaces; the average contents of the antigens on cell surfaces were 24% for Rauscher virus (H-2^d); 23% for Friend virus (H-2^d); 16% for Graffi virus (H-2^b); 20% for Mazurenko virus (H-2^b); 24% for SZ virus (H-2^b); and 13% for Gross virus (H-2^k). The proportion of mature virus particles with H-2 antigens on their surfaces ranged from 7-15%. No virus had more than five to seven ferritin molecules used to mark H-2 antigens on its surface and no virus particles were fully covered by H-2 antigens. The same was true of budding viruses in leukemia cells; even on membrane sites which had H-2 antigens, buds were devoid of antigen. Possible reasons for the absence of H-2 antigens on mature and budding viruses are discussed.

3871 EXPRESSION OF VARIOUS TUMOR-SPECIFIC ANTIGENS IN POLYOMA VIRUS-INDUCED TUMORS. (E.)

Ting, C.-C. (Natl. Cancer Inst. Bethesda, Md.), D. H. Lavrin, K. K. Takemoto, R. C. Ting and R. B. Herberman. *Cancer Res* 32(1):1-6, 1972.

Antigen expression in polyoma virus-induced tumors was studied. Cells of two lines were used: polyoma 4198, which originated in culture from polyoma virus-transformed mouse cells; and 4198V, a variant of 4198. 4198V arose during passage *in vitro*; it was similar to 4198 in *in vitro* growth rate and in morphology but showed a marked decrease in *in vivo* growth rate in nonirradiated mice compared to 4198. In *in vivo* immunorejection tests, immunization of mice with 4198 or 4198V cells did not protect against challenge with 4198 cells. However, mice immunized with 4198 or 4198V cells were protected against challenge with 4198V cells (100- and 500 fold protection, resp., in mice immunized with 4198 and 4198V cells). 4198 cells were thus more immunosensitive than 4198V cells and presumably possessed more polyoma tumor-specific transplantation antigen. 4198V cells had 8.8 times more tumor-specific cell surface antigen than 4198 cells as detected by the isotopic antiglobulin method. In immunofluorescence tests and complement fixation tests, 4198 cells showed no T-antigen while all 4198V cells tested were strongly positive for T-antigen.

3872 ASSAY FOR CELL TUMORIGENICITY IN SUBHUMAN PRIMATES TREATED WITH ANTILYMPHOCYTE

GLOBULIN. (E.) Petricciani, J. C. (Natl. Inst. Hlth., Bethesda, Md.), R. L. Kirschstein, R. E. Wallace and D. P. Martin. *J Nat Cancer Inst* 48(3):705-713, 1972.

Newborn, infant and juvenile rhesus monkeys and African green monkeys were injected s.c. with rabbit antilymphocyte globulin (ALG) (13-50 mg/kg) ten days before inoculation i.m. of human epidermoid carcinoma cells (KB cells) in doses of 10^4 - 10^7 cells. The 10^7 dose produced large, progressively growing tumors i.m. in all of 12 rhesus monkeys treated,

3869 SYNERGISTIC OR ANTAGONISTIC EFFECT OF DIFFERENT ANTIBODY CONCENTRATIONS ON *IN VITRO* LYMPHOCYTE CYTOTOXICITY IN THE MOLONEY SARCOMA VIRUS SYSTEM. (E.) Skurzak, H. M. (Dept. Tumor Biol., Karolinska Inst., Stockholm, Sweden), E. Klein, T. O. Yoshida and E. W. Lamon. *J Exp Med* 135(4):997-1002, 1972.

Moloney sarcoma virus (MSV) was injected i.m. into mice; immune lymphocytes were harvested from lymph nodes and sera were collected from immunized rats. Immune lymphocytes were incubated with cells of an MSV-transformed fibroblast line and cytotoxicity was observed. Immune lymphocytes alone caused a 33.5% reduction in target cell number compared to nonimmune lymphocytes. Pre-treatment of target cells with immune serum in high concentrations increased destruction of target cells by three of the sera. At lower concentrations, the serum was without effect and target cell destruction by three other sera was reduced. As sera were further diluted, cytotoxicity disappeared and continued to decline. The results suggested that synergistic cytotoxic effect of antiserum and lymphocytes from a sensitized host can take place when high concentrations of antisera are used to treat target cells.

3870 H-2 ANTIGENS ON MURINE LEUKEMIA CELLS AND VIRUSES. (E.) Dorfman, N. A.

Dept. Biol., Moscow St. U., USSR), V. N. Stepina and E. S. Ievleva. *Int J Cancer* 9(3):693-701, 1972.

Leukemia cells from Rauscher, Friend, Graffi, Mazurenko, Gross and SZ virus-induced mouse leukemias were mixed with antisera to H-2 (b, d and k) antigens, and the distribution of the antigens on leukemia cells and viruses was observed under

regardless of age. The 10^4 dose of KB cells produced only small nodules which regressed by two wk. African green monkeys given 10^7 KB cells developed tumors indistinguishable to those in rhesus monkeys in six of seven cases. KB cells produced no tumors in monkeys not pretreated with ALG, and normal diploid human cells produced no tumors in ALG-treated monkeys.

3873 THYMOCYTES FROM MICE IMMUNIZED AGAINST AN ALLOGRAFT RENDER BONE-MARROW CELLS SPECIFICALLY CYTOTOXIC. (E.) Grant, C. K. (Chester Beatty Res. Inst., Sutton, England), G. A. Currie and P. Alexander. *J Exp Med* 135(1):150-164, 1972.

C57BL mice were immunized against the L5178Y lymphoma of DBA/2 mice by i.p. injection of live tumor cells; cell suspensions of spleen, bone marrow and thymocytes were produced and used to treat L5178Y cells *in vitro*. Growth of L5178Y cells was inhibited in an immunologically specific manner by mixtures of bone marrow or spleen cells from non-immune mice and thymocytes from immune mice. The cytotoxicity of thymocytes and spleen or marrow cell mixtures increased as the concentration of immune thymocytes was increased. DNA synthesis in thymuses of C57BL mice fell after injection of L5178Y cells and remained reduced for seven days, the time at which thymocytes become capable of inhibiting tumor growth when mixed with nonimmune spleen or marrow cells. ^{51}Cr -release cytotoxicity tests of L5178Y cells treated with thymocyte-spleen-marrow cells indicated that tumor cell lysis was not the mechanism of growth inhibition by thymocyte mixtures. Cell-to-cell contact of growth-inhibiting cells and L5178Y cells was required for inhibition of growth of tumor cells. When thymocytes and bone marrow cells were irradiated separately and then mixed with L5178Y cells, thymus cells were found to be more radiosensitive than marrow cells; cytotoxicity of thymocytes was reduced by 400 R while cytotoxicity of marrow cells was only reduced by 2000 R. Immune thymocytes that were cultured with L5178Y cells as antigen and irradiated, did not lose their cytotoxicity, but immune irradiated thymocytes not cultured with antigen lost cytotoxicity. RNA synthesis was increased in thymocytes from immunized mice in the presence of antigen. Cell-free supernatants from immune thymocytes mixed with antigen contained a factor which rendered marrow cells cytotoxic; supernatants from nonimmune thymocytes and antigen, and from immune thymocytes alone, contained no such factor.

3874 COMPARISON OF AN IMMUNORESISTANT AND AN IMMUNOSUSCEPTIBLE ASCITES SUBLINE FROM MURINE TUMOR TA3: II. IMMUNOSENSITIVITY AND ANTIBODY-BINDING CAPACITY *IN VITRO*, AND IMMUNOGENICITY IN ALLOGENEIC MICE. (E.) Friberg, S., Jr. (Karolinska Inst. Med. Sch., Stockholm, Sweden). *J Nat Cancer Inst* 48(5):1477-1489, 1972.

Cells of the TA3-Ha and TA3-St sublines of the TA3

mouse mammary carcinoma from A/Sn mice were tested for susceptibility to antibody-mediated, complement-dependent cytotoxicity with mouse antisera prepared by allogeneic tissue injections. The TA3-Ha cells completely resisted cytotoxicity of sera while TA3-St cells were susceptible to humoral cytotoxicity. TA3-Ha cells could, however, be killed by heterologous antibodies. In ^{51}Cr -release tests of susceptibility to cell-mediated cytotoxicity, TA3-St cells were more susceptible than TA3-Ha cells. In tests of quantitative alloantibody absorption, TA3-St cells carried several times more surface histocompatibility H-2^a antigens than TA3-Ha cells; TA3-St cells could bind 20-30 times more specific antibodies than TA3-Ha cells. The low capacity of TA3-Ha cells to bind alloantibody may have been related to the antibody resistance of TA3-Ha cells. The two cell lines were compared for immunogenicity in mice; animals immunized with irradiated TA3-Ha or TA3-St cells were tested for humoral and cell-mediated immune responses. TA3-St cells were more immunogenic than TA3-Ha cells.

3875 INTERACTIONS OF IMMUNOGLOBULINS G AND M IN THE DETECTION OF THE MAMMALIAN C-TYPE VIRUS CROSS-REACTIVE ANTIGEN. (E.) Oroszlan, S. (Flow Lab., Rockville, Md.), D. Bova, R. Toni and R. V. Gilden. *Science* 176(4033):420-422, 1972.

To determine whether immunoglobulins IgG and IgM both enter into the reaction of antisera to the cross-reactive interspecific (gs-3) antigenic determinant carried by mammalian C-type viruses, antisera to murine leukemia virus and murine sarcoma virus were prepared in rabbits and rats, resp. The two antisera were separated into IgG and IgM fractions on Sephadex G-200, and their ability to detect the gs-3 determinant was observed in gel diffusion assays with various C-type virus antigens. Antisera which were not separated into IgG and IgM fractions showed a single precipitation line when reacted with C-type virus from hamster, cat and rat; this pattern of reactivity indicated that the reaction involved the interspecific gs-3 determinant. The IgM fractions of the antisera alone gave no reaction with C-type viral gs antigens, and the IgG fractions alone gave only reactions involving the gs-1 (species-specific) determinant. Recombination of IgG and IgM fractions resulted in recovery of gs-3 activity. The results indicate a novel synergistic effect of the IgG-IgM-containing fractions for demonstration of the cross-reactive gs-3 viral antigen in gel diffusion.

3876 EV-VIRUS ASSOCIATED SEROLOGY IN MALIGNANT DISEASE: ANTIBODY LEVELS TO VIRAL CAPSID ANTIGENS (VCA), MEMBRANE ANTIGENS (MA) AND EARLY ANTIGENS (EA) IN PATIENTS WITH VARIOUS NEOPLASTIC CONDITIONS. (E.) De Schryver, A. (Karolinska Inst., Stockholm, Sweden), G. Klein, G. Henle, W. Henle, H. M. Cameron, L. Santesson and P. Clifford. *Int J Cancer* 9(2):353-364, 1972.

Antibodies against Epstein-Barr virus (EBV)-induced

membrane antigens (MA), early antigens (EA) and viral capsid antigens (VCA) were studied by immunofluorescence in 249 sera obtained from African cancer patients. Patients included subjects with lymphoproliferative tumors, carcinomas and sarcomas. Patients with Burkitt's lymphoma and nasopharyngeal carcinoma were excluded, since it had been established that these conditions are associated with high levels of MA, EA and VCA antibodies against EBV. Blocking index (BI) values for test sera against MA, and serum anti-VCA titers were both low (BI < 0.50 and anti-VCA titers < 1:80) in patients with lymphoproliferative tumors. EA titers in lymphoproliferative cancer patients' sera were also low in most cases; 75% of sera were anti-EA negative. Among carcinoma patients BI values, anti-VCA titers and anti-EA titers were again generally low; only 12 of 92 sera tested were EA-positive. Anti-VCA titers, anti-EA titers and BI values for anti-MA were also low among sarcoma patients. These results confirmed the suggestion that malignant tumors other than Burkitt's lymphoma and nasopharyngeal carcinoma are not regularly associated with high anti-EBV antibody titers.

3877 TUMOR SUPPRESSION BY CELL WALLS OF *MYCOBACTERIUM BOVIS* ATTACHED TO OIL DROPLETS. (E.) Zbar, B. (Nat'l. Cancer Inst., Bethesda, Md.), H. J. Rapp and E. E. Ribl. *J Nat Cancer Inst* 48(3):831-835, 1972.

Guinea pigs were injected intradermally with cells of a diethylnitrosamine-induced hepatoma; the tumor cells were mixed with cell walls of bacillus Calmette-Guerin *Mycobacterium bovis* (BCG) attached to light mineral oil droplets. The oil-attached BCG walls mixed with tumor cells completely suppressed tumor growth. Oil droplets without BCG, cell walls alone, and cell walls in the presence of but not attached to oil droplets did not inhibit tumor growth. Guinea pigs in which tumor growth was suppressed were injected with line-10 hepatocellular carcinoma cells; delayed hypersensitivity skin reactions to line-10 cells developed, indicating that guinea pigs treated with oil-attached BCG and tumor cells had developed systemic immunity.

3878 *IN VITRO* LYMPHOCYTE RESPONSES TO MALIGNANT, BENIGN NEOPLASTIC AND NORMAL TISSUE EXTRACTS. (E.) Anderson, R. J. (Dept. Developmental Therap., U. Texas, Houston), C. M. McBride and M. M. Hersh. *Proc Soc Exp Biol Med* 140(2):465-470, 1972.

Extracts were prepared from 39 malignant melanomas, eight sarcomas, seven squamous cell carcinomas, three ovarian carcinomas, one Hodgkin's disease lymph node, one mammary carcinoma and one Wilms' tumor. Of the 60 patients involved, 57 had metastatic tumors. Stimulation of lymphocyte blastogenesis by extracts was observed using autochthonous lymphocytes, lymphocytes from other patients with similar tumors, and lymphocytes of normals.

Fifty-six percent of patients with metastatic tumors showed a significant blastogenic response to autochthonous tumor material; 60% also responded to autochthonous benign tumor extracts. In 50% of tests, patients' lymphocytes reacted significantly to extracts of normal tissue. The dose-response curves to benign and malignant tissue extracts were similar; similar doses induced similar degrees of response. The degree of blastogenesis in each responding patient increased as the protein concentration of normal and malignant tissues increased. Phytohemagglutinin (PHA) and streptolysin-O (SLO) induced greater blastogenic responses in patients' lymphocytes than did malignant or benign tissue extracts. Thirty-seven percent of normal subjects' lymphocytes and 60% of cancer patients' lymphocytes responded to allogeneic malignant tissue extracts. PHA and SLO induced greater responses than allogeneic tissue extracts. The evident lack of tumor specificity of the lymphocyte blastogenesis response suggests that this response is of limited use in the investigation of tumor immunity.

3879 *IN VITRO* STUDIES ON CELL-MEDIATED IMMUNITY FOLLOWING SURGERY IN MICE SENSITIZED TO SYNGENEIC MAMMARY TUMORS. (E.) Heppner, G. H. (Div. Bio-Med. Sci., Brown U., Providence, R.I.). *Int J Cancer* 9(1):119-125, 1972.

C3H/HeJ, C3HeB/FeJ, BALB/c and BALB/cfC3H mice were injected with syngeneic mammary tumor cells. When tumors became palpable, they were removed surgically, sham-operated but not removed, or left intact. Ten to 15 days after surgery, hosts were killed and lymph node cells (LNC) from tumor hosts were tested for cell-mediated immunity by colony-inhibition tests. LNC from mice whose tumors had been completely removed, or from mice which had received only sham surgery, were significantly more likely to show cellular immunity against their tumors than were LNC from mice with intact tumors. Cell-mediated immunity was seen in 12 of 13 mice in the complete tumor removal group, in 12 of 15 mice in the sham-operated group, and in seven of 17 mice with intact tumors. Sera taken from mice in these three experimental groups at one to five or 10-15 days after surgery were tested for ability to block cell-mediated immunity of LNC. Significant blocking activity was seen in five of six tests with sera from mice in the complete tumor removal group, in two of four tests with sera from mice in the sham-operated group, and in two of five tests with sera from mice with intact tumors. Blocking activity of sera had decreased in sera collected 10-15 days after surgery.

3880 SEROLOGICAL ANALYSIS OF CELL SURFACE ANTIGENS OF TUMORS INDUCED BY MURINE LEUKEMIA VIRUS. (E.) Herberman, R. B. (Nat'l. Cancer Inst., Bethesda, Md.). *J Nat Cancer Inst* 48(1):265-271, 1972.

Cells of Gross virus-induced W/Fu rat lymphoma and Gross virus-induced E6G2 leukemia of C57BL/6 mice, or cells of Rauscher virus-induced BALB/c mouse leukemia, were injected into syngeneic mice or rats to produce antisera against Gross or Rauscher virus-induced tumors. Cells of these and other tumors were reacted with antisera in ^{51}Cr -release cytotoxicity tests. The mouse anti-Gross serum reacted with Gross virus-induced rat and mouse tumor cells, but not with Rauscher virus-induced tumors or plasma cell tumors. Mouse anti-Rauscher serum reacted with Rauscher virus-induced tumor cells but not with Gross virus induced tumor cells. The W/Fu anti-Gross rat serum reacted strongly with Gross virus-induced mouse tumor cells, Rauscher virus-induced tumor cells, and plasma cell tumor cells. To define further the specificity of the W/Fu anti-Gross serum, absorption studies were performed. The antiserum was found to contain three antibodies to different cell surface antigens, including an antigen of plasma cell tumors and Gross, Rauscher and Moloney virus-induced tumors; an antigen of mouse Gross virus-induced tumors; and an antigen which appeared to be identical to the G_{IX} alloantigen. A benzo(a)pyrene-induced leukemia also showed some detectable antigenic reactivity with the W/Fu anti-Gross sera.

3881 ANTIGENICITY OF CLONES OF MOUSE PROSTATE CELLS TRANSFORMED *IN VITRO*. (E.)

Embleton, M. J. (McArdle Lab. Cancer Res., U. Wisconsin, Madison) and C. Heidelberger. *Int J Cancer* 9(1):8-18, 1972.

Colony inhibition tests, cytotoxicity tests and membrane immunofluorescence tests were performed on C3H mouse prostate cells transformed by 3-methylcholanthrene (MCA) or MCA-epoxide, or spontaneously transformed. Nontransformed mouse prostate cells did not grow upon injection into mice, and were not immunogenic. MCA-treated cells which did not transform were not immunogenic. Of 24 carcinogen-transformed cell lines, 19 were significantly antigenic in cell-mediated cytotoxicity and colony inhibition tests with lymph node cells from mice immunized against the respective cell lines. In cross-tests with antigenic transformed cell lines, all but two cell lines reacted only with the cell lines used for immunization and showed no cross-reactivity. Of eight spontaneously transformed C3H prostate cell lines, only two were antigenic; cell surface alloantigens were detected in the other six lines, although the lines were not immunogenic in syngeneic mice.

3882 DELAYED HYPERSENSITIVITY TO SIMIAN VIRUS 40 TUMOR CELLS IN BALB/c MICE DEMONSTRATED BY A RADIOISOTOPIC FOOT-PAD ASSAY. (E.) Paranjpe, M. S. (Natl. Cancer Inst., Bethesda, Md.) and C. W. Boone. *J Nat Cancer Inst* 48(2):563-566, 1972.

Male BALB/cAnN mice were immunized against SV40-

induced fibrosarcoma cells by s.c. inoculation of tumor cells. Immune and nonimmune mice were later challenged with SV40 tumor cells by foot-pad injection; immediately after challenge, mice were given ^{125}I -labeled syngeneic mouse serum protein i.p. Inoculation of tumor cells into the foot pad of immunized mice induced a delayed hypersensitivity reaction, as measured by the escape of ^{125}I -labeled protein into foot pad interstitial fluids. The reaction was specific; mice immunized with Freund's complete adjuvant did not show increased ^{125}I release after tumor cell challenge, nor did immunized mice "challenged" with normal syngeneic cells. Passive transfer of the delayed hypersensitivity reaction was accomplished with spleen cells, but not with serum, from immune mice.

3883 COMPLEMENT DEPENDENT INHIBITION OF RNA SYNTHESIS IN MALIGNANT MELANOMA CELLS.

(E.) Ikonopisov, R. L. (Oncol. Res. Inst., Sofia, Bulgaria). *Tumori* 57(4):247-285, 1971.

Malignant melanoma cells from 44 patients were labeled with tritiated uridine and reacted in the presence of active complement with sera from these patients (autologous sera), with sera from other melanoma patients (homologous sera) and with sera from normals. Uptake of tritiated uridine by tumor cells, which indicates RNA synthesis, was observed as a measure of cytotoxic antibody activity in sera. Complement-dependent inhibition of RNA synthesis (implying cytotoxic activity) was seen in 11 tests in which autologous sera were reacted with melanoma cells, and in five tests with homologous sera. Cytotoxic activity of sera diminished with the spread of melanoma.

3884 ANTIBODIES TO THE EPSTEIN-BARR VIRUS IN KIDNEY TRANSPLANT RECIPIENTS. (E.)

Spencer, E. S. (Inst. Med. Microbiol., U. Aarhus, Denmark) and H. K. Andersen. *Acta Med Scand* 191(1-2):107-110, 1972.

Sera from 30 kidney transplant recipients averaging 31 yrs of age were reacted in indirect immunofluorescence tests with EB-3 cells to detect anti-Epstein-Barr virus (EBV) antibody. The sera were taken at the time of kidney transplantation (initial sera) and for 120-357 days thereafter. All but one of the 30 initial sera contained detectable EBV antibodies. A fourfold rise in EBV antibody titer was seen in three patients during the serum observation period. Geometric mean EBV antibody titers in sera from patients without antibody titer rise was 90 (range from > 20-320); six patients had titers \geq 160. The three patients who showed significant rises in EBV antibody titer (two girls aged 11 and 18 and a 31 yr old man) also showed increases in heterophil antibody. Twenty-three EBV antibody-positive sera also showed anticytomegalovirus antibodies.

- 3885 FURTHER STUDIES ON TUMOR-SPECIFIC IMMUNITY INDUCED BY NONTUMORIGENIC MOUSE ASCITES TISSUE-CULTURE CELLS. (E.) Eng, C. P. (Dept. Cancer Res., U. Saskatchewan, Saskatoon, Canada) and J. F. Morgan. *Can J Microbiol* 18(6):775-781, 1972.

TA3 mouse ascites tumor cells which had lost their transplantability were used for inoculation in male A strain mice; immunizing inoculations were given weekly for three wks. A wk after the final injection, immunized mice were challenged with 10^2 - 10^6 virulent TA3 cells. All of 120 non-immunized mice given TA3 challenge cells developed fatal tumors. Immunization with nontumorigenic TA3 cells afforded 70% protection against challenge with 10^6 cells and 100% protection against lower challenge doses. Immunization by the i.p. route was more effective than immunization by the i.v. route, which in turn was more effective than i.m. immunization. Mice immunized with virulent TA3 cells which had been devitalized by iodoacetate treatment, lyophilization, sonication or freezing-and-thawing were not protected against challenge with virulent TA3 cells. Nontransplantable devitalized TA3 cells, however, afforded moderate protection against TA3 cell challenge. Nontumorigenic TA3 and 6C3HED ascites tumor cells induced 85-100% protection against challenge with solid tumor cells when immunization preceded tumor cell challenge. Non-tumorigenic TA3 cells also protected against a previous solid tumor cell challenge if immunization was performed by two wk after challenge; immunization three wk after challenge was not protective.

- 3886 IMMUNIZATION AGAINST SV40 VIRUS TUMORS: IMPORTANCE OF THE ROUTE OF INOCULATION. (Fr.) Dubreuil, R. (U. Montreal, Quebec, Canada), E. DiFranco and V. Pavilanis. *Int J Cancer* 9(2):426-434, 1972.

The effect of the route of inoculation in the vaccination of hamsters with SV40 virus or heterologous or homologous SV40-transformed cells against SV40 tumors was studied. Adult Syrian golden hamsters received s.c. injections, on days 0, 14, and 28, of one of the following: 1 ml un-diluted SV40 virus, 4-6 X 10^6 gamma-irradiated SV40-transformed hamster (CH4-Ry) cells, or culture medium 199 (control group). Ten days after the last injection, CH4 tumor cells were transplanted s.c. into the hamsters. At the end of a six month observation period, the hamsters vaccinated with the SV40 virus or the CH4-Ry cells showed a significantly greater resistance to the development of tumors than the control group. The experiment was repeated with another group of hamsters, giving i.p. injections, with the control group receiving normal hamster embryo (EHa) cells and an additional group of hamsters receiving heterologous (rabbit) SV40-transformed (RL3-T) cells. The results showed that while vaccination with the CH4-Ry and RL3-T cells did offer greater protection than in the control group, vaccination with SV40 virus did not. In all groups, including the controls, a greater

number of hamsters developed tumors than in the experiment in which the s.c. route of inoculation was used. In a further experiment, when hamsters received s.c. or i.p. inoculations of CH4-Ry or RL3-T cells after excision of transplanted tumors, there were fewer recurrences of tumors and metastases than in the control group, and again the protection was markedly higher with s.c. than i.p. injections. I.p. inoculation seemed to be especially effective in inhibiting the development of later metastases, particularly in the lung.

- 3887 CELL PROLIFERATION DURING IMMUNOLOGICAL PERTURBATION IN THREE TRANSPLANTED TUMOURS. (E.) Janik, P. (Inst. Cancer Res., Sutton, Surrey, England) and G. G. Steel. *Brit J Cancer* 26:108-114, 1972.

The timing of the mitotic cycle was studied by the percent labeled mitosis technique in three tumors: the L5178Y lymphoma growing in DBA/2 mice; the BICR/A3 osteosarcoma growing in the leg of a rat; and the BICR/A12 adenocarcinoma, a rat mammary tumor. Growth of the L5178Y and BICR/A3 tumors was completely arrested by injection of host mice with irradiated tumor cells and X-irradiation of host rats, resp. Growth of the BICR/A12 tumor was retarded by injecting the hosts with Freund's complete adjuvant. Despite arrested or retarded growth of the three tumors, the percent labeled mitosis levels in tumor cells from animals with inhibited tumors were not significantly different from the percent labeled mitosis levels in untreated animals with growing tumors. Even if tumor growth was completely arrested by an immunological response in the hosts, there was evidently little change in the timing of cell division in those tumor cells which continued to proliferate. It is suggested that growth retardation was associated with a reduction in the proportion of proliferating tumor cells and/or with a reduction in the rate of cell production.

- 3888 CELLULAR REACTIONS AGAINST BURKITT LYMPHOMA CELLS: III. EFFECTOR CELL ACTIVITY OF LEUKOCYTES STIMULATED *IN VITRO* WITH AUTOCHTHONOUS CULTURED LYMPHOMA CELLS. (E.) Golub, S. H. (Dept. Tumor Biol., Karolinska Inst., Stockholm, Sweden), E. A. J. Svedmyr, J. F. Hewetson, G. Klein and S. Singh. *Int J Cancer* 10:157-164, 1972.

Lymphoblastoid culture lines (LCL) were established from tumor biopsies from four Burkitt's lymphoma patients. Peripheral blood leukocytes from the same patients were mixed with autochthonous LCL cells and colony inhibition (CI) tests and tests of leukocyte stimulation by LCL cells were performed. When leukocytes were tested against autochthonous LCL target cells without prior stimulation of leukocytes by LCL cells, no significant CI activity was seen. When leukocytes were mixed with mitomycin C-stimulated autochthonous LCL cells, leukocytes were stimulated (as measured by ^3H -thymidine uptake), sometimes by

as much as three- to twenty-fold. Leukocytes stimulated by incubation with autochthonous or allogeneic LCL cells were mixed with allogeneic or autochthonous LCL cells and CI activity was observed. Leukocytes stimulated with autochthonous LCL cells showed strong CI activity, against both autochthonous and allogeneic LCL target cells. Stimulated leukocytes showed considerably less CI activity against a non-Burkitt lymphoma-derived target cell line. Autochthonous fibroblasts were ineffective as stimulator cells.

- 3889 AUTOIMMUNE REACTIONS IN UVEAL MELANOMA.
(E.) Rahi, A. H. S. (Inst. Ophthalmol., U. London, England). *Brit J Ophthalmol* 55(12):793-803, 1971.

Sera from 21 patients with uveal melanoma were tested for antibodies against their own tumors using cytotoxicity tests and sometimes RNA synthesis inhibition and immunofluorescence tests. Tumor cells were cultured and reacted with autochthonous sera alone or with complement. Seven of 21 tumors tested showed complement-dependent cytotoxic antibody reactions. In four cases where RNA synthesis inhibition was tested, complement-dependent inhibition of RNA synthesis was seen for autochthonous sera with two tumors. Each of these sera had showed cytotoxic antibody in the preceding test. Three cytotoxic sera gave positive results when tested for membrane immunofluorescence against their respective tumors.

- 3890 THE DISTRIBUTION OF HL-A LEUKOCYTE ANTIGENS IN SINGAPORE CHINESE, MALAYS, AND INDIANS.
(E.) Ting, A. (Dept. Surg., U. Melbourne, Australia), G. B. Wee, M. J. Simons and P. J. Morris. *Tissue Antigens* 1(6):258-264, 1971.

Venous blood from 146 Chinese, 104 Malays, and 85 Indians, all residents of Singapore, were tested for 19 HL-A antigens from the two HL-A loci. One antigen from each locus was found to occur more frequently in each ethnic group relative to the other two groups. HL-A11 and W10 were more frequent in Chinese; HL-A9 and W15 were more frequent in Malays; and HL-A1 and W17 were more frequent in Indians. HL-A1 was virtually absent from Chinese, showed low frequencies in Malays, and a high frequency in Indians. This confirmed that HL-A1 is a "Caucasian" antigen. Delta (linkage disequilibrium between the two loci) values for pairs of phenotypically detected antigens, one from each locus, were calculated. No pairs of antigens showed significant associations in Malays. In Chinese, HL-A2 and HL-A12, HL-A9 and HL-A5, HL-A9 and W17, and HL-A11 and W15 were associated. In Indians, HL-A1 and W17, HL-A2 and W17, and HL-A3 and W5 were associated.

- 3891 TRANSPLANTATION ANTIGENS AND MALIGNANT LYMPHOMAS IN MAN: FOLLICULAR LYMPHOMA, RETICULUM CELL SARCOMA AND LYMPHOSARCOMA. (E.)

Forbes, J. F. (Dept. Surg., U. Melbourne, Australia) and P. J. Morris. *Tissue Antigens* 1(6):265-269, 1971.

HL-A antigen typings were performed on peripheral blood lymphocytes from 134 malignant lymphoma patients, including 50 patients with lymphosarcoma, 56 with follicular lymphoma and 28 with reticulum cell sarcoma. Most patients were in remission; all were Caucasian. A highly significant association was found between the diseases and the specificity HL-A12 ($p < 0.005$). The association was most apparent in the follicular lymphoma group, where the frequency of HL-A12 antigen was 62.5%. The increased frequency of HL-A12 in lymphosarcoma and reticulum cell sarcoma patients was not statistically significant.

- 3892 HL-A LEUKOCYTE ANTIGEN STUDIES IN WOMEN WITH GESTATIONAL TROPHOBLASTIC NEOPLASMS.
(E.) Lewis, J. L., Jr. (Memorial Hosp. Cancer Allied Dis., New York, N.Y.) and P. I. Terasaki. *Trans Amer Gynec Soc* 94:85-92, 1971.

Fifteen women with gestational choriocarcinoma developing in pregnancy resulting in a living child were studied. In each case, the husband and the child associated with the pregnancy resulting in choriocarcinoma were typed for HL-A leukocyte antigens. In addition, 23 of 25 other offspring were also studied. Eleven of the 15 women had tumor metastases at the time of treatment. Only one of the 11 showed HL-A antigen compatibility with the offspring associated with choriocarcinoma. The tumor of this subject metastasized before delivery. One other patient with metastases showed possible HL-A compatibility with the offspring associated with choriocarcinoma. In four patients with nonmetastatic disease, one was compatible with the fetus associated with choriocarcinoma. Eleven other offspring (not associated with choriocarcinoma) had HL-A patterns identical with the offspring associated with choriocarcinoma. Sixteen families in which the mother developed a gestational trophoblastic neoplasm in a pregnancy which did not result in a living infant were also studied. In eight of the 16 women with metastatic disease, there was a possibility that mating produced a fetus compatible for HL-A pattern with the mother in three cases. There were two possibly compatible fetuses in eight cases of nonmetastatic disease. This incidence was higher than would have been expected for random mating. There was no correlation between HL-A compatibility and presence of metastases.

- 3893 CELL-MEDIATED IMMUNITY DIRECTED AGAINST A SYNGENEIC PLASMA CELL TUMOR IN THE MOUSE. DETECTION BY MACROPHAGE-MIGRATION INHIBITION TEST. (E.) Poupon, M.-F. (Sci. Cancer Res. Inst., Villejuif, France) and G. Lepinat. *J Nat Cancer Inst* 48(5):1297-1301, 1972.

Cells of the LA3 plasmacytoma of BALB/c mice were mixed with splenic lymphocytes from mice immunized

against LA3 and with peritoneal exudate cells (PEC) from normal and immunized mice. The migration of PEC cells was observed by the macrophage-migration inhibition test. The migration of PEC from normal mice in the presence of splenic lymphocytes from immunized mice was significantly inhibited when LA3 cells was present. The average inhibition was 50% of control (i.e., normal PEC plus LA3 cells and normal lymphocytes). Migration of PEC from immunized mice was also inhibited in this system. Immune lymphocytes from allogeneic C3H and C57BL mice in the presence of LA3 cells also inhibited PEC migration. The migration of BALB/c spleen cells was inhibited under the same conditions as was PEC migration. The PEC and spleen cell migration inhibition was mediated by a soluble factor which could be demonstrated in supernatants from mixtures of immune lymphocytes and LA3 cells.

3894 IMMUNOGENICITY OF VARIOUS FORMS OF H-2 ANTIGENS AS DETECTED BY THE GROWTH RATE OF AN ALLOGENEIC TUMOUR. (E.) Hilgert, I. (Czechoslovak Acad. Sci., Prague), H. Kristofova and S. Stoyanov. *Folia Biol* 17(6):353-359, 1971.

A/Ph and B10.D2 mice were given i.p. injections of irradiated (20,000 R) allogeneic spleen cells or cell-free spleen extracts, or i.p. injections of irradiated cells or extracts that had been submitted to freezing and thawing or lyophilization. The immunogenicity of the different forms of cell and extract H-2 antigens was measured by observing the growth of an allogeneic sarcoma grafted onto mice pretreated with spleen cells. Irradiation eliminated the proliferative capacity of spleen cells but did not affect their ability to absorb H-2 antibody. Irradiation produced maximal immunogenicity in spleen cells; growth of sarcomas in mice given irradiated spleen cells alone was impaired compared to growth of sarcomas in mice given freeze-thawed or lyophilized irradiated cells. Freeze-thawing reduced spleen cell immunogenicity more than lyophilization, but the difference was not essential. On cell-free extracts, the immunogenicity-reducing effect of freezing and thawing and lyophilization was weaker than but similar to that on irradiated cells.

895 HSV-2 ANTIGENS ABSENT FROM BIOPSIED CERVICAL TUMOR CELLS: A MODEL CONSISTENT WITH LATENCY. (E.) Aurelian, L. (Johns Hopkins Sch., Baltimore, Md.), J. D. Strandberg and H. J. Davis. *Proc Soc Exp Biol Med* 140(2):404-408, 1972.

Frozen sections and biopsy specimens from 29 patients with preinvasive and invasive cervical carcinoma were reacted in indirect immunofluorescence tests with a rabbit immune serum against the herpesvirus type-2 (HSV-2) antigen. No fluorescence reactions were seen in any of the neoplastic material. Electron microscopy revealed no herpesvirus virions or cytoplasmic changes associated with synthesis of herpesvirus antigens in cervical carcinoma biopsy material. How-

ever, 25 of 29 patients' exfoliated cervical carcinoma cells showed cytoplasmic HSV-2 fluorescence. Nuclear fluorescence was not seen. Virus particles were not seen in exfoliated cell material, but cytoplasmic changes associated with herpesvirus antigen synthesis were observed. These results demonstrate that biopsied cervical tumor cells harbor the HSV-2 genome in a repressed state.

3896 STUDIES ON THE ANTIGENICITY OF RADIATION-INDUCED MURINE OSTEOSARCOMATA. (E.)

Moore, M. (Charles Salt Res. Ctr., Oswestry, Shropshire, England) and D. E. Williams. *Brit J Cancer* 26:90-98, 1972.

Cells from 15 osteosarcomas induced in CBA mice by injection of ^{90}Sr were irradiated (15,000 rads) and implanted s.c. into syngeneic mice; immunizing grafts of irradiated tumor cells were given three times at intervals of ten to 21 days. In some cases, osteosarcoma grafts growing in mice were excised to immunize hosts to the tumor. Mice immunized against osteosarcoma by implantation with irradiated cells or by excision of a tumor graft were given 400 rads whole-body X-irradiation before challenge with osteosarcoma cells. Of 15 osteosarcomas, six were immunogenic in that the number of challenge tumor takes was less in hosts immunized by grafts of irradiated tumor cells than in unimmunized mice. However, the resistance induced to osteosarcomas was of a relatively low order. Nine tumors were either not immunogenic or were immunogenic to a negligible degree only. Only one osteosarcoma was immunogenic when inoculated as a challenge in a mouse immunized by excision of an osteosarcoma graft. Moreover, transplantation resistance in this case was weak. Sera from mice immunized against radiation-induced osteosarcomas by implantation of irradiated tumor cells gave no significant immunofluorescence reactions when reacted against cells of the same osteosarcoma.

3897 EFFECT OF IMMUNE FACTORS ON THE MOTILITY OF LYMPHOMA CELLS. (E.) Cochran, A. J.

(Dept. Tumor Biol., Karolinska Inst., Stockholm, Sweden), E. Klein and R. Keissling. *J Nat Cancer Inst* 48(6):1657-1661, 1972.

The effect of antisera on the migration of Moloney virus-induced YAC lymphoma cells, collected from A/Sn mice bearing the tumor, in Eagle's minimum essential medium was studied. Both anti-H-2a antiserum and an anti-Moloney virus antiserum markedly inhibited YAC cell migration when added to the tissue culture medium in which YAC cells were migrating. The anti-H-2a serum was more active in inhibiting YAC migration than the anti-Moloney antiserum. The inhibition of YAC migration by the antisera paralleled antisera activity in complement-dependent cytotoxicity tests with YAC cells as target. This suggested that YAC migration inhibition by antisera is independent of exogenous complement. The inhibitory effect of antisera was removed by absorbing sera with YAC cells.

YAC cells preincubated with antisera before migration testing showed considerably reduced migration. YAC cells preincubated with nonimmune normal A/Sn mouse serum migrated better than YAC cells not preincubated with any serum. YAC migration was inhibited by cell-free ascitic fluid from YAC lymphoma-bearing mice, but was not affected by fluid from tumor-free mice.

- 3898 CELLULAR CYTOLYSIS *IN VITRO*: MECHANISMS UNDERLYING A QUANTITATIVE ASSAY FOR CELLULAR IMMUNITY. (E.) MacPherson, B. R. (Nat'l. Cancer Inst., Bethesda, Md.) and Y. H. Pilch. *J Nat Cancer Inst* 48(6):1619-1627, 1972.

Guinea pigs were immunized against a methylchloanthrene-induced transplantable liposarcoma (MCA-A) or an osteosarcoma (MCA-25) by injection of tumor cell inocula. Immune lymphocytes were collected from the spleen, lymph nodes and blood of immune guinea pigs and introduced into cultures containing ³H-thymidine-labeled MCA-A or MCA-25 cells. Immune cytotoxicity of tumor cells was assayed by determining radioactivity of adherent tumor cells. Allogeneic and syngeneic immune lymphocytes from spleen, lymph nodes and blood produced detectable immune cytotoxicity at all dilutions tested. Immune cytotoxicity by syngeneic immune lymphocytes was at a lower level than that effected by allogeneic lymphocytes. The interaction of immune lymphocytes and target cells failed to cause lysis of immunologically unrelated target cells in the same culture. Serum from immune guinea pigs did not lyse MCA-A or MCA-25 cells. "Immune" cell-free supernatants from mixed immune lymphocytes and MCA-A cells did not lyse MCA-A cells. However "immune" supernatants combined with normal (nonimmune) guinea pig lymphocytes did produce slight cytotoxicity in MCA-A cells.

- 3899 CULTURES FROM ADULT RAT LIVER CELLS: II. DEMONSTRATION OF ORGAN-SPECIFIC CELL SURFACE ANTIGENS ON CULTURED CELLS FROM NORMAL LIVER. (E.) Iype, P. T. (Christie Hosp. Manchester, England), R. W. Baldwin and D. Graves. *Brit J Cancer* 26(1):6-9, 1972.

Freshly isolated liver cell lines from male Wistar rats, and epithelial and non-epithelial cell lines in culture for 60-182 days, were reacted with anti-normal rat liver membrane antiserum (ANLM), anti-liver cell antiserum, anti-plasma membrane antiserum (APM), or anti-normal liver *h* protein antiserum. The presence of liver-specific antigens on the surfaces of fresh as well as cultured rat liver cells was demonstrated by positive membrane immunofluorescence reactions of these cells with ANLM. APM also reacted strongly with freshly isolated cells. Antigens were also detected on enzyme-treated liver cells in which parenchymal cells had been disaggregated from liver tissue.

- 3900 MONOCLONAL MEMBRANE IMMUNOGLOBULINS IN CHRONIC LYMPHOCYTIC LEUKEMIA. (Fr.)

Preud'homme, J. L. (St. Louis Hosp. Blood Dis. Res. Inst. Paris, France), M. Klein, P. Verrdust and M. Seligmann. *Rev Eur Etudes Clin Biol* 16(10): 1025-1031, 1971.

Peripheral (and in some cases, medullary or ganglionic) lymphocytes from 13 patients with chronic lymphocytic leukemia were examined by direct immunofluorescence on viable cell suspensions for the presence of membrane-bound immunoglobulins. In 11 cases of lymphocytic leukemia lacking serum monoclonal immunoglobulins, 80-95% of the circulating lymphocytes carried monoclonal immunoglobulin chains. These were usually made up of μ chains, associated more often with κ than λ chains. The presence of monoclonal IgG was found in one case and monoclonal IgA, in another case also. These lymphocytes were considered to represent the proliferation of B lymphocytes which has been arrested in the maturation process. No membrane-bound immunoglobulins were found on the lymphocytes of two patients, suggesting a proliferation of thymus-dependent (T) lymphocytes. In two cases of chronic lymphocytic leukemia associated with serum monoclonal immunoglobulins, the finding of both membrane and intracytoplasmic immunoglobulins demonstrated a bclonal proliferation. In one case both IgA and IgM markers shared λ light chains whereas in the other case, the two immunoglobulins had different heavy and light chains. The detection of membrane-bound monoclonal immunoglobulins as markers of B cells could be useful in the early diagnosis of chronic lymphocytic leukemia.

- 3901 IMMUNOSUPPRESSION BY BISDIOXOPIPERAZINES: EFFECTS ON ANTIBODY-FORMING CELLS AND SERUM TITERS. (E.) Tucker, D. F. (Imperial Cancer Res. Fund, London, England) and M. D. Finch. *J Nat Cancer Inst* 48(5):1347-1354, 1972.

Male random-bred Swiss-Schneider ICRF mice were given i.p. injections totaling 15 mg/kg of 1,2-bis(3,5-dioxopiperazin-1-yl) ethane (ICRF 154) or (\pm)-1,2-bis(3,5-dioxopiperazin-1-yl) propane (ICRF 159); administration of 154 or 159 began three days before and ended two days after immunization of mice with sheep red blood cells (SRBC). With this injection schedule, the plaque-forming cell (PFC) response in spleens of treated mice was inhibited to about the same degree by 154 and 159 as it was by cyclophosphamide (CPA). There was good correlation between drug dose and inhibition of PFC response; the extent of PFC inhibition increased proportionally with increasing doses of 154 or 159. Similar treatment schedules with 154 or 159 also interfered with the primary immunization to bovine serum albumin, as judged by weakened secondary immune responses. The greatest interference was seen when 154 or 159 was given daily from the time of primary antigen exposure. The time dependence of immunosuppression by 154 or 159 was studied in more detail by use of the PFC assay system only. 154 or 159 were most

effective in immunosuppression when given 48 or 72 hr after SRBC (60% suppression of PFC). This effect was similar to but less striking than immunosuppression produced by CPA (83 and 79% depression of PFC at 48 and 72 hr after SRBC, resp.) When administered before SRBC, CPA gave only slight PFC inhibition; 159 gave 42% inhibition when given 72 hr before SRBC, and 154 was not inhibitory when given at 72 hr before SRBC.

3902 SPONTANEOUS TRANSFORMATION OF RAT CELLS AFTER LONG-TERM *IN VITRO* CULTIVATION AND THE "SWITCH-ON" OF A NEW COMPLEMENT-FIXING ANTIGEN. (E.) Rhim, J. S. (Natl. Inst. Hlth., Bethesda, Md.), M. L. Vernon, R. J. Huebner, H. C. Turner, W. Lane and R. V. Gilden. *Proc Soc Exp Biol Med* 40(2):414-419, 1972.

Morphological alterations and an abnormally increased growth pattern were seen in S-1193h rat embryo cells in culture at the 45th subculture. Foci of transformed cells appeared which consisted of randomly oriented, criss-crossed spindle-shaped cells. In complement-fixing (CF) tests with antisera produced in rats carrying Moloney sarcoma virus (MSV)-induced transplanted sarcomas, transformed rat embryo cells at the 51st subculture showed the CF antigen reactive with the anti-MSV serum. No viruses or virus-like particles were detected in transformed rat embryo cell cultures. Progressive transplantable tumors were readily produced in newborn rats by inoculation with spontaneously transformed rat embryo cells. Cultured tumor cells and rat tumors contained antigens reactive with the MSV rat antisera but not antigens reactive with the gs-1-specific guinea pig antisera. Rat tumors also reacted with sera from rats bearing tumor induced by polyoma virus-transformed rat embryo cells. While the antigen in the spontaneously transformed cells was similar to the antigen in polyoma-transformed cells, it appeared much earlier in polyoma-transformed cells.

3903 QUANTITATIVE STUDIES ON THE BINDING OF SYNGENEIC ANTIBODY TO THE SURFACE ANTIGENS OF AKR-VIRUS-INDUCED RAT LYMPHOMA CELLS. (E.) Boone, C. W. (Natl. Inst. Hlth., Bethesda, Md.), P. R. Brandchaft, D. N. Irving and R. Gilden. *Int J Cancer* 9(3):685-692, 1972.

Suspensions of Gross virus-induced rat lymphoma cells were treated with antisera against the lymphoma; mixed normal and immune sera mixed with lymphoma cells had been labeled with ^{125}I or ^{131}I , a technique permitting precise estimations of nonspecific antibody adsorption. The binding of antibody to the G cell surface antigen (GCSA) of lymphoma cells was determined by immune serum titration and cell titration; the number of antigenic sites per lymphoma cell and per bond was calculated. The number of antibody molecules bound to GCSA sites per lymphoma cell was 6.90×10^6 and the number of antigen sites

on each cell was $11,300$ sites/ μ^2 . The average equilibrium constant of the GCSA-antibody association reaction was 6.54×10^6 l/mole. The ΔF° (mean binding affinity) value of binding for the antibody-surface antigen bond was -9.17 Kcal/mole and the dissociation rate constant (k_2) of bound antibody at 0°C was 3.67×10^{-5} /sec.

3904 SPECIFIC ENHANCEMENT OF TRANSPLANTATION IMMUNITY WITH HEAT-KILLED *MYCOBACTERIUM BUTYRICUM* AND IMMUNIZING EXTRACTS FROM ADENOVIRUS 12-INDUCED TUMOUR CELLS. (E.) Rees, R. C. (Virus Res. Lab., U. Sheffield, England) and C. W. Potter. *Brit J Cancer* 26:139-140, 1972.

CBA mice were inoculated with cell suspensions from an adenovirus 12-induced transplantable CBA mouse tumor once a wk for three wk; some mice were given tumor cells together with heat-inactivated *Mycobacterium butyricum*. Two wk after the last immunizing inoculation, mice were challenged with viable tumor cells from the same tumor. The incidence with tumor cells and *M. butyricum* was significantly lower than in mice immunized with tumor cells alone. Forty-four percent of mice given tumor cells alone developed tumors while 5.5% of mice given tumor cells plus *M. butyricum* developed tumors. *M. butyricum* alone did not protect against tumor cell challenge; tumor incidences of 100% and 78% were obtained in two groups of controls.

3905 CELLULAR IMMUNITY TO RENAL CARCINOMAS IN MAN. (E.) Bubenik, J. (Inst. Exp. Biol. Genetics, Czechoslovak Acad. Sci., Prague), J. Jakoubkova, P. Krakora, M. Baresova, P. Helbich, V. Viklicky and V. Malaskova. *Int J Cancer* 8:503-513, 1971.

A microassay in disposable tissue-culture plates was used to demonstrate a cell-mediated immune response against human renal adenocarcinomas. Leukocytes from 12 of the 19 patients with renal carcinoma were cytotoxic for autochthonous and allogeneic renal carcinoma cells *in vitro*. No reproducible cytotoxic effects were produced by leukocyte suspensions from patients with pulmonary or mammary carcinoma, or by leukocytes from healthy and non-neoplastic control subjects. No cytotoxicity was observed when cells of unrelated tumors, mesothelioma and urinary bladder carcinoma were used as target cells for leukocytes from a patient who reacted positively against autochthonous renal carcinoma cells. The results indicate that human renal adenocarcinomas possess tumor-associated antigens which cross-react with each other. Cytological and electron microscopic characteristics of cultivated renal carcinoma cells are described.

3906 EFFECTS OF PIG LEUKOCYTES ON MOUSE LYMPHATIC LEUKEMIA. (E.) Hill, G. (U. Colorado Med. Ctr., Denver), K. Littlejohn, G. Kelly, R.

Atkins, J. Greer and B. Eiseman. *J Surg Oncol* 3(5): 569-579, 1971.

AKR/J mice were injected i.p. with BW 5147 lymphatic leukemia cells and with blood or spleen leukocytes from pigs immunized against BW 5147 leukemia. In some cases, tumor cells and pig leukocytes were incubated together and injected into mice together; in other cases, tumor cells were injected, followed by pig leukocytes. The increase in life span ILS, defined as percentage of improvement in mean survival time of treated as compared to untreated mice) was observed. Significant prolongation of ILS was seen in 8 of 13 experiments in which leukemic cells were incubated with tumor-immune pig leukocytes prior to injection into mice. ILS was prolonged when tumor cells were incubated with immune leukocytes from perfused pig spleens, from live pig spleens or from pig peripheral blood. ILS was not increased when leukemic cells were incubated with immune leukocytes from splenic perfusates from pigs. Significant ILS prolongation was not seen when tumor cells were incubated with nonimmune pig leukocytes or with leukocytes immunized against normal mouse lymphoid tissue. Also, no therapeutic benefit was apparent when tumor injections in mice were followed by treatment with tumor-immune pig leukocytes or normal pig leukocytes.

3907 SUPPRESSION OF *IN VIVO* IMMUNE RESPONSES IN THE GUINEA PIG BY PHYTOHEMAGGLUTININ.

(E.) Pilch, B. Z. (Natl. Cancer Inst., Bethesda, Md.), H. R. Gertner and P. B. Chretien. *J Surg Oncol* 3(5):525-532, 1971.

Guinea pigs were injected i.p. with phytohemagglutinin (PHA, 1 ml of an 0.85% solution/kg body wt) daily beginning two days before injection of antigenic bovine gamma globulin (BGG), skin grafting or injection of antigenic tuberculin D. Immune responses to antigens and skin grafts were observed. There was a significant delay in the rise of anti-BGG titers in all of seven PHA-treated guinea pigs two wks after BGG; the mean log₂ titer of untreated animals was ten while that of PHA-treated animals was 5.5. Skin allograft survival was prolonged from a mean of 10.6 days in untreated guinea pigs to a mean of 13.1 days in PHA-treated animals. The delayed cutaneous hypersensitivity reaction to tuberculin in guinea pigs immunized with BCG was completely suppressed in seven of eight PHA-treated guinea pigs.

3908 DETECTION OF AN ANTIGEN ASSOCIATED WITH ACUTE LEUKEMIA. (E.) Mann, D. L. (Natl. Cancer Inst., Bethesda, Md.), G. N. Rogentine, R. Halterman and B. Leventhal. *Science* 174(4014):1136-1137, 1971.

Antiserums to a purified cell membrane component from a Burkitt's lymphoma tissue culture cell line were produced in rabbits. These antiserums were cytotoxic to peripheral white blood cells from 8 of 15 patients with acute leukemia and 5 of 41 relatives,

but not to peripheral white blood cells from leukemia patients in clinical remission or from normal individuals. These antiserums appear to be detecting an acute leukemia associated antigen or antigens.

3909 IMMUNOLOGIC ENHANCEMENT OF ALLOGENEIC TUMOR GROWTH WITH SOLUBLE HISTOCOMPATIBILITY-2 ANTIGENS. (E.) Law, L. W. (Natl. Cancer Inst., Bethesda, Md.), E. Appella, P. W. Wright and S. Strober. *Proc Nat Acad Sci USA* 68(12):3078-3082, 1971.

Soluble, partially purified, histocompatibility antigens that were obtained from the membranes of A/J spleen cells have been assayed for their capacity to elicit immunologic enhancement of two tumors of A-strain origin: YAA-C1 and Sarcoma I. Crude membrane material and a partially purified, soluble antigen that were contained in a specific fraction, obtained after chromatography on a Sephadex G-150 column, elicited enhancement: this fraction has been shown to contain immunogenic histocompatibility-2^a antigens as well as alloantigenic specificities that were detected serologically. Another soluble fraction did not induce enhancement; this fraction has been shown to contain antigens other than H-2. Passive enhancement of both tumors was achieved with antisera produced in allogeneic mice that were inoculated with crude membrane material or with a fraction obtained by Sephadex G-150 chromatography. These antisera contained cytotoxic and/or hemagglutinating antibodies. Immunologic enhancement was specific. A readily enhanceable tumor, Py 89, of C57BL origin was not enhanced with anti-H-2^a antisera. These results suggest strongly that all important H-2^a transplantation antigenic determinants of spleen cells can be recovered by partial papain digestion and fractionation on a Sephadex G-150 column.

3910 TUMOR-ASSOCIATED ANTIGEN IN PATIENTS WITH CARCINOMA OF THE COLON. (E.) Lo Gerfo, P. (Columbia U., Coll. Physicians Surg., New York, N.Y.), F. Lo Gerfo, F. Herter, H. G. Barker and H. J. Hansen. *Amer J Surg* 123:127-131, 1972.

3911 SPLEEN WEIGHT IN RATS DURING TUMOUR GROWTH AND IN HOMOGRAFT REJECTION. (E.) Blamey, R. W. (Inst. Cancer Res., Cardiff, England) and D. M. D. Evans. *Brit J Cancer* 25(3):527-532, 1971.

3912 THE PRESENCE OF AN ANTIGEN PROTEIN IN THE URINE OF CANCER PATIENTS REVEALED BY IMMUNOELECTROPHORESIS; ITS CONFIRMATION BY IMMUNODIFFUSION. (Fr.) Aron, M. (Sch. Med. Strasbourg, France) and J.-P. Isaac. *C R Acad Sci [D] (Paris)* 275:305-308, 1972.

3913 DEPENDENCE OF THE ANTIBODY FORMING CELL NUMBER ON THE SPLEEN CELL PROLIFERATION STAGES, INDUCED EXPERIMENTALLY IN MICE. (Jap.)

Nakamura, S. (Med. Sch. U. Kobe, Japan).
Jap Physiol Soc 33:640-649, 1971.

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3915 SERUM PROTEIN ALTERATIONS IN THE EHRlich TUMOR-BEARING MOUSE. (It.) Billitteri, A. (Inst. Gen. Path. U. Catania, Italy) and A. Brucchiari. *Lo Sperimentale* 119(6):435-446, 1969.

3916 THE ACTION OF CHRONIC HYPERIMMUNIZATION WITH APDT (ASSOCIATED PERTUSSIS-DIPHTHERIA-TETANUS) VACCINE ON THE DEVELOPMENT OF LEUKEMIA IN AKR AND CC57BR MICE. (Rus.) Babinkov, V. J. (I. M. Sechenov Med. Inst. Moscow, USSR) and A. M. Shapiro. *Biull Eksp Biol Med* 73(2):89-92, 1972.

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918 ELECTROPHORETIC CHANGES OF SERUM PROTEIN FRACTIONS IN LEUKEMIA. (Tur.) Gökyay, E. (Inst. Clin. Hemat. Ankara, Turkey) and C. Arici. *Ip Fac Med (Istanbul)* 24(2):306-318, 1971.

919 STUDIES OF INHIBITION OF TUMOUR CELL DNA SYNTHESIS BY IMMUNE CELLS IN GROSS VIRUS INDUCED LEUKEMIA. (E.) Finklestein, J. Z. (UCLA Sch. Med., Los Angeles, Calif.), J. Byfield, K. Little and D. T. Imagawa. *Rev Eur Etud Clin Biol* 17(3):287-292, 1972.

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22 IN VITRO LYSIS OF TUMOR CELLS BY GUINEA PIG LYMPHOID CELLS SENSITIZED TO HETEROLOGOUS MA GLOBULINS. (E.) Sin, Y. M. (Fac. Med., U. Manitoba, Winnipeg, Canada), E. Sabbadini and A. H. Ion. *Cell Immunol* 2(3):239-249, 1971.

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3923 COMPARATIVE IMMUNOGENICITY OF VARIOUS CELLULAR AND CELL-FREE PREPARATIONS IN A LEUKEMIA ISOTRANSPLANT SYSTEM. (E.) Tennant, J. R. (Sloan-Kettering Inst. Cancer Res., New York, N. Y.) and S. Kingsley. *J Nat Cancer Inst* 47(5):953-960, 1971.

3924 RENAL TUBULAR ANTIGENS IN KIDNEY TUMORS. (E.) Wallace, A. C. (Dept. Path., U. Western Ontario, London, Canada) and R. C. Nairn. *Cancer* 29(4):977-981, 1972.

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3926 SERUM ALPHA-FETOGLOBULIN AND PRIMARY CANCER OF THE LIVER IN TAIWAN. (E.) Lin, T.-Y. (Nat. Taiwan U. Hosp., Taipei), S.-H. Chu, M.-F. Chen and C.-H. Chen. *Cancer* 30(2):435-443, 1972.

3927 EVIDENCE FOR THE PRESENCE OF IMMUNOREACTIVE GROWTH HORMONE IN CANCERS OF THE LUNG AND STOMACH. (E.) Beck, C. (Prince Henry's Hosp. Melbourne, Australia) and H. G. Burger. *Cancer* 30(1):75-90, 1972.

3928 MULTIPLE MYELOMA ASSOCIATED WITH A 9S IgG PARAPROTEIN AND CARCINOMA OF THE PROSTATE. (E.) Chin C.-K. (Med. Coll. Georgia, Augusta), L. L. Smith, C.-S. Wright, B. P. Barton, R. R. Moores and C. L. Litcher. *Cancer* 30(1):206-213, 1972.

3929 IMMUNOLOGICAL SPECIFICITY OF ASTROCYTOMA ANTIGENS. (E.) Lim, R. (Div. Neurosurgery, U. Chicago, Ill.) and L. Kluskens. *Cancer Res* 32:1667-1670, 1972.

3930 ANTIGENIC CROSS-REACTIVITY BETWEEN PRIMARY SPONTANEOUS MOUSE MAMMARY TUMORS AND THEIR TRANSPLANTABLE ASCITES TUMORS. (E.) Irie, R. F. (Niigata U. Sch. Med., Japan). *Cancer Res* 31:1682-1689, 1971.

3931 CONCOMITANT IMMUNITY AND SPECIFIC DEPRESSION OF IMMUNITY BY RESIDUAL OR REINJECTED SYNGENEIC TUMOR TISSUE. (E.) Vaage, J. (U. Texas M.D. Anderson Hosp. Tumor Inst., Houston). *Cancer Res* 31:1655-1662, 1971.

3932 IMMUNOGLOBULINS IN CARCINOMA CERVIX. (E.) Vasudevan, D. M. (All-India Inst. Med. Sciences, New Delhi), K. Balakrishnan and G. P. Talwar. *Indian J Med Res* 59:1653-1659, 1971.

3933 NEWER CONCEPTS OF CANCER OF THE COLON AND RECTUM: DELAYED HYPERSENSITIVITY RESPONSES OF PATIENTS WITH CARCINOMA OF THE COLON AND OTHER SOLID TUMORS. (E.) Kronman, B. S. (Coll. Phys. Surgeons, Columbia U., New York, N.Y.), H. M. Shapiro, and S. A. Localio. *Dis Colon Rectum* 15(2):106-110, 1972.

3934 NORMAL AND CANCEROUS TISSUE TRANSPLANTATION IN ALLOGENEIC AND SYNGENEIC *XENOPUS LAEVIS*. (E.) Hadji-Azimi, I. (Exp. Zool. Ctr., U. Geneva, Switzerland) and M. Fischberg. *Cancer Res* 31:1594-1599, 1971.

3935 ALTERED ANTIGENICITY IN SPONTANEOUS PULMONARY METASTASES FROM AN ANTIGENIC MURINE SARCOMA. (E.) Sugarbaker, E. V. (Massachusetts Gen. Hosp., Boston) and A. M. Cohen. *Surgery* 72(1):155-161, 1972.

See also:

- * (Rev): 3606, 3609, 3628, 3634
- * (Chem): 3686
- * (Phys): 3729, 3733
- * (Viral): 3744, 3747, 3753, 3757, 3784, 3814, 3817

3936 NEOPLASTIC TRANSFORMATION *IN VITRO* OF A CLONE OF ADULT LIVER EPITHELIAL CELLS INTO DIFFERENTIATED HEPATOMA-LIKE CELLS UNDER CONDITIONS OF NUTRITIONAL STRESS. (E.) Borek, C. (Columbia U., New York, N.Y.). *Proc Nat Acad Sci USA* 69(4): 956-959, 1972.

A cloned line of epithelial-like cells was established from the normal liver of a three-month-old buffalo rat and maintained in contact-inhibited monolayers by continuous subculture for a period of 8 months. After ten consecutive days in culture without feeding, the cells appeared as a tightly packed monolayer in which mitosis was observed. Within 30-40 days of the start of the experiment, isolated loci of refractile cells went into mitosis and began to form a second layer in 45 of the 50 experimental plates; no such loci were observed in the controls. Five to seven days after the appearance of the transformed cells, the whole petri dish was covered by a multilayer of cells. Analysis of the transformed cells showed that these cells had: maintained their ability to synthesize serum proteins, developed morphological changes, sustained a decreased adhesiveness to one another, were able to grow in semi-soft agar, acquired agglutination characteristics in the presence of heat germ agglutinin and concanavalin A and lost the inhibition of replication on contact with other cells. This experiment presents a simple device for producing transformation *in vitro*.

3937 THE KARYOTYPE OF BONE MARROW CELLS FROM CATTLE WITH PERSISTENT LYMPHOCYTOSIS AND IN LYMPHOSARCOMA. (E.) Cerny, L. (U. Sch. Vet. Med., Brno, Czechoslovakia), L. Lojda and R. Rademacher. *oplasma* 19(3):217-225, 1972.

Bone marrow cells were aspirated from five cows with lymphocytosis and from two cows with lymphosarcoma. Chromosome counts were made on bone marrow cells. In cows with lymphocytosis, bone marrow cell ploidy resembled that in normal healthy cow marrow; hypodiploidy was seen but hyperploidy was rare. The ratio of dividing to resting cells in marrow of cows with lymphocytosis ranged from 1:238 to 1:125. One of two cows with lymphosarcoma showed near-tetraploid bone marrow cells. In this cow, the ratio of near-tetraploid to diploid leukocytes in marrow was 1:20.

3938 CHANGES IN THE STRUCTURAL ORGANIZATION OF THE SURFACE MEMBRANE IN MALIGNANT CELL TRANSFORMATION. (E.) Ben-Bassat, H. (Weizmann Inst. Sci., Rehovot, Israel), M. Inbar and L. Sachs. *Membrane Biol* 6(3):183-194, 1971.

A comparison was made between the size of normal Syrian hamster embryo cells grown in "adult 1 calf serum", "adult 2 calf serum" or fetal calf serum and the size of cells transformed *in vitro* by polyoma virus or dimethylnitrosamine and grown in the same media. Transformed cells did not acquire the growth

pattern of normal cells in any of the three culture media. The relationship between cell size, binding sites and agglutinability in cells under different growth conditions was then examined using the Concanavalin A (Con A) agglutination assay and the radioactive method of counting binding sites. Adult 1 calf serum caused transformed hamster cells to bind a higher number of Con A molecules per cell than normal cells. The increase in the number of molecules bound was associated with an exposure of cryptic sites in transformed cells and to a lesser extent with a slight decrease in size of transformed cells. Both adult 2 calf serum and fetal serum permitted normal and transformed cells to bind a similar number of Con A molecules; only the transformed cells however were agglutinated by Con A. In adult 2 calf serum, the gain in agglutinability was associated with a concentration of exposed sites due to a decrease in cell size; there was no evidence of exposure of cryptic sites. In fetal serum, the gain in agglutinability in transformed cells was not due to differences in cell size but presumably to a rearrangement of exposed sites, resulting in clustering of sites.

3939 MORPHOLOGY AND DEVELOPMENT OF CERVICAL ATYPIA IN 106 CASES OUT OF 12,300 PREGNANCIES. (Fr.) Brux, J. de (Inst. Path. Cytol., Paris, France), C. Panopoulous and F. Coupez. *Rev Franc Gynec* 66(11-12):671-679, 1971.

Case reports of 12,300 pregnant women who received regular check-ups during pregnancy were screened and 180 cases (1.5%) of epithelial atypical of the cervix were found for a 10-yr period. Of these, 106 had received regular and thorough cytological and histological examinations, with adequate follow-up. These 106 lesions were scored objectively, as follows: 71 benign lesions and 34 borderline lesions, including 12 severe dyskaryoses and 22 lesions resembling intraepithelial carcinoma. Of the 34 severe lesions, 20 (58%) improved, 9 (27%) remained unchanged and 5 (15%) became worse. The risk of severe lesions was greater for multiparous women and those between the ages of 30-34 yrs. Hormonal imbalances that occur during pregnancy are involved in the histogenesis of the lesions; no histological or cytological indices have been found to indicate how the lesions will develop.

3940 CHROMOSOMES OF CONDYLOMA ACUMINATUM, PAGET'S DISEASE, *IN SITU* CARCINOMA, INVASIVE SQUAMOUS CELL CARCINOMA AND MALIGNANT MELANOMA OF THE HUMAN VULVA. (E.) Katayama, K. P. (Johns Hopkins U. Sch. Med., Baltimore, Md.), J. D. Woodruff, H. W. Jones, Jr. and E. Preston. *Obstet Gynec* 39(3):346-356, 1972.

Punch biopsies were taken from lesions from 21 patients with malignant conditions of the vulva, including three condyloma acuminatum cases, one Paget's disease case, six carcinomas *in situ*, ten

invasive squamous cell carcinomas and one malignant melanoma of the vulva. Biopsy material was prepared for chromosome study by the direct squash method. Five of six patients with mature carcinomas had lymph node metastases, while immature carcinomas showed no metastases. In chromosome studies, 78.4% of condyloma acuminatum cell metaphases and 55% of Paget's disease metaphases were diploid. Twenty-four percent of carcinoma *in situ* cells were diploid, 22% were triploid and 54% were tetraploid or above. Eighty-nine percent of invasive squamous cell carcinoma (immature type) cells were diploid, 11% were tetraploid and none was triploid. Thirty-seven percent of invasive squamous cell carcinoma (mature type) cells were diploid, 26% were triploid and 37% were tetraploid or above. The most striking chromosome aberrations were seen in malignant melanoma metaphases; 13% of these were diploid, 74% were triploid and 13% were tetraploid or above. Structural aberrations were also more common in malignant melanoma cells; 66 reciprocal translocations were seen in these cells. Mature type squamous cell carcinoma had the next highest frequency of structural aberrations, and condyloma acuminatum had the fewest aberrations (15 translocations).

- 3941 STEMLINE EVOLUTION OF A C57BL/10 MOUSE LYMPHOMA. (E.) Barr, K. J. (Dept. Microbiol., California St. Coll., Long Beach), B. G. Sanders, A. F. Brodetsky and R. L. Teplitz. *Arch Path* 93(1):22-25, 1972.

The splenic lymphoma of C57BL/10 mice could not be transferred to adult T6T6 mice, but could be transferred to "immunologically naive" neonatal T6T6 mice. Transplanted lymphomas had two cell populations, one with 40 chromosomes (T6 normal host cells) and one with 39 chromosomes (lymphoma cells). Spleen cells from C57BL/10 lymphoma-bearing T6T6 mice grew in C57BL/10 recipients but were rejected by T6T6 mice, suggesting that tumor transfer had been effected by true transplantation of tumor cells. The C57BL/10 lymphoma was cytogenetically mixoploid initially, but after 690 days and 50 transfers a single dominant stem cell line emerged. Every metaphase examined had 39 chromosomes, and there has been no chromosomal variation since. Karotypes showed no chromosomal translocations or other rearrangements. Tumor morphology and growth rate remained similar to those of the tumor prior to stemline evolution. Intracytoplasmic A particles (but no C particles) were seen in 10% of lymphoma cells. In an attempt to determine the presence of infectious virus in lymphomas, cell-free tumor extract was injected into adult and neonatal C57BL/10 mice. No tumors developed. It is concluded that if the A particles were of viral origin, they were incomplete and not recoverable by conventional means.

- 3942 EVIDENCE FOR A CLONAL ORIGIN OF HEAD AND NECK TUMORS. (E.) Fialkow, P. J. (Kenyatta Natl. Hosp., Nairobi, Kenya), G. M. Martin,

G. Klein, P. Clifford and S. Singh. *Int J Cancer* 9(1):133-142, 1972.

Blood and tumor biopsy specimens from 28 African patients with head and neck tumors were examined for glucose-6-phosphate dehydrogenase (G-6-PD) type. Patients were heterozygous at the G-6-PD locus and accordingly normal cells from patients contained both of the two G-6-PD phenotypes, A and B. A single enzyme phenotype in tumor cells was taken as evidence for a clonal origin for the tumor. Ten of 11 tumor biopsies from anaplastic carcinoma of the nasopharynx showed both G-6-PD types. Biopsy specimens, however, were heavily contaminated with nonneoplastic cells and no conclusion as to the origin of the tumor could be drawn. The one relatively pure anaplastic carcinoma of the nasopharynx had a single enzyme phenotype. A single enzyme phenotype was found for a squamous cell carcinoma of the palate and suspected for two other such tumors. In one well-differentiated squamous cell carcinoma of the maxillary antrum, both A and B enzymes were found; nevertheless, a clonal origin for this tumor could not be ruled out. Another antral squamous cell carcinoma had a single enzyme phenotype. Single enzyme phenotypes were also found for an adenocystic palatal salivary gland carcinoma, a plasmacytoma, a neuroblastoma, a melanoma and a reticulum cell sarcoma. A benign follicular thyroid adenoma had a single enzyme phenotype, as did a benign ectopic salivary gland adenoma. Thus, findings in virtually all cases suggest a clonal origin for mature tumors.

- 3943 HYPERPLASTIC AND EARLY NEOPLASTIC CHANGES IN THE OVARIES OF MICE AFTER GENIC DELETION OF GERM CELLS. (E.) Murphy, E. D. (Jackson Lab., Bar Harbor, Me.). *J Nat Cancer Inst* 48(5):1283-1295, 1972.

Early events in the development of bilateral ovarian tubular adenomas in C57BL/6J- \bar{w}^c/\bar{w}^c female mice were observed. This strain is characterized by early development of adenomas; mice of the same genetic background, but which were not prone to adenoma development, were observed as normal controls. In controls at one day of age, the standard number of oocytes/ovary was 6,000. In ovaries of adenoma-prone mice, the standard number of oocytes/ovary at one day of age was 49, less than 1% of normal. By 13 wk of age, no oocytes were seen in ovaries of adenoma-prone mice. At one day of age, sterile ovaries in adenoma-prone mice were composed chiefly of pregranulosa cell cords. Growing follicles or corpora lutea predominated in control ovaries by three wks of age; follicular development lagged behind controls in the adenoma-prone mice. Follicles disappeared from sterile ovaries by 13 wk and corpora lutea disappeared by 17 wk. "Germinal" epithelium invaded preovarian tissue beginning at wk eight; by 13 wk of age, it had penetrated and completely permeated two sterile ovaries, which were diagnosed as tubular adenomas. By 22 wk, 19 of 20 sterile ovaries were diagnosed as complex tubular adenomas. Interstitial cells in sterile ovaries were under-

going hyperplasia by four wk of age; the cells invaded the germinal epithelium by six wk and thin-walled blood vessels by eight weeks. The rete ovarii in sterile ovaries became hyperplastic by three wk. Interstitial cells formed inside granulosa cell cords, in theca interna of atretic follicles, in degenerating corpora lutea, in rete ovarii and directly from stromal cells. Sex hormones continued to be produced in ovaries after the disappearance of follicles and the development of interstitial cell hyperplasia.

3944 PROLIFERATIVE EPITHELIAL LESIONS OF THE URINARY BLADDER OF NONHUMAN PRIMATES INFECTED WITH *SCHISTOSOMA HAEMATOBII*. (E.) Kuntz, E. (Southwest Fdn. Res. Educ., San Antonio, Texas), W. Cheever and B. J. Myers. *J Nat Cancer Inst* 8(1):223-235, 1972.

Monkeys of eight species were infected s.c. with cercariae of the worm *Schistosoma hematobium*. When the infected monkeys died or were killed three to four months after infection, pelvic area tissues were examined. Papillary transitional cell carcinomas of the bladder were seen in a talapoin monkey which died 21 months after infection and in a capuchin monkey killed 56 wk after infection. Areas of epithelial proliferation were generally adjacent to schistosome eggs in bladder lamina propria. Two squirrel monkeys showed proliferation and squamous metaplasia of bladder epithelium, again located near *S. hematobium* eggs. An infected baboon killed one yr after infection had a papilloma in its ureter. The affected ureter contained schistosome eggs. Since spontaneous bladder cancer has not been reported in monkeys, it is thought that these lesions were caused by *S. hematobium* infection.

45 TISSUE INTERACTIONS IN MORPHOGENESIS, MORPHOSTASIS AND CARCINOGENESIS. (E.) Pirin, D. (Sch. Med., U. Leeds, England). *J Theor Biol* 34(1):61-72, 1972.

Studies of the relationship between different tissues and organs undergoing carcinogenesis and other pathological conditions are summarized. These studies provide support for the hypothesis that derangement of tissue interactions responsible for producing and maintaining biological structure is one of the fundamental mechanisms of carcinogenesis. Ultrastructural studies of skin and mammary carcinomas have revealed a series of marked changes at the junction between epithelium and connective tissue and have demonstrated that neoplastic epithelium mounts an enzyme attack on the underlying connective tissue. Based on the observation that viruses, chemicals and hormones cause remarkably similar morphological changes, different carcinogenic agents disturb the biological processes. At present it is not known if derangement of the interactions between epithelium and connective tissue arises from failure of epithelial function, failure of connec-

tive tissue function, or both, or from some impedance in communication between the tissues. Connective tissue tumors, benign and malignant tumors, and metastasis are also discussed in the context of the hypothesis of derangement of tissue interactions.

3946 GROWTH OF PRIMARY PLASMACYTOMAS IN THE MINERAL OIL-CONDITIONED PERITONEAL ENVIRONMENT. (E.) Potter, M. (Natl. Cancer Inst., Bethesda, Md.), J. G. Pumphrey and J. L. Walters. *J Nat Cancer Inst* 49(1):305-308, 1972.

Ascites cells from 15 primary mineral oil-induced BALB/c mouse plasmacytomas were injected i.p. into normal BALB/c mice or into BALB/c mice pretreated with one or two monthly i.p. injections of mineral oil. All the tumors grew in mineral oil-conditioned mice, while only three grew in unconditioned animals. Immunoelectrophoretic analysis of tumor and host cell proteins indicated that the tumors originated from host tissues. The effect of the number of conditioning doses of mineral oil on subsequent tumor development could not be properly evaluated.

3947 SPONTANEOUS STEM CELL LEUKEMIA IN YOUNG SPRAGUE-DAWLEY RATS. (E.) Richter, C. B. (Biol. Div., Oak Ridge Natl. Lab., Tenn.), P. C. Estes and R. W. Tennant. *Lab Invest* 26(4):419-428, 1972.

Over a one and one-half yr period, a total of 12 spontaneous leukemias (ten acute stem cell, one acute granulocytic, and one histologically untyped) was observed in a population of 600 outbred CR:CD (SD) rats. These tumors were studied by light and electron microscopy. The tumors characteristically appeared in young rats, and a high incidence of paralysis occurred due to encroachment of the tumor masses on the spinal cord. Hepatosplenomegaly and anemia were common findings at autopsy. Peroxidase stains of peripheral blood smears and liver imprints were negative. Although the liver and spleen were involved, infiltration of leukemic cells was most extensive in bone marrow. Liver infiltration tended to be diffuse and foci of extramedullary hematopoiesis were observed in most rats. Lymph node involvement was only secondary with the mesenteric nodes being the most common site. Thymic involvement was never observed. The pattern of neoplastic involvement in rats receiving tumor transplants differed from that in the spontaneous cases. I.p. inoculation produced large spleen and liver infiltrations. Unlike spontaneous cases, the lungs and lymph nodes were frequently involved while bone marrow involvement was less common. S.c. inoculation produced solid tumors which did not differ histologically from the leukemic form. The spontaneous leukemias were readily transplantable into CD:CR (SD) outbred and R344 inbred rats younger, but not older, than 25 days. Inoculation of rats with cell-free leukemia material failed to induce tumor formation.

Mouse leukemia virus antigens could not be detected in leukemic tissues by complement fixation nor were virus particles seen in tumor sections by electron microscopy. The characteristics of these spontaneous tumors suggest that they may serve as a useful model for the study of childhood leukemias.

- 3948 HISTOGENESIS OF ALVEOLAR SOFT PART SARCOMA. (E.) Welsh, R. A. (Louisiana State U. Sch. Med., New Orleans), D. M. Bray III, F. H. Shipkey and A. T. Meyer. *Cancer* 29(1):191-204, 1972.

Six alveolar soft part sarcomas, two granular cells myoblastomas, one carotid body tumor, and one normal carotid body were compared at the ultrastructural level. Strong similarities were noted between the alveolar soft part sarcoma and paragangliomas of carotid-body type. Similarities were the basic structural unit composed of chief cells, peripheral spindle cells, boundary laminae and surrounding vascular spaces arranged in a consistent pattern. Secretory-like granules resembling those of the carotid body were found in the chief cells of alveolar soft part sarcomas. Other similarities were the presence of light and dark cells, randomly located desmosomes between chief cells and characteristic hemidesmosomes at the periphery of chief cells. There was no similarity to the granular cell myoblastoma. The close homology between alveolar soft part sarcoma and the paragangliomas of carotid body type suggests that the tumors are of a related histogenesis.

- 3949 CHRONIC GASTRITIS AND STOMACH CANCER. (It.) Camarri, E. (Civil Hosp. Grosseto, Italy), L. Zaccherotti and E. Fanteria. *Rec Prog Med (Roma)* 51(2):144-158, 1971.

Morphologic changes induced in the mucous membrane by chronic atrophic gastritis (CAG); the relationship between pernicious anemia, achlorhydria and stomach cancer; and recent discoveries bearing on the development of CAG are reviewed. Of 150 CAG patients under treatment and observation at the Medical Clinic of Siena from 1961 to 1967, 48 died; five died from malignant neoplasms of the stomach. Of these, two had manifested clinical symptoms of cancer upon admission and both died within a year. The remaining three (2% of the total) died after two, five, and six years; biopsy confirmed CAG. Abnormalities in the mucous membrane including metaplastic changes (intestinal pseudometaplasia) occur frequently in CAG, but such changes occur also in a substantial number of cases of gastritis with a nonmalignant course. The finding that stomach cancer develops in the area of the glandular collum, where cells take part in regenerative processes of the mucous membrane, may show a causal relationship between CAG and stomach cancer. The same applies to hyperplastic structures in the

mucous membrane which can lead to cancer by an intermediate stage of adenomatous polyps which frequently become malignant. The high incidence of gastric cancer among pernicious anemia patients is attributed to the histological alterations (hyperplasia, atrophy, adenomatous polyps) of the gastric mucosa occurring in the course of this hemopathy. Histamine-resistant achlorhydria is a functional condition, frequent in both CAG and gastric cancer patients. But gastric cancer is often accompanied by normal hydrochloric acid secretion as well. Available evidence does not seem to substantiate the claim that CAG is a precancerous state. However, it precedes development of malignant gastric neoplasia in a certain number of cases. Gastric cancer can develop for unknown reasons at any age, no matter whether the mucosa secretes hydrochloric acid normally or abnormally.

- 3950 ULTRASTRUCTURAL SITE OF ATPase ACTIVITY IN THE MOUSE HEPATOMA CELL CYTOPLASMIC MEMBRANES. (Rus.) Petrunyaka, V. V. (Inst. Exp. Clin. Oncol., Moscow, USSR), N. T. Raikhlin, N. A. Filippova and L. V. Ol'shevskaya. *Vop Onkol* 17(12):57-63, 1971.

The effect of cell differentiation on ATPase activity in the cytoplasmic membrane was studied in Gel'shtein's minimal mouse hepatoma 46 and anaplastic hepatoma 22^a; normal liver cells in C3HA mice were used as controls. A modification of Wachstein and Meizel's method was used to determine ATPase. In normal liver tissue fixed with 5% glutaraldehyde maximum ATPase activity was found in microvilli of the bile capillaries, while little activity was present in microvilli of Disse's spaces, and no activity was observed in smooth parts of the membrane. When fixed with 2.5% glutaraldehyde, however, a marked increase occurred in ATPase in the microvilli of Disse's spaces and the activity in smooth parts of the membrane was as great as that in microvilli of the bile capillaries. This difference in results is attributed to the almost complete inhibition of Na⁺-K⁺-ATPase by 5% glutaraldehyde. However, hepatomas were fixed only with 5% glutaraldehyde and were therefore compared with normal liver fixed in 5% glutaraldehyde. In hepatoma 46, ATPase activity was highest in the microvilli of the bile canaliculi and smooth parts of the membrane and was low in Disse's spaces. This is apparently because of Mg⁺⁺-dependent ATPase activity which was not observed in normal liver tissue. In most cells of hepatoma 22^a there was no ATPase activity at all or the activity was spread over all parts of the membrane, while in a small number of cells the ATPase activity was high along the entire perimeter. There was no correlation between the extent of structural dedifferentiation and the site of ATPase activity; ATPase activity could occur at any site in the cytoplasmic membrane with equal probability. It is concluded that as hepatoma cells undergo dedifferentiation, ATPase activity becomes increasingly less associated with specific sites in the cytoplasmic membrane.

- 3951 EVALUATION OF THE OVARIAN FUNCTION IN PRE-CANCEROUS CONDITIONS OF THE UTERUS. (Rus.) Gataullin, K. D. (S. V. Kurashov Med. Inst. Kazan, USSR). *Kazan Med Zh* (2):59-62, 1972.
- 3952 ON THE ETIOLOGY OF SKIN CANCER. (Rus.) Baran, L. A. (Kiev Radiol. Oncol. Inst. USSR), I. F. Yunda and V. M. Sukhenko. *Vestn Derm Vener* (1):22-23, 1972.
- 3953 CHRONIC CICATRICIAL ULCERATION: A POTENTIAL CANCER SITE. (Fr.) Texler, M. (St. Louis Hosp., Paris, France) and J. Preaux. *Gaz Med France* 79(17):2849-2853, 1972.
- 3954 CYTOFLUOROMETRIC STUDY OF THE DNA CONTENT IN GASTRIC MUCOSAL SURFACE EPITHELIAL CELLS UNDER CONDITIONS OF ULCER AND CANCER. (Rus.) Vasilenko, V. Kh. (All-Union Res. Inst. Gastroent., USSR Min. Pub. Hlth., Moscow), Ye. D. Matyushina and S. I. Rapoport. *Biull Eksp Biol Med* 73(2):112-116, 1972.
- 3955 MALIGNANT TUMORS OF THE MESOPHARYNX. (Ger.) Hansen, D. (Otorhinolaryngol. Clin. U. Kiel, Germany) and U. Mahlberg. *Dtsch Med Wschr* 97(24):931-935, 1972.
- 3956 THE SO-CALLED CARCINOMA LOBULARE *IN SITU* OF THE BREAST. V. CONTRIBUTIONS TO THE PATHOLOGICAL HISTOLOGY OF THE BREAST. (Ger.) Hamperl, H. (Inst. Path. U. Bonn, Germany). *Krebsforsch* 77(3):231-246, 1972.
- 3957 STOCHASTIC MODEL FOR ABNORMAL CLONE SPREAD THROUGH EPITHELIAL BASAL LAYER. (E.) Williams, T. (Sch. Math., U. Bristol, England) and R. Bjerknes. *Nature* 236(5340):19-21, 1972.
- 3958 EPITHELIOID SARCOMA. A LIGHT AND ELECTRON MICROSCOPIC STUDY SUGGESTING A SYNOVIAL ORIGIN. (E.) Gabbiani, G. (Coll. Phys. Surgeons, Columbia U., New York, N.Y.), Y.-S. Fu, G. I. Kaye, J. Lattes and G. Majno. *Cancer* 30(2):486-499, 1972.
- 3959 EPITHELIAL NATURE OF SPINDLE-CELL THYMOMA. AN ULTRASTRUCTURAL STUDY. (E.) Levine, M. D. (Stanford U. Sch. Med., Calif.) and K. G. Jenness. *Cancer* 30(2):500-511, 1972.
- 3960 ULTRASTRUCTURE OF A SCLEROSING HEMANGIOMA OF THE LUNG. (E.) Haas, J. E. (U. Pittsburgh Sch. Med., Pa.), E. J. Yunis and R. S. Gotten. *Cancer* 30(2):512-518, 1972.
- 3961 PRIMARY RENAL VEIN LEIOMYOSARCOMA. (E.) Bhatena, D. (U. Kentucky Med. Ctr., Lexington) and M. Vazquez. *Cancer* 30(2):541-544, 1972.
- 3962 OBSERVATIONS ON BENIGN MESOTHELIOMA OF THE GENITAL TRACT (ADENOMATOID TUMOR). A COMPARATIVE ULTRASTRUCTURAL STUDY. (E.) Ferenczy, A. (Coll. Physicians Surgeons, Columbia U., New York, N.Y.), J. Fenoglio and R. M. Richart. *Cancer* 30(1):244-260, 1972.
- 3963 THE ROLE OF LYMPHATIC OBSTRUCTION IN THE FORMATION OF ASCITES IN A MURINE OVARIAN CARCINOMA. (E.) Feldman, G. B. (Harvard Med. Sch., Boston, Mass.), R. C. Knapp, S. E. Order and S. Hellman. *Cancer Res* 32:1663-1666, 1972.
- 3964 CELL PROLIFERATION IN THE 'PRELEUKAEMIC' PHASE OF ACUTE LEUKAEMIA. A CYTOPHOTOMETRIC AND AUTORADIOGRAPHIC STUDY. (E.) Queisser, U. (Int. Med. Pediat. Ctr. U. Ulm, Germany), A. Olischläger, W. Queisser and H. Heimpel. *Acta Haematol* 47:21-32, 1972.

See also:

- * (Rev): 3603, 3618, 3641
- * (Chem): 3680, 3688, 3695
- * (Phys): 3732

- 3965 A MORPHOMETRIC ANALYSIS OF HUMAN BREAST CARCINOMA. (E.) Underwood, J. C. E. (Dept. Path., Sheffield U., England). *Brit J Cancer* 26(3):234-237, 1972.

A morphometric procedure was devised to determine the volumetric cellular composition of human breast carcinoma. Ten surgical specimens of scirrhous carcinomas and two of medullary carcinoma of the breast were selected. An equatorial slice passing close to the center of the tumor was fixed and blocks of tumor were sliced, stained with hematoxylin and eosin, and the percentage volume of tumor cells was estimated morphometrically by point counting. The mean tumor cell volume of the scirrhous carcinomas was 287.6 mm^3 (range $10.5-845 \text{ mm}^3$), or 21.5% (range 3.9 to 39.4%) of the total volume of the neoplasm. The medullary lesions had a mean tumor cell volume of 417 mm^3 (range 342 to 492 mm^3), 64.5% (range 54.3 to 76.4%) of the total volume of the neoplasm. The main errors in volumetric analysis of tissues by morphometry were fixation-induced shrinkage and human error in identification of tumor cells. The wide range of total cell volume of scirrhous neoplasms was not entirely related to the size of the neoplasm; therefore, conclusions on the cellularity of breast tumors based solely on the size of the tumor are inadvisable.

- 3966 MALE MAMMARY CANCER: AN ANALYSIS OF 32 CASES. (E.) Crichlow, R. W. (Sch. Med., U. Pennsylvania, Philadelphia), E. L. Kaplan and W. H. Kearney. *Ann Surg* 175(4):489-494, 1972.

Thirty-two cases of male mammary cancer seen over a 25-year period (1940-1964) are described. Five of the 32 patients were Negroes; the rest were Caucasian. Sixteen tumors appeared in the right breast and 15 in the left breast. None of the patients had received hormone therapy prior to diagnosis of mammary cancer. The ages of patients ranged from 36-82 yr (mean = 60 yr). Twenty tumors appeared to be invasive ductal carcinoma; the degree of anaplasia varied from tumor to tumor and from one part of a tumor to another part. There were two Paget's carcinomas of the breast. Of 24 patients subjected to radical mastectomy, eight had axillary lymph node metastases. The survival rates at five and ten yr after diagnosis were 47% and 38%, resp. Although comparison between the sexes of prognosis in mammary cancer is hindered by the scarcity of data for men, the available data do suggest a poorer prognosis for men overall.

- 3967 CANCER MORTALITY: VITAL STATISTICS VERSUS CANCER REGISTRY. (E.) Steinitz, R. (Ministry Hlth., Jerusalem, Israel) and C. Costin. *Israel J Med Sci* 7(12):1405-1412, 1971.

Cancer mortality figures compiled by two Israeli agencies, the Central Bureau of Statistics (CBS) and the Israel Cancer Registry (ICR), for the years 1964 and 1965, were compared. Differences were expected between ICR and CBS figures since the

CBS cancer mortality figures were based on underlying cause of death only, while the ICR figures were based on the mortality of the population with cancer. The sum of cases reported as primary or unspecified liver cancer in the ICR tables was greater than the number reported by the CBS. Similar findings applied to uterine carcinoma. ICR data showed that the ratio of uterine cervix to uterine corpus cancer was 3:4. The CBS figures indicated a greater preponderance of corpus carcinoma. Cancer mortality as reflected by the ICR was generally higher than that reflected by the CBS. Some obstacles to the accumulation of complete and accurate cancer mortality data are discussed.

- 3968 IRRADIATION IN THE EPIDEMIOLOGY OF LEUKEMIA AMONG ADULTS. (E.) Gibson, R. (St. U. New York, Buffalo), S. Graham, A. Lilienfeld, L. Schuman, J. E. Dowd and M. L. Levin. *J Nat Cancer Inst* 48(2):301-311, 1972.

The association of diagnostic X-irradiation and increased leukemia risk was studied in a survey of 1,414 adults who had died of leukemia or who suffered from diagnosed leukemia. The cases were from 26 upstate New York counties and the Baltimore and Minneapolis-St. Paul areas. There were 1,370 controls. In all cases details of X-ray exposure by site and numbers of films were taken from hospital records. Increased risks associated with irradiation were found only for acute myeloid and monocytic leukemia. Males with 41 or more X-ray films to all sites and especially to the "trunk" (i.e., thorax, abdomen and pelvic area) showed greater risks of leukemia compared to patients with fewer exposures. The risks for more and less exposed patients were 5.06 and 2.34, resp. No correlation of myeloid leukemia risk and radiation was found for females. As the numbers of X-ray films in males increased the relative risk of myeloid leukemia increased also. Neither irradiated males nor females had increased risks for any other leukemia type. The results indicated that, while small, the proportion of leukemia cases attributable to diagnostic irradiation is important. Still, most patients given irradiation do not develop leukemia.

- 3969 CANCER MORTALITY AND IMMIGRATION TO ISRAEL, 1950-67. (E.) Halevi, H. S. (Tel Aviv U. Med. Sch., Israel), F. Dreyfuss, E. Peritz and U. O. Schmelz. *Israel J Med Sci* 7(12):1386-1404, 1971.

Figures on cancer mortality among Israelis are presented; the data were compiled by the Israeli Central Bureau of Statistics and cover the period 1950-1967. For both sexes and for all sites, the lowest mortality rates were seen among Israelis born in Asia and Africa. The age of onset of stomach and prostate carcinoma and of leukemia was greater in Israelis born in Israel than among those born elsewhere. Mortality rates for lung neoplasms and intestinal neoplasms except rectal neoplasms increased throughout the data period. Mortality from stomach tumors and from rectal cancers in males declined during the data

period. A steep decrease in mortality rates was seen for rectal cancer among men and women born in Asia and Africa. Mortality curves for carcinoma of most sites did not show any clear and well-defined trend. Overall cancer mortality increased markedly among Israelis born in Iraq as compared to mortality among Israelis born in Yemen, among whom overall cancer mortality decreased slightly. Leukemia mortality was much higher among European and American-born Israelis over 25 yr than among those born in Asia and Africa.

- 3970 CANCER IN JEWISH IMMIGRANTS. (E.)
Steinitz, R. (Ministry Hlth., Jerusalem, Israel) and C. Costin. *Israel J Med Sci* 7(12):1413-1436, 1971.

Data on cancer morbidity from the Israeli Central Bureau of Statistics were analyzed and five-yr age-specific incidence rates for cancers of various sites among Israelis were established. A total of 31,194 newly diagnosed cancer cases were covered by the data, which dealt with the period 1960-1966. Extremely high rates for many cancers were found for Israeli Jews from Eastern and Central Europe, while extremely low rates were seen among Yemeni and Iranian Jews. The latter groups, however, had high rates of esophageal cancer. High rates for stomach cancer were seen among Israelis from all nations except Yemen and Iraq. Stomach cancer was most prevalent among Jews from Eastern Europe. Lung cancer had its highest incidence among Jewish male Israelis from Greece, Bulgaria and Turkey. Yemeni Israelis had low lung cancer rates. Yemenites were also conspicuous for their low morbidity from mammary carcinoma. Israeli Jews from northwest Africa had high rates for cervical cancer. The Israeli population generally appeared to have a high rate for leukemia and lymphoma.

- 3971 MENOPAUSE AND BREAST CANCER RISK. (E.)
Trichopoulos, D. (Harvard Sch. Public Hlth., Boston, Mass.), B. MacMahon and P. Cole. *J Nat Cancer Inst* 48(3):605-613, 1972.

Age at menopause and type of menopause from hospital records of breast cancer patients were compared with similar information reported by a national probability sample of women. The cancer series consisted of 3,887 patients selected from those reported to the Connecticut Cancer Registry between 1950-1959. The national sample comprised 3,581 women responding to the National Health Examination Survey of 1960-1962. The validity of the comparison and the effect of the relatively large number of breast cancer patients whose menopause histories were deficient were evaluated; no substantial bias was identified. Overall, surgically induced menopause was associated with a reduction in breast cancer risk to about 60% of that experienced by women having natural menopause at ages 45-54. The decrease was greatest for those with menopause induced before age 45, but induction up to age 50 was protective. Among

women with menopause induced before age 35, breast cancer risk remained as low as one-third that expected 30 and more years later. Relative risk of breast cancer increased with age at natural menopause. Women with natural menopause at age 55 or older had twice the risk experienced by those whose menopause occurred before age 45. The relative risk of breast cancer associated with late natural menopause was greatest after age 70. These findings illustrate the long period which may elapse between etiologic events and the appearance of human cancer; and they imply that the ovarian etiology of human breast cancer is not restricted to cancers appearing during the years of active ovarian function.

- 3972 MALIGNANT TROPHOBLASTIC DISORDERS. EPIDEMIOLOGIC ASPECTS AND RELATIONSHIP TO HYDATIDIFORM MOLE. (E.) Matalon, M. (Tel Hashomer Government Hosp., Israel), B. Paz, M. Modan and B. Modan. *Am J Obst Gynecol* 112(1):101-106, 1972.

Records of all women with newly diagnosed choriocarcinoma and chorionadenoma destruens in Israel between 1950-1965 were reviewed. The mean annual incidence of malignant trophoblastic disorders (MTD) was 1:15,000 live births in Jewish women. Incidence was similar in all age groups below 40 yr, with a sharp rise subsequently; this is in contrast to Puerto Rico where an increased incidence in the under-20 age group was observed as well. Birth rank had no effect on MTD incidence, and the only difference among ethnic groups was a higher incidence in European-born women above age 45. In women with a history of hydatidiform mole, the risk of developing MTD declined from 21.8% in 1950-1954 to 4.4% in 1960-1965. The decline is attributed to earlier recognition and better treatment of hydatidiform mole.

- 3973 CARCINOMA OF THE CERVIX IN JEWISH WOMEN IN ISRAEL, 1960-67: AN EPIDEMIOLOGICAL STUDY. (E.) Pridan, H. (Dept. Social Med., Hadassah U. Hosp., Jerusalem, Israel) and A. M. Lilienfeld. *Israel J Med Sci* 7(12):1465-1470, 1971.

The life habits of Israeli Jewish women with carcinoma of the cervix (index group) were compared with those of a matched group of Jewish women suffering from a non-malignant gynecological condition and with those of a matched group from the general population. Of a total of 452 cases of cervical carcinoma reported to the Cancer Registry from 1960 to 1967, 222 were included in the index group. No differences were seen between the index group and the control groups in geographic origin, population of birthplace, average number of cities lived in, education, degree of orthodoxy of religion, number of pregnancies, number of abortions, median age of menarche, frequency of intercourse, total period of sexual relations, or social class. Index women, however, tended to immigrate to Israel later than did the women in the control groups. Index cases also

commenced sexual relations earlier and had more sexual partners than women in the control groups. More index women had been widowed or divorced. Although the incidence of herpes type 2 infections was higher in index women (38.4%) than in the general population controls (12.8%), the incidence in the gynecological controls was the highest (51.5%). The husbands of women in the index group tended to have had a greater number of sexual partners than had the husbands of women in either control group. This finding seems to strengthen the possibility of the operation of an infective agent in the etiology of carcinoma of the cervix uteri.

- 3974 HIGH INCIDENCE OF GASTRIC CARCINOMA IN A COAL MINING REGION. (E.) Matolo, N. M. (U. Utah Coll. Med., Salt Lake City), M. R. Klauber, W. M. Gorishek and J. A. Dixon. *Cancer* 29(3):733-737, 1972.

An epidemiologic study was conducted from January 1965 to December 1969 to determine the incidence of gastric cancer in Carbon and Emery Counties, Utah, the only coal-mining regions in the state. Fifty-nine percent of male patients in the two counties were coal miners. The age-adjusted gastric cancer incidence in the miners was at least three times that of nonminers and at least eight times that of males in counties with no coal mining. The increased risk for females in Carbon and Emery Counties was not statistically significant, but the increased risk in males was highly significant compared to other Utah males. All homes of gastric cancer patients in Carbon and Emery Counties were heated with coal, and in some of the homes coal was used for cooking. It is concluded that coal mining in the area and, to a lesser degree, the extensive use of soft coal might be etiologic factors. If coal smoke particles reach the stomach, gastric carcinoma could be induced by benzo(a)pyrene and its related carcinogens.

- 3975 RELATION BETWEEN CANCER AND CONGENITAL MALFORMATIONS. THE VALUE OF SMALL SERIES, WITH A NOTE ON PINEAL TUMORS IN NATIVE AND MIGRANT JAPANESE. (E.) Miller, R. W. (Nat'l. Cancer Inst., Bethesda, Md.). *Israel J Med Sci* 7(12):1461-1464, 1971.

Definitive evidence of a relationship between specific cancers and congenital malformations usually requires study of hundreds of cases of a particular cancer or dozens of a rare anomaly with very high risk of cancer. Associations between Down's syndrome and leukemia, congenital hemihypertrophy or congenital aniridia and Wilm's tumor, and between Bloom's syndrome and acute myelogenous leukemia or squamous cell carcinoma of the tongue were discovered using this approach. However, when the population of an area is small, there may be difficulties in obtaining large enough numbers of cases for epidemiologic study. A useful method in these cases is to find

two or three patients or families with a previously unsuspected association involving a congenital malformation and cancer and to test this association elsewhere epidemiologically. For example, Good and his colleagues developed their concept of immunosurveillance from laboratory observations and human data on eight cases of ataxia-telangiectasia with lymphoma, three of Wiskott-Aldrich syndrome with lymphoreticular neoplasia and three of X-linked agammaglobulinemia with acute lymphocytic leukemia. Sophisticated laboratory procedures are also being used to explore the connection between oncogenesis and teratogenesis as they occur together in certain persons or families. In this manner, an association between Fanconi's anemia and the enhanced transformability of the patients' cultured skin fibroblasts by SV40 was discovered. It is also possible, even in small populations, to demonstrate rare associations in a subpopulation. In a recent study, the high incidence of pineal tumors in Japanese migrants to Hawaii was discovered. This finding substantiated the previously published claim of a high incidence of pineal tumors in native Japanese.

- 3976 MORTALITY FROM MALIGNANT TUMOURS IN THE CITY OF KAZAN IN 1960-1970. (Rus.) Kashtanov, N. F. (No affiliation). *Kazan Med Zh* (2):82-83, 1972.

- 3977 ENVIRONMENTAL FACTORS OF LEUKEMIA MORBIDITY. (Pol.) Janicki, K. (Krakow Acad. Med., Poland). *Pat Pol* 23(1):29-48, 1972.

- 3978 MULTIPLE PRIMARY MALIGNANT NEOPLASIA. (EPIDEMIOLOGICAL STUDY OF 378 CASES ACCORDING TO DATA COLLECTED FROM A TUMOR REGISTRY). (It.) Cappa, A. P. M. (Piemonte and Valle D'Aosta Tumor Registry, Torino, Italy), E. Anglesio and M. Panero. *Cancro* 24(1):25-53, 1971.

- 3979 UTERINE CERVIX CANCER *IN SITU*: STATISTICAL STUDY. (Sp.) Carreras Ruiz, O. (Oncol. Hosp. Santiago, Cuba). *Rev Cub Med* 10(4):395-406, 1971.

- 3980 RATE OF GROWTH OF SOFT TISSUE METASTASES OF BREAST CANCER. (E.) Lee, Y.-T. N. (Ellis Fischel St. Cancer Hosp., Columbia, Mo.) and J. S. Spratt, Jr. *Cancer* 29(2):344-348, 1972.

- 3981 INHIBITION OF CHEMICALLY INDUCED NEOPLASIA BY IMMUNIZATION WITH AN ANTIGENIC CARCINOGEN-PROTEIN CONJUGATE. (E.) Peck, R. M. (Inst. Cancer Res, Philadelphia, Pa.) and E. B. Peck. *Cancer Res* 31:1550-1554, 1971.

3982 KAPOSI'S SARCOMA IN THE BANTU OF MOZAMBIQUE.
(E.) D'Oliveira, J. J. G. (Hosp. Miguel
Bombarda, Mozambique, Portuguese, East Africa) and
F. O. Torres. *Cancer* 30(2):553-561, 1972.

3983 ORBITO-OCULAR TUMORS IN NIGERIA. (E.)
Olurin, O. (U. Ibadan, U. Coll. Hosp.,
Nigeria) and A. O. Williams. *Cancer* 30(2):580-587,
1972.

3984 CROSSING OF THE MORTALITY CURVES FOR STOMACH
AND PANCREATIC CARCINOMA. (E.) Krain,
L. S. (UCLA Med. Ctr., Los Angeles, Calif.).
Int Surg 57:307-310, 1972.

See also:

* (Rev): 3612, 3619, 3636, 3639
* (Path): 3939, 3964

- 3985 MECHANISMS OF METASTASIS: AN ULTRASTRUCTURAL STUDY ON THE RELATIONSHIP BETWEEN VASCULATURE AND NEOPLASTIC CELLS ORIGINATING IN THE MASTOMYS STOMACH. (E.) Tazawa, K. (Niigata U. Sch. Med., Japan). *Acta Medica Biol* 18(4):219-248, 1971.

To determine the relationship of migrating neoplastic cells to the endothelium and the basement membrane of the vascular system, ultrastructural studies were performed on 27 histologically proven malignant epithelial neoplasms developing spontaneously in the glandular stomachs of 21 mastomys aged 14-30 months and weighing 45-90 g. Changes similar to those observed in inflamed vessels were found in the small vasculatures in the neoplastic tissue. The basement membrane on the side of the vascular vessels was often well-preserved, but occasionally showed focal disruption at the points of the "hooking" of neoplastic projections. Resistance of the membrane to invading neoplastic cells was unexpectedly high. In areas of erythrocytic extravasation, free endothelial cells were sometimes attached to the invading neoplastic cells. It is postulated that differences in the biologic features of two types of neoplastic cells, the solid form and the free ascitic form without preserved basement membrane, may be important factors in vascular invasion by neoplastic cells.

- 3986 HYDROLASE ACTIVITY FOR N-SUBSTITUTED AMINOACYL-tRNA IN RIBOSOMES AND SUPERNATANT FRACTIONS FROM HUMAN TISSUES AND TUMORS. (Ger.) Neth, R. (U. Pediat. Clin. Polyclin., Hamburg, West Germany), N. Dunlop, G. Heller-Schöch, G. Schöch, and K. Winkler. *Hoppe Seylers Z Physiol Chem* 353:117-121, 1972.

Activities and characteristics of hydrolase activity are described for N-substituted aminoacyl-tRNA (aa-tRNA) in ribosomes and supernatant fractions of human tonsils, spleens, tumors, normal and leukemic leukocytes, and rat tissue and rat tumors. The "non-specific fragmentation reaction without puromycin" in observed ribosomes from spleen and tumors may be due to contamination with foreign proteins, which have a high hydrolase activity for N-substituted aa-tRNA. High hydrolase activity was found in the supernatant fractions of human spleen, leukocytes, adenocarcinomas, and paramyeloblasts as well as in rat spleen, kidneys and lungs, upon centrifugation at 100,000 x g. In these supernates, there are extreme differences in hydrolase activities. The reason is the varied tRNA content of these organs, the hydrolase being inhibited by unloaded tRNA. The function of this enzyme is probably the hydrolysis of peptidyl-tRNA, inadvertently released from a peptide chain. The difference in hydrolase activity between paramyeloblasts and paraproerythroblasts is of particular interest in the biochemical supplement to the cytochemical studies in leukemia.

- 3987 NUCLEIC ACID CONTENT IN CELL NUCLEI OF THE HUMAN LIVER AND SPLEEN IN VARIOUS FORMS OF LEUKEMIA. (Rus.) Drel', K. A. (Donetsk Med. Inst., Donetsk, USSR) and S. A. Veksler. *Vop Med Khim* 17(6):632-634, 1971.

Nucleic acid levels in cell nuclei of the livers and spleens of 42 patients who died of leukemia and 19 healthy people who died accidentally were determined spectrophotometrically. In nuclei of liver cells the RNA level decreased 20-30% in hemocytoblastosis, myelogenous leukemia, and lymphocytic leukemia but increased 17% in reticulum cell sarcoma. DNA levels in liver nuclei decreased greatly in leukemia (66% in hemocytoblastosis, 35% in myelogenous leukemia and 40% in lymphocytic leukemia), but decreased slightly in reticulum cell sarcoma. Nucleic acids in spleen cell nuclei decreased in both forms of leukemia (52% in reticulum cell sarcoma and 50% in lymphocytic leukemia). RNA decreased 48% in lymphocytic leukemia and 38% in reticulum cell sarcoma. Morphologically, hyperplastic cell growth and lymphocytic leukemic infiltrates were observed in both organs. The decreases in RNA and DNA are due to cell proliferation and hyperplasia in leukemia. In addition to cells undergoing mitosis, there is a large number of long-living cells which are unable to differentiate and mature, divide, and synthesize DNA.

- 3988 PROTEIN METHYLASES IN HEPATOMAS. (E.) Paik, W. K. (Temple U. Sch. Med., Philadelphia, Pa.), H. W. Lee and H. P. Morris. *Cancer Res* 32(1):37-40, 1972.

Levels of various protein:S-adenosyl-L-methionine methyltransferases were examined in solid hepatomas with various growth rates. Protein methylase I (protein-arginine:S-adenosyl-L-methionine methyltransferase) activity in tumors roughly paralleled tumor growth rate. The enzyme activity in the host

liver was significantly elevated in animals bearing both a slow-growing and a fast-growing hepatoma but otherwise remained in the normal range. Protein methylase II (protein-carboxyl:S-adenosyl-L-methionine methyltransferase) activity in both tumors and host livers showed no significant change from normal rat liver. Protein methylase III (protein-lysine:S-adenosyl-L-methionine methyltransferase) decreased with decreasing rate of growth of tumors; in a fast-growing Novikoff hepatoma, it was approximately two to three times higher than that of normal rat liver. The activity in host livers was essentially the same as for the normal rat liver. These results suggest that methylation of the guanidino group of arginine, which is particularly abundant in histone, might have some important specific role in neoplastic growth.

- 3989 HISTOENZYMATIC CHARACTERISTICS OF HUMAN LARYNGEAL CANCER. (Rus.) Avtandilov, G. G. (Inst. Human Morphol., Moscow, USSR), I. S.

Kruglova and L. I. Avtandilova. *Vop Onkol* 18(3): 28-31, 1972.

A comparative microspectrophotometric study was made of enzymatic activity of slices from squamous-cell carcinomas of the larynx and quantitative changes in the oxidative enzymes in the neoplasms after radiation therapy. Larynxes, either partially or completely resected, from 14 male patients over 45 yr old were studied. Five of them received radiation therapy (6000-10000 r) preoperatively. Glutamate dehydrogenase and cytoplasmic α -glycerophosphate dehydrogenase were determined by a modified version of the Rubinstein-Klatzo-Miquel method; mitochondrial α -glycerophosphate dehydrogenase and succinate dehydrogenase were determined by the method of Nachlas *et al.* The activity of glutamate dehydrogenase varied in different layers of the squamous cell epithelium of intact sections of the mucous membrane, being highest in the cytoplasm of cells in the growth layer and lowest in the prickle-cell layer. The activities of glutamate dehydrogenase and succinate dehydrogenase in parts of the tumor where growth was submerged were three times higher and the cytoplasmic α -glycerophosphate dehydrogenase was four times higher than in the multilayered squamous epithelium of the laryngeal mucosa. These findings indicate that the rate of lipid metabolism is increased in the multilayered squamous-cell epithelium of the larynx in patients with laryngeal cancer. In cells of the growing tumor the rate of protein synthesis is increased, as are carbohydrates taking part in α -glycerophosphate synthesis. Mitochondrial α -glycerophosphate dehydrogenase was decreased by 15%. There was a sharp decrease in the activities of glutamate-succinate dehydrogenase and cytoplasmic α -glycerophosphate dehydrogenase in the cylindrical cells of the epithelium after radiation.

3990 COLLAGENOLYTIC ENZYMES IN HUMAN NEOPLASMS.
(E.) Dresden, M. H. (Baylor Coll. Med., Houston, Texas), S. A. Heilman and J. D. Schmidt. *Cancer Res* 32(5):993-996, 1972.

A variety of human tissue specimens were examined for their ability to produce collagenolytic enzymes in culture. Basal and squamous cell carcinomas, keratocanthomas, and carcinomas of the colon demonstrated a very high frequency of collagenolytic activity. Nonmalignant skin lesions, i.e., actinic and seborrheic keratoses, normal skin, and neoplasms of mesenchymal origin only rarely produced collagenase. Basal cell, squamous cell, colon, and endometrial carcinoma enzymes were isolated and purified. The tumor collagenases degraded soluble native collagen into tropocollagen fragments (75% TC_A and 25% TC_B), showed maximum activity at neutral to alkaline pH, and were inhibited by EDTA, cysteine, and pooled human sera. These results indicate that collagenolytic enzymes from human neoplasms and normal human skin are similar.

3991 PTERIDINE AND RIBOFLAVIN IN TUMOR TISSUE AND THE EFFECT OF CHLORAMPHENICOL AND

ISOXANTHOPTERIN. (E.) Kokolis, N. (Dept. Gen. Biol., U. Athens, Greece), N. Mylonas and I. Ziegler. *Z Naturforsch* 27(3):292-295, 1972.

The results of injection experiments to determine the effects of chloramphenicol and isoxanthopterin on tumor growth and on tetrahydrobiopterin/isoxanthopterin (TH/IX) and tetrahydrobiopterin/riboflavin (TH/RB) ratios in human skin tumors and mouse submaxillary glands are reported. Male and female Wistar rats weighing between 200-250 g were injected s.c. with 80×10^6 T-8 Guerin human cancer cells. Isoxanthopterin injections at 3 μ g/g body wt were made i.p. every 12 hr for ten days; chloramphenicol at 200 μ g/g body wt was injected i.p. every six hr for ten days. Rats receiving both drugs showed delayed tumor growth and longer survival times than untreated rats. The delay in tumor growth and the increase in life time were the most marked after isoxanthopterin injection. The submaxillary glands contained 0.760 μ g riboflavin and 0.330 μ g TH; the human skin tumors contained 1.490-2.530 μ g TH and 0.270-0.330 μ g riboflavin. TH was also found accumulated in the transplanted growing tumors. Isoxanthopterin was not present in human tumor tissue or submaxillary glands. Decreased xanthinoxidase activity is presumably involved in the high TH/IX and/or TH/RB ratios characteristic of tumor tissue and regeneration blastema. Thus the regulation of this enzyme could be an important factor in neoplastic growth.

3992 THE RELATIONSHIP BETWEEN SYNTHESIS AND METHYLATION OF DNA IN MOUSE FIBROBLASTS.
(E.) Adams, R. L. P. (Dept. Biochem., U. Glasgow, Scotland). *Biochim Biophys Acta* 254(2):205-212, 1971.

Studies on the *in vivo* methylation of DNA in cultured mouse L cells confirm the presence of a distinct lag between synthesis of DNA and its methylation. To determine the lag period, mouse L cells subcultured from the stationary phase were synchronized by treatment with aminopterin for 16 hr. This treatment extends the growth period before DNA synthesis starts. The block in DNA synthesis induced by aminopterin was reversed by thymidine; the DNA made at different points in the synthesis (S) phase was then investigated by incubating the synchronized cells with 5-bromodeoxyuridine. The DNA made in the first hr of S was more extensively methylated than that made later in the S phase. Moreover, methylation of this early DNA was completed very soon after synthesis. This was in contrast to the DNA made between two and three hr of S phase and particularly to the DNA made between four and five hr of S phase. The significance of these observations is unclear. The function of methyl groups in 5-methylcytosine in DNA is unknown, but the evidence does not support a role for DNA methylation in the determination of which genes are to be transcribed.

3993 STUDY OF THE PRODUCTION OF ALPHA-1-FETO-PROTEIN (FP) DURING THE DEVELOPMENT OF

PRIMARY CANCER OF THE LIVER: 83 CASES. (Fr.) Sankalé, M. (Med. Fac., Dakar, Senegal), R. Masseyeff, P. Teyssier and L. Leblanc. *Arch Franc Mal Appar Dig* 60(12):615-628, 1971.

Both qualitative and semi-quantitative determinations of α_1 -fetoprotein (α_1 -FP) were made on 83 African patients (64 men and 19 women). Liver cancer was confirmed, either by autopsy or biopsy, in 47 of these 83 patients. Clinical forms of liver cancer diagnosed were hepatomegaly (56 cases), cirrhotic (14 cases), pseudosuppurative (4 cases), and protracted in which the patient survived for more than six months (9 cases). Associated diseases included polyarthritis (1/83), polycythemia (2/83), hypoglycemia (6/83), and hypercholesterolemia (11/83). Histological examinations, made on 27 patients, showed that 15 had trabecular hepatocellular cancer, one had mixed trabecular and vesicular hepatocellular cancer, nine had unidentified hepatocellular cancer, one had anaplastic cancer, and one had mixed cholangiocellular and hepatocellular cancer. No correlations were found between the presence or titer of α_1 -FP and the sex, age, geographic origin, ethnic origin, clinical form, or histological class of cancer. Of the 11 patients with hypercholesterolemia, eight produced α_1 -FP (72.7%). However, there were not enough patients in this group to draw any definite conclusions. Determinations of α_1 -FP were made at least three times on 30 patients with liver cancer. In 10/11 patients with negative findings, no change occurred during the course of the disease. In the 19 patients who secreted α_1 -FP, little or no change occurred in the level of this protein during the course of the disease.

3994 LIVER BIOPSY IN HODGKIN'S DISEASE. CLINICOPATHOLOGIC CORRELATIONS IN 127 PATIENTS. (E.) Bagley, C. M., Jr. (Nat'l. Cancer Inst., Bethesda, Md.), J. A. Roth, L. B. Thomas and V. T. Devita, Jr. *Ann Intern Med* 76(2):219-225, 1972.

Liver biopsy sections in 127 patients (89 previously untreated) with Hodgkin's Disease (HD) were classified for the presence of Reed-Sternberg cells and other cellular infiltrates and abnormalities. The histologic findings were then correlated with clinical and laboratory findings in each patient. In the 20 patients with positive biopsies (eight untreated and 12 previously untreated), atypical reticulum cells were seen in association with Reed-Sternberg cells in the portal triads involved with HD. In the 89 previously untreated patients, there was no correlation between the absence of infiltrates or the presence of mononuclear or mixed cell infiltrates and other histologic or clinical variables, including symptoms, liver size, stage of nodal disease, liver function tests, Lukes-Butler class, eosinophil count, or prognosis. When these patients were classified by extent of nodal disease, more extensive disease showed significant correlations with fever, weight loss, liver enlargement, and mixed cellularity Lukes-Butler classification. Alkaline phosphatase and sulfobromophthalein tests were of

little value in predicting positive findings. Like mononuclear and granulocytic infiltration and hepatomegaly, alkaline phosphatase elevation and increased sulfobromophthalein retention may be nonspecific hepatic reactions to the presence of HD elsewhere in the patient. However, patients with splenomegaly had a high risk of liver involvement. The frequency of positive biopsies was approximately doubled by performing a laparotomy or peritoneoscopy when a percutaneous biopsy was negative.

3995 ENHANCEMENT BY INTERFERON OF THE SPECIFIC CYTOTOXICITY OF SENSITIZED LYMPHOCYTES. (E.) Lindahl, P. (Inst. Cancer Res., Villejuif, France), P. Leary and I. Gresser. *Proc Nat Acad Sci USA* 69(3):721-725, 1972.

The effect of interferon preparations on the cytotoxicity of sensitized lymphocytes for allogeneic target cells was examined. C57BL/6 mice were injected i.p. with 5×10^7 mouse lymphoid leukemia L 1210 cells; splenic lymphocytes were obtained from immunized or normal C57BL/6 mice. L 1210 cells, an interferon-resistant subline of L 1210 cells (L 1210-R), and Ehrlich ascites cells were the target cells. Mouse, human, and rabbit interferon preparations were tested on mouse L-, monkey BSC-, and rabbit RK13 monolayer cell cultures, resp. Splenic lymphocytes from C57BL/6 mice immunized with allogeneic L 1210 cells lysed ^{51}Cr -labeled L 1210 target cells readily within six hr of incubation. This specific cytotoxicity was markedly increased when the sensitized lymphocyte suspensions were first treated with mouse interferon preparations. Interferon was shown to act on the sensitized lymphocytes and not on the target cells; specific cytotoxicity was enhanced by all mouse interferon preparations tested. Control immune lymphocytes and interferon-treated immune lymphocytes were not cytotoxic for Ehrlich ascites target cells. Splenic lymphocytes from nonimmunized C57BL/6 mice were not cytotoxic for L 1210 target cells and prior interferon treatment did not make them cytotoxic. The results indicate that interferon enhances a specialized cellular function in addition to its inhibition of viral multiplication and inhibition of cell division.

3996 GLYCOGEN METABOLISM IN REGENERATING LIVER AND LIVER NEOPLASMS. (E.) Lea, M. A. (Coll. Med. Dent. New Jersey, Newark), P. Murphy and H. P. Morris. *Cancer Res* 32(1):61-66, 1972.

Glycogen levels in mice and rat livers were examined after partial hepatectomy to determine if an inverse correlation exists between glycogen concentration and growth rate of hepatic tissues. Maximum DNA synthesis occurred later after partial hepatectomy in mouse liver than in rat liver, and there was a similar delay in maximum glycogen depletion. The decline in activities of glycogen synthetase and phosphorylase did not parallel changes in glycogen concentration in the regenerating rat liver. The glycogen concen-

tration of two slowly growing tumors was greater than in the rapidly growing tumors examined. *In vitro* assays of tumor glycogen synthetase activity showed a decrease to less than 25% of the activity in normal or host liver. On addition of glucose 6-phosphate this change was less marked, and in the slowest growing hepatoma there was no significant difference in activity. Glycogen phosphorylase activity decreased in the hepatomas, but was stimulated by AMP; in the most rapidly growing tumor, AMP caused a doubling of the enzyme activity. Cysteine inhibited glycogen phosphorylase activity in the fast-growing tumor but increased the activity in the rat liver and the gastrocnemius muscle. Acid α -glucosidase activity was markedly increased in the fast-growing tumor though not in regenerating rat liver. It is concluded that glycogen metabolism in regenerating liver more closely resembles that in normal liver than in rapidly growing hepatomas.

3997 PYRIDINE-ADENINE DINUCLEOTIDE TRANSHYDROGENASE ACTIVITY IN CELLS CULTURED FROM RAT HEPATOMA. (E.) De Luca, C. (Sch. Dent., State U. New York, Buffalo) and R. P. Gioeli. *Canad J Biochem* 50(5):447-456, 1972.

Some characteristics of transhydrogenase (TH) activity found in *in vitro* rat hepatoma cell preparations are described. Cell line H4-II-E-C3 (H4 cells), derived from a minimal-deviation hepatoma, was used. TH activity measurement was based on the reduction of two specific analogues of NAD, the 3-acetylpyridine analogue (3AP-NAD) and the thionicotinamide analogue (TN-NAD), in the presence of reduced NAD and a cell preparation treated with digitonin. TH activity was first observed with crude H4 cell homogenates using Tris buffer at pH 8.6 and with TN-NAD as acceptor; addition of dithiothreitol (DTT) significantly increased the rate of transfer to the analogue. Digitonin treatment immediately exposed full enzyme activity. Storage half-life of TH activity in digitonin preparations was about 16-18 hr at 5°C. Both 3AP-NAD and NADH had typical Michaelis saturation curves, yielding apparent half-saturation values of 3.55×10^{-4} M and 9.87×10^{-6} M, resp. Maximum TH activity with 3AP-NAD as acceptor occurred at pH 5.8; Tris buffer caused 50-60% inhibition at pH 7.0-8.5. In the presence of DTT, a second area of optimum activity was seen between pH 8.0-9.0, thus reversing the Tris effect. Similar results were obtained with TN-NAD as acceptor. Addition of androsterone, ATP, or NAD at the start of the reaction, before addition of NADH, had an inhibitory effect in all cases. The observed stoichiometry led to the conclusion that hydrogen was transferred directly from NADH to 3AP-NAD.

3998 ACTIVITIES OF HEXOKINASE AND ASPARTATE- AND ALANINE AMINOTRANSFERASES IN TRANSPLANTED RAT SARCOMAS. (Rus.) Il'in, V. S. (S. M. Kirov Inst. Postgrad. Med., Leningrad, USSR) and P. Ya. Kovner. *Vop Med Khim* 17(6):644-649, 1971.

Activities of hexokinase and aspartate- and alanine-aminotransferases and changes in them induced by hydrocortisone were studied in three different transplanted rat sarcomas. Sarcomas M-1, 45, and Jensen sarcomas were inoculated s.c. into non-inbred white rats weighing 100-160 g. The activities of the enzymes in tumors were determined 7-9 and 15-16 days after inoculation. Hydrocortisone was administered s.c. (5 mg/100 g body weight daily for seven days), starting from the second day after inoculation. The animals were killed 24 hr after the last injection of hydrocortisone. Sarcomas M-1 developed rapidly, weighing 14.3 ± 2.5 g 7-9 days and 35.5 ± 3.68 g 14-16 days after inoculation; Jensen sarcomas developed slowly, weighing 6.71 ± 0.70 g and 22.7 ± 3.01 g, resp. The activity of hexokinase was highest in sarcoma M-1, being 40.2 ± 4.86 μ g/10 mg tissue/15 min after 7-9 days and 44.7 ± 3.31 after 14-16 days; its activity was lowest in Jensen sarcoma (21.8 ± 4.26 and 20.8 ± 3.60 , resp.). The activity of aspartate-aminotransferase was lowest in sarcoma M-1 (34.4 ± 1.53 μ g/mg tissue/hr) and highest in Jensen sarcoma (45.7 ± 3.44 μ g/mg tissue/hr). Thus, there is a direct relation between the tumor growth rate and hexokinase activity, while there is an inverse relation between the tumor growth rate and aspartate aminotransferase activity. The relation between alanine-aminotransferase activity and tumor growth rate was not clarified. Hydrocortisone caused decreases in body weight and inhibited the development of sarcomas. The weight decreased 15% in rats with sarcoma M-1, 18% in those with sarcoma 45, and 22% in rats with Jensen sarcoma. Hydrocortisone did not have any appreciable effect on enzyme activities in any of the three types of sarcomas.

3999 CHARACTERIZATION OF HUMAN LEUKEMIA AND BURKITT LYMPHOMA CELLS BY THEIR ACIDIC NUCLEAR PROTEIN PROFILES. (E.) Weisenthal, L. M. (U. Michigan Med. Sch., Ann Arbor) and R. W. Ruddon. *Cancer Res* 32(5):1009-1017, 1972.

Leukocytes were purified from peripheral blood from seven patients with acute or chronic leukemia and from normal donors. Leukemic lymphocytes were cultured in the presence of PHA (8 μ g/ml) in medium containing 10% fetal calf serum. Burkitt lymphoma (P₃J) cells were similarly maintained but without PHA. Nuclei were isolated from leukocytes by homogenization and acidic nuclear proteins (ANP) and nucleohistones were purified from nuclear sonicates. Examination of the ANP fraction from various leukemias was conducted by SDS-polyacrylamide gel electrophoresis. The banding patterns from these largely nondividing populations (paucity of high-molecular-wt. and majority of lower-molecular-wt. proteins) was quite different from the banding patterns of ANP of cultured Burkitt lymphoma cells, which contained a heterogeneous population of high-molecular-wt proteins and a comparatively small amount of lower-molecular-wt proteins. Some higher-molecular-wt protein bands were detectable in the myeloid leukemias which were not seen in the lymphoid leukemias. A correlation was found between the ANP binding pattern and "maturity" of lymphoid cells as

immature leukemic cells contained protein species that banded near the middle of the gels but more fully mature leukemic cells of the large lymphocyte type and normal donor lymphocytes showed smaller amounts of these proteins. Leukemic lymphocytes cultured with PHA increased ^3H -thymidine incorporation into DNA by 100-fold by the sixth day. At the same time, their ANP profile showed a progressive disappearance of low-molecular-wt proteins and a progressive appearance of high-molecular-wt proteins, a pattern similar to that of P₃J Burkitt lymphoblasts. The change in ANP profile preceded the increase in thymidine incorporation into DNA. A similar shift in ANP content was observed in PHA-stimulated normal donor lymphocytes.

- 4000 EFFECT OF HYPERGLYCEMIA ON TUMOR GROWTH IN RATS. (Rus.) Tagi-Zade, S. B. (Res. Inst. Roentgenol. Radiol. Oncol., Baku, USSR). *Vop Onkol* 17(11):75-80, 1971.

Sarcoma M₁ was transplanted s.c. into noninbred albino rats. Diabetes was first induced in one group of animals by two 15 mg/kg i.p. injections of alloxan three days apart; these rats were given 5% glucose with their drinking water and, ten days after the last dose of alloxan, received the tumor transplant. A second group of rats received glucose (2 mg/g/day s.c.) for ten days, starting seven days after tumor transplantation. A third group of rats received glucose (2 mg/g s.c.) six times a day for ten days, starting from the day of transplantation or seven days later. Injection of glucose once a day had no appreciable effect on tumor growth. Administration of glucose six times a day significantly reduced tumor weight, particularly when injections started on the day of transplantation. Maximum inhibition of tumor growth was observed in diabetic animals. Tumor necrosis was also more pronounced in diabetic rats than in those given six glucose injections per day. These findings support the hypothesis that inhibition of tumor growth in diabetic animals is a result of systemic changes in the carbohydrate and protein metabolism of the host and that tumor necrosis results from the successful competition of normal cells with cancer cells for glucose.

- 4001 COMPARISON OF ACTIVITY AND ISOZYME PATTERNS OF FOUR ENZYMES FROM HEPATOMAS OF DIFFERENT GROWTH RATES. (E.) Otani, T. T. (Natl. Cancer Inst., Bethesda, Md.) and H. P. Morris. *J Nat Cancer Inst* 47(6):1247-1253, 1971.

The activity and relative isozyme distribution of four enzymes--glutamic-oxalacetic transaminase (GOT), glutamic-pyruvic transaminase (GPT), malate dehydrogenase (MDH), and lactic dehydrogenase (LDH)--were determined in electrophoretically purified water extracts of normal liver cells from young (72-76 days) and old (172-212 days) Buffalo rats, from young (72-83 days) and old (184-217 days) ACI rats, and

from fast-growing (3924A), intermediate-growing (5123tc), and slow-growing (7793 and R₇) Morris hepatomas. Enzyme assays were performed by measuring the decrease in absorbance at 340 mμ accompanying the oxidation of NADH₂ to NAD. The normal levels of GOT (20.2-23.4 x 10³ spectrophotometric units/mg protein N), GPT (4.3-8.0 x 10³), MDH (89.0-103.6 x 10³), and LDH (48.8-59.0 x 10³) were unaffected by the age of the animals. Hepatic GPT was higher and hepatic LDH was lower in the ACI strain than in the Buffalo strain. Hepatoma GOT specific activities were inversely proportional to the rate of growth being lowest (5.5 x 10³) in 3924A and highest (30.4 and 38.9 x 10³ resp.) in 7793 and R₇. No detectable GPT activity was found in hepatomas 3924A and 5123tc. GPT levels of 7793 and R₇ were approximately the same as that of normal liver. MDH activity was apparently unrelated to growth rate; though lower than normal (61.9 x 10³) in the fast-growing 3024A tumor, it was in the range of levels of normal liver in hepatomas 5123tc, 7793 and R₇. LDH levels showed a direct relation to tumor growth rate when compared in a given strain, but did not appear to be correlated with growth rate if strain difference was disregarded, since 5123tc (generation time of 1.1 month) had about the same LDH level as R₇ (4.5 months). LDH levels of all tumors (except 3924A) were well below those of normal liver. Separation of isozymes by electrophoresis was noted with GOT (two peaks) and MDH (two or more peaks). LDH and GPT showed predominantly single peaks. No qualitative differences in mobility of the isozymes were seen between normal liver and hepatomas. The relative distribution of the isozymes of the different enzymes varied considerably among the tumors and each of the tumor enzyme activities differed from those of normal liver in the activity of at least one enzyme or isozyme. The fast-growing, poorly differentiated hepatoma 3924A showed the greatest deviation with five "abnormal" enzyme components out of six.

- 4002 METHYLATION OF PURIFIED TRANSFER RNA PREPARATIONS BY EXTRACTS DERIVED FROM RAT KIDNEY AND KIDNEY TUMOURS. (E.) Pegg, A. E. (Middlesex Hosp. Med. Sch., London, England). *Biochim Biophys Acta* 262(3):283-289, 1972.

The methylation of tRNA^{fMet}, tRNA^{Glu}, and unfractionated tRNA from *E. coli* K12 (methyl deficient) by normal rat kidney extracts and extracts from kidney tumors induced by dimethylnitrosamine is described. The tumor extract was two to three times more active than normal tissue extract in the presence of excess tRNA, expressed as pmoles methyl groups incorporated per mg protein per 15 min. With unfractionated tRNA as substrate maximal activity occurred with either 25 mM putrescine or 0.3 M NH₄⁺; 60% of this methylation rate was seen with 2 mM spermidine and 20% with Mg²⁺. tRNA^{Glu} showed maximal activity with NH₄⁺; it was almost inactive with Mg²⁺. tRNA^{fMet} was active with Mg²⁺ but maximal activity was seen with putrescine or spermidine. Unfractionated tRNA as substrate gave methylation products of 5-methylcytosine, N²-methylguanine, and

1-methyladenine; 5-methyluracil, N^2,N^2 -dimethyl-guanine, 1-methylguanine, and 7-methylguanine were also present. Tumor extracts produced two to four times as much base in the 15-min incubation period as did normal kidney extracts. Maximal incorporation of methyl groups into tRNA occurred when 1 μ g of unfractionated tRNA or 20 pmoles of tRNA^{fMet} or tRNA^{Glu} was incubated with 3 mg protein for 54 min. It is suggested that factors other than the specificity of the tRNA methylases were responsible for the degree of tRNA methylation found in the experiments.

4003 METHYLATION PATTERNS OF TRANSFER RNA FROM ASCITES HEPATOMAS. (E.) Inose, M. (Sasaki Inst., Tokyo, Japan), S. Miyata and Y. Iwanami. *Biochim Biophys Acta* 259(1):96-103, 1972.

In vivo methylation patterns were studied in ³H-methionine-labeled tRNA purified from mouse ascites hepatoma strains 13, 66, 108A and 7974. Paper chromatography of labeled hepatoma tRNA acid hydrolysates showed relatively low uracil and increased guanine plus cytosine compared to normal liver tRNA. Relative content of 1-methyladenine was 13 to 14% of total methyl counts in all hepatoma strains. Methylguanine content of hepatoma tRNA was generally decreased compared to that of normal liver tRNA. Analyses of the four methylated bases comprising the methylguanine fraction showed that, while 1-methylguanine, N^2 -methylguanine and N^2 -dimethylguanine tended to vary, 7-methylguanine content of all hepatoma strain tRNAs was lower than that of normal liver. The ratios of 7-methylguanine to 1-methylguanine in hepatomas were consistently lower than that in normal liver.

4004 FETAL-TYPE ISOENZYMES IN HEPATIC AND NON-HEPATIC RAT TUMORS. (E.) Farron, F. (Harvard Med. Sch., Boston, Mass.), H. H. T. Hsu and W. E. Knox. *Cancer Res* 32(2):302-308, 1972.

Isoenzymes of lactate dehydrogenase (LDH), aldolase and pyruvate kinase were analyzed by starch gel or Sepharose III cellulose polyacetate electrophoresis and by assay of enzyme activity. The enzymes were obtained from cell homogenates of fetal rat (NEDH) liver, normal and regenerating adult rat liver, adult kidney and a variety of transplanted Morris hepatomas, two renal tumors and one rhabdomyosarcoma, covering a range of growth rates. The single forms, LDH-5 (M monomer), aldolase A and pyruvate kinase K, predominated in fetal rat tissues. Although normal and regenerating adult liver also contained predominantly LDH-5, the prominent form in adult kidney was LDH-1 (H monomer). Aldolase B and the L and M forms of pyruvate kinase predominated in normal adult tissues. A new finding was the detection of the cathodic aldolase C in lactating rat mammary gland. This form was absent in the hepatomas studied. Tumors originating from each of the tissues studied contained mainly the fetal types of the three enzymes and lacked

the adult forms. Whereas isoenzyme patterns of the faster-growing, less-differentiated tumors were closest to the fetal forms, slower-growing tumors generally showed patterns intermediate between those of adult and fetal tissue.

4005 TRANSFER RIBONUCLEIC ACID METHYLASES OF NUCLEOLI ISOLATED FROM A RAT TUMOR. (E.) Liao, M. C. (M.D. Anderson Hosp. Tumor Inst., Houston, Tex.), C. M. O'Rourke and R. B. Hurlbert. *Biochemistry* 11(4):629-636, 1972.

Novikoff ascites hepatoma cells were harvested after five or six days' growth in Sprague-Dawley rats, and methylases capable of transferring ³H-methyl from labeled S-adenosyl-L-methionine to purine and pyrimidine bases of *E. coli* tRNA were extracted from purified nucleoli with 0.5 M NH₄Cl. These enzymes were compared with pH 5-precipitated tRNA methylases derived mainly from cytoplasmic or soluble portions of the cells. The isolated nucleoli contained a constant and significant proportion (5%) of the total cellular tRNA methylase activity when assayed with heterologous *E. coli* RNA as substrate. Both nucleolar and "cell-soluble, pH 5" preparations were similar in pH optimum (pH 9), ionic strength (maximum activity in 0.2 M NH₄Cl) and response to ATP concentration (maximum at 1 mM), but they differed somewhat in their response to NaF and MgCl₂. Homologous RNAs and synthetic polynucleotides were ineffective substrates for both enzymes. Major methylation products, identified by paper chromatography of tRNA hydrolysates, were the same for both preparations (1-methyl-adenine, 7-methylguanine, 1-methylguanine, N^2 -methylguanine, 5-methylcytosine, thymine and 5-hydroxymethyluracil). The relative proportions of the methylated bases, however, differed considerably between the two preparations. In nucleolar preparations, 69% of label was in methylcytosine and 15% in methylguanines, while in the cell-soluble fraction 13% was in methylcytosine and 60% in the guanine derivatives. When cells were labeled *in vivo* with [³H-methyl]-methionine, the patterns of labeling of endogenous 4-6S RNAs showed the same trend, with nucleolar label primarily in the cytosine derivatives and cytoplasmic label primarily in the guanine derivatives. The nucleolar tRNA methylation enzymes were therefore judged to be true components of the nucleoli and to form a distinct subgroup of the total cellular methylation enzymes.

4006 DEGENERATION OF THE PINEAL GLAND OF PATIENTS WITH CANCER. (E.) Hajdu, S. I. (Mem. Hosp. Cancer Allied Dis., New York, N.Y.), R. S. Porro, P. H. Lieberman and F. W. Foote, Jr. *Cancer* 29(3):706-709, 1972.

Gross and microscopic changes of the pineal gland in 275 cancer patients were studied. Multiple slit-like cystic cavities, gliosis, and large numbers of Rosenthal fibers were found in the enlarged pineal gland of 31 patients (mostly children and adolescents). Twenty-four of the 31 patients died with acute granu-

locytic or lymphocytic leukemia. The extent of the changes found suggest a chronic process and that damage to the pineal gland is nonreversible. Although changes were observed only in the pineal gland it is possible that this degenerative process may involve other parts of the nervous system.

- 4007 MORPHOGENESIS OF TWO IMMUNOLOGICALLY INDUCED MOUSE LYMPHOMAS. (E.) Krueger, G. R. (Nat'l. Cancer Inst., Bethesda, Md.) and U. I. Heine. *Cancer Res* 32(3):573-582, 1972.

Female BALB/c and DBA/2N mice were treated simultaneously with azathioprine and an antigen (LDH virus, tubercle bacteria, or bovine serum albumin). Experimental animals developed between 20 and 66% malignant lymphomas that were classified by light and electron microscopy as lymphoblastic types. The tumors developed in an atrophic thymus and subsequently spread to involve the remaining lymphoreticular and hemoreticular tissues, as well as nearly all other organs. Cytologically, the initial thymic tumor nodules did not differ from hyperplastic nodules of nonneoplastic lymphoblastic stem cells. Also, cells of a well-established tumor showed only slight differences from those of normal lymphoblastic stem cells, such as increased esterase activity and presence of cytoplasmic annulate lamellae. Virus particles (C-type) were identified by electron microscopy only in early tissue culture passages of the BALB/c lymphoma but not in the DBA lymphoma. All tumors were readily isotransplantable. Cell-free transplantation remained negative in all instances tried. The tumor grows in tissue culture as an established lymphoblast cell line.

- 4008 COLLATERAL SENSITIVITY OF RESISTANT LINES OF MOUSE LEUKEMIAS L1210 AND L5178Y. (E.) Schmid, F. A. (Sloan-Kettering Inst. Cancer Res., New York, N.Y.) and D. J. Hutchison. *Cancer Res* 32(4):808-812, 1972.

Mouse leukemias L1210 and L5178Y, and two sublines of each, which are resistant to various chemotherapeutic agents and show pronounced patterns of collateral sensitivity (i.e., by acquiring resistance to one agent, the cell becomes more sensitive to another), were studied. BDF₁ mice received i.p. implantations of the leukemia cells and sensitivity to single or multiple injections of chemotherapeutic agents was measured by median survival time (MST). Sensitivity to cytoxan, carbazilquinone, methotrexate, 6-mercaptopurine and cytosine arabinoside was greatly increased in the resistant sublines as compared to the parent lines. MST of all lines except the parental L1210 were shorter when mice received whole-body x-irradiation (400R) 24 hr prior to s.c. injection of leukemia cells. Growth potential of the six leukemia lines in x-irradiated homologous mice and in x-irradiated and

streptomycin-treated heterologous golden hamsters was inversely proportional to the sensitivity to the chemotherapeutic agents, indicating a decrease in oncogenic potential, rather than antigenic changes of the tumor cells. No uniform pattern in the distribution of chromosome numbers was associated with change in oncogenic potential.

- 4009 THE ORIGIN OF HUMAN EMBRYO LUNG CELLS IN CULTURE: A COMMENT ON CELL DIFFERENTIATION, *IN VITRO* GROWTH AND NEOPLASIA. (E.) Franks, L. M. (Imperial Cancer Res. Fund, London, England) and T. W. Cooper. *Int J Cancer* 9(1):19-29, 1972.

The ultrastructure of cells from 15 cell lines derived from human embryo lung tissue at 11 different transfer generations (2nd-19th) was examined with an electron microscope and compared with that of cells present in starting cell suspensions and explants. Differentiated epithelial cells were not seen after the 2nd transfer generation. Two predominant cell types were present in all cultures although the proportion of each type varied from culture to culture. These cells were morphologically similar to endothelial cells and pericytes present in the initial explants. Type 1 cells had rounded or bean-shaped nuclei with a thin rim of marginal chromatin. The cytoplasm contained some rough endoplasmic reticulum, many free ribosomes, a small Golgi zone, and relatively few other organelles. Cell processes were short and few in number. Type 2 cells had a more convoluted nucleus with a thicker peripheral chromatin layer and small clumps of nuclear chromatin. The Golgi zone was large and there were usually many lysosomes and autophagic vacuoles and often dilated cisternae of rough endoplasmic reticulum. These and previous observations on other cell lines suggest that many cell lines established from normal tissues, and some lines established from tumors, have the same two predominant cell types, which may be derived from the endothelium and pericytes of small blood vessels. Since some differentiated tumor cells with recognizable tissue markers can be maintained *in vitro* under similar conditions, it is concluded that "normal" and tumor cells must have similar metabolic pathways. Therefore, the "normal" cells may not be satisfactory control material for biochemical and other studies of normal and tumor cells. The ability of differentiated cells to become established *in vitro* is apparently associated with the development of neoplastic characters.

- 4010 PRODUCTION OF THE PLACENTAL-TYPE ALKALINE PHOSPHATASE ISOENZYME BY LUNG CANCER TISSUE. (E.) Kang, K.-Y. (Osaka U. Sch. Md., Japan), K. Higashino, M. Hashinotsume, Y. Takahashi, T. Aoki, E. Tsubura and Y. Yamamura. *Gann* 63(2):217-224, 1972.

Alkaline phosphatase was purified from primary lung

tumor and from lung and liver metastases from a 55-yr-old male with a poorly differentiated adenocarcinoma of the left lung and compared to alkaline phosphatase isolated from a placenta. Enzyme activity was determined by spectrophotometric measurement of the release of phenol from sodium phenyl phosphate, and analysis of the tumor enzyme was carried out by polyacrylamide gel thin-layer electrophoresis, by immunoelectrophoresis, and by immunodiffusion, using rabbit anti-placental alkaline phosphatase. Enzyme from lung cancer and metastatic tumor was found to be identical to that from human placenta in heat-inactivation kinetics and in gel electrophoretic and immunoelectrophoretic banding patterns. Both tumor and placental enzymes showed the same kinetics of inactivation by L-phenylalanine, L-leucine, urea, L-isoleucine, L-valine, L-cysteine·HCl, KH_2PO_4 , NaCN and EDTA. The K_m values for tumor and placental alkaline phosphatase were both 2.27×10^{-3} M, compared with 2.95×10^{-3} M for normal lung enzyme. No other enzymes assayed showed a change of activity in tumor tissue. Fluorescent antigen-antibody staining of sections of lung tumor and normal lung tissue showed that placental-type alkaline phosphatase was present only in tumor tissue. It was concluded that placental-type alkaline phosphatase might be synthesized in lung cancer cells.

Tohoku U., Sendai, Japan), H. Kikuchi, H. Saeki and S. Tsuiki. *Biochim Biophys Acta* 244:19-29, 1971.

Yoshida sarcoma, ascite hepatomas AH-66F and AH-130 and Ehrlich ascites carcinoma were transplanted i.p. into male Donryu rats and male dd mice. Five or ten days after implantation the tumor cells were harvested, incubated with glucosamine in the presence or absence of glucose and examined for rate of glucosamine consumption. The metabolism of glucosamine differed strikingly according to the concentration used. Yoshida sarcoma cells readily phosphorylated 2 mM glucosamine and transformed a large portion of the formed glucosamine 6-phosphate into glycogen and lactate, the latter being the major end product. Exposure of Yoshida cells to 2 mM glucosamine also resulted in a marked fall in ATP unaccompanied by a rise in ADP. When the cells were incubated with 0.5 mM glucosamine, formation of glucosamine 6-phosphate was delayed and the major end product was glycogen. The cellular level of adenine nucleotides was only slightly affected. These metabolic differences due to differences in glucosamine concentration arise primarily from a low affinity of hexokinase toward glucosamine. Consumption of glucosamine by Yoshida cells ceased completely in the presence of glucose. Although no glycogen was formed by Ehrlich ascites carcinoma, the pattern of glucosamine metabolism was similar for the other tumors. All tumors were rich in phosphoglucosamine isomerase, which appears to determine the rate of conversion of glucosamine to glycogen, lactate, and CO_2 in tumor cells.

4011 EVIDENCE FOR TRANSLATIONAL REGULATION OF SPECIFIC ENZYME SYNTHESIS BY N^6, O^2 -DIBUTYRYL CYCLIC AMP IN HEPATOMA CELL CULTURES. (E.) Wicks, W. D. (Natl. Jewish Hosp. Res. Ctr., Denver, Colo.) and J. B. McKibbin. *Biochem Biophys Res Commun* 48(1):205-211, 1972.

Dibutyryl cAMP has been shown to increase the rate of phosphoenolpyruvate carboxykinase (PEPCK) synthesis in cultured Reuber hepatoma (H35) cells. A two- to three-fold increase in incorporation of ^3H -leucine into PEPCK occurred as early as 1.5 hr after addition of dibutyryl cAMP (0.5 mM) to H35 cultures which had been transferred to serum-free medium 12-18 hr previously. Addition of actinomycin D, which has been shown to inhibit the early phase of dibutyryl cAMP-dependent stimulation of tyrosine transaminase (TT) in H35 cells, had no early inhibitory effect on PEPCK activity. As time progressed, however, inhibition of increasing intensity was observed. In contrast, actinomycin D could prevent PEPCK stimulation by dexamethasone. These results are consistent with the conclusion that the response of PEPCK to dexamethasone requires new RNA synthesis while that to dibutyryl cAMP does not. Dibutyryl cAMP may affect a post-transcriptional step in PEPCK synthesis. Superinduction of TT was observed after addition of high concentrations of actinomycin D with both dexamethasone and dibutyryl cAMP; PEPCK, however, did not exhibit this phenomenon with either indicator.

4013 THE GENERATION TIME OF HUMAN LEUKEMIC MYELOBLASTS. (E.) Greenberg, M. L. (Mount Sinai Sch. Med., City U. New York, N.Y.), A. D. Chanana, E. P. Cronkite, G. Giacomelli, K. R. Rai, L. M. Schiffer, P. A. Stryckmans and P. C. Vincent. *Lab Invest* 26(3):245-252, 1972.

Three patients with acute myelocytic leukemia, one with acute myelomonocytic leukemia and one with a morphologic blast crisis in chronic myelocytic leukemia were studied to determine the generation time of the leukemic myeloblasts. No patient received therapy during the experimental period. Each subject was injected i.v. with ^3H -thymidine followed by a series of bone marrow aspirations for autoradiographs. Myeloblasts were divided into large, medium and small size populations on the basis of micrometer measurements. As a rule, myeloblasts in DNA synthesis were larger than those in other phases of the cell cycle. Based on the kinetics of cell labeling, it was concluded that the larger myeloblasts divided to produce small myeloblasts. The large myeloblast populations in all patients had labeling indices of 30 to 51%, values similar to those reported for nonleukemic myeloblasts. The time required for DNA synthesis, determined from the wave of labeled mitoses and from a dual labeling autoradiography technique, was similar to or slightly longer than that reported for nonleukemic myeloblasts. Generation times,

4012 TRANSFORMATION OF GLUCOSAMINE TO GLYCOGEN AND LACTATE BY ASCITES TUMOR CELLS. (E.) Sukeno, T. (Res. Inst. Tuberculosis, Leprosy, Cancer,

estimated using the labeling indices of the large myeloblasts and DNA synthesis times, were 19.5 to 53.5 hr, values also similar to those reported for nonleukemic myeloblasts. No striking differences were observed between normal and leukemic myeloblasts with respect to the duration of the various phases of the cell cycle. It is possible that differences in the cell cycle of potential therapeutic advantage may be found at the stem cell level; however, such work is presently technically impossible.

- 4014 MALIGNANT TUMORS OF THE SPERMATIC CORD.
(E.) Malek, R. S. (Mayo Clinic, Rochester, Minn.), D. C. Utz and G. M. Farrow. *Cancer* 29(4): 1108-1113, 1972.

The diagnosis, treatment and prognosis of ten patients with sarcoma of the spermatic cord seen at the Mayo Clinic in a 39-year period (1932-1970) is presented. Eight of the ten patients had undergone a radical or simple orchiectomy elsewhere; the remaining two had a radical orchiectomy after a cord tumor was "shelled out". Three of the patients had an embryonal rhabdomyosarcoma confined to the cord; five had the same tumor invasive to the testis; one had a leiomyosarcoma, grade 4; and one a fibroblastic liposarcoma, grade 3. Treatment (surgical, chemotherapeutic and adjunct radiotherapy) was dependent on the degree of spread of metastases. The patients with tumors confined to the cord are among the longest survivors (1 1/2 to 39 yr). The prognosis for the invasive tumors is poor, but two patients are still living (2 to 2 1/2 yr). The patients with leiomyosarcoma and fibroblastic liposarcoma are alive 3 and 18 yr, resp., after the initial diagnosis.

- 4015 MATURATION PATHWAY FOR RIBOSOMAL RNA IN THE HeLa CELL NUCLEOLUS. (E.) Maden, B. E. H. (Dept. Biochem., U. Glasgow, Scotland), M. Salim and D. F. Summers. *Nature New Biol* 237(70):5-9, 1972.

The maturation pathway for rRNA in the HeLa cell nucleolus proposed by Weinberg and Penman was confirmed by "fingerprinting" T1 RNase plus alkaline phosphatase digests of mature 18S and 28S rRNA and nucleolar precursor RNA after *in vitro* labeling with ³H-methyl methionine. Using this technique, several unique 18S and 28S spots were resolved by two dimensional thin-layer chromatography. With only a few exceptions, the spots seen in fingerprints of digests of 45S and 41S precursor RNA molecules purified on sucrose density gradients corresponded to those of 18S and 28S fingerprints, indicating a nucleolar origin for rRNA. 32S fingerprints showed patterns similar only to those of 28S rRNA, confirming that 32S RNA is a unique precursor of 28S rRNA. Fingerprints of nucleolar 18-20S RNA corresponded to those of cytoplasmic 18S rRNA, thus indicating

a precursor-product relationship between these moieties.

- 4016 A STUDY OF MULTINUCLEATED TUMOR CELLS DEMONSTRATING THE EFFECT OF TRANSPLANT DURATION ON SERUM CHANGES IN CANCER-BEARING HAMSTERS. (E.) Gillespie, D. M. (Dept. Zoology, U. Vermont, Burlington) and D. F. Stevens. *Cancer Res* 32:1577-1579, 1972.

A cancer-induced change had previously been reported in the serum of hamsters bearing transplantable cheek pouch tumors. In the present study, the kinetics of appearance and disappearance of this serum change were studied. Female golden hamsters received an injection of $1.5 \times 10^6 \pm 10\%$ ascites tumor cells into the left cheek pouch. At various times thereafter, blood samples were drawn and tested for tumor-associated serum changes. The ability of serum to decrease the number of multinucleated tumor cells in an *in vitro* incubation assay was used as the criterion for the serum change. Sera from more than 90% of all hamsters receiving tumor cell injections were able to decrease the number of multinucleated tumor cells by 24 hr after tumor cell inoculation. Tumors were excised after three days when all sera exhibited activity. At varying times after tumor excision, serum samples were again drawn and tested. Serum activity was still present in all animals five days after tumor excision; however, the percentage decreased to 45.5% on day six and continued to drop until zero activity was reached 9 to 10 days after tumor excision. The appearance of a specific, cancer-induced serum change was probably related to the number of cells present in the host as serum from animals inoculated with only 1.0×10^6 cells was inactive up to four days after transplantation, even though small tumor nodules were present. If nodules were allowed to continue to grow, the serum eventually became active. Transplantation of 1.5×10^6 normal regenerating liver cells into female hamster cheek pouches failed to induce serum activity.

- 4017 SYNTHETIC RNA-DEPENDENT DNA POLYMERASE ACTIVITY IN NORMAL RAT LIVER AND HEPATOMAS. (E.) Ward, D. C. (Imperial Cancer Res. Fund Labs., London, England), K. C. Humphries and I. B. Weinstein. *Nature* 237:499-503, 1972.

A high level of synthetic RNA-dependent DNA polymerase (RD-DP) activity has been detected in a low-speed pellet fraction of normal Sprague-Dawley rat liver and dimethylaminoazobenzene-induced rat hepatoma crude cell homogenates. RD-DP activity, which was evidently located in nuclei or on large membrane fragments, was purified 200-fold by ammonium sulfate precipitation followed by fractionation on DNA-cellulose and Sephadex G-100 columns. The purified enzyme showed optimum activity with 0.5 mM Mn⁺⁺ at a pH

of 8.0 to 9.5. RD-DP used poly(dT)·poly(rA) and poly(rA)·poly(rU) as templates but showed little or no ability to incorporate ³H-TTP into DNA with poly d(A-T), poly r(A-U), native or denatured nicked and unnicked calf thymus DNA, or various "single-stranded" RNAs as templates. Crude homogenates of hepatomas had twice as much RD-DP activity per gm wet wt as did normal rat liver, when assayed with poly(dT)·poly(rA) or poly(rA)·poly(rU). However, both tissues had the same amounts of DNA-dependent DNA polymerase activity when assayed with poly d(A-T).

4018 A COMPARISON OF THE ETIOLOGIC FACTORS IN VIRAL HEPATITIS, CIRRHOSIS AND PRIMARY LIVER CANCER. (Fr.) Bertrand, E. (C.H.U., Abidjan, Ivory Coast), M. Lebras and B. Beda. *Bull Soc Pathol Exot* 64(3):251-259, 1971.

An epidemiological study of three liver diseases (hepatitis, cirrhosis and liver cancer) in Abidjan hospitals was conducted for evidence of an etiologic relationship between the three. Hepatitis was the most frequently occurring, with severe (hospitalized) cases constituting 3.84% of all hospital cases, with a 3.80% occurrence for cirrhosis cases and 1.60% for liver cancer. All the diseases occurred more frequently in men than women; the ratio of male to female cases was: for hepatitis, 3:1; for cirrhosis, 5.5:1, and for cancer, 11:1. Hepatitis occurred more frequently at an earlier age (20-30 yr) than cirrhosis and cancer (30-40 yr), with a second peak arising between 50-60 yr for cirrhosis where the alcoholic factor was important. The hepatitis and cirrhosis age distribution curves indicated cirrhosis of the 3rd and 4th age decade to be of hepatitic origin. Primary liver cancer epidemiology revealed development of this neoplasia to occur often in patients with a cirrhosis history. These epidemiologic findings seem to confirm the hypothesis, which has been advanced on clinical, anatomical and experimental grounds, that hepatitis, cirrhosis and liver cancer are etiologically related.

4019 CHROMOSOME 16: A SPECIFIC CHROMOSOMAL PATHWAY FOR THE ORIGIN OF HUMAN MALIGNANCY? (E.) Bender, M. A. (Dept. Radiol., Vanderbilt U., Nashville, Tenn.), M. A. Kastenbaum and C. S. Lever. *Brit J Cancer* 26(1):34-42, 1972.

An excess of E16 chromosomes was correlated with malignancy in a recent study of 17 human cell lines. The study employed a semi-automatic karyotyping system in which a computer program was used to classify chromosome arm length measurements from stylized tracings of actual chromosomal images. To test the accuracy of this method of karyotyping, chromosome arm lengths in a sample of 723 normal human cells from 100 normal subjects were measured by an experienced cytogeneticist. The human observer arrived at very different results from those obtained with the computer. Only 29% of chromosomes classified as E16 by the computer

were classified as E16 by the cytogeneticist. The computer method also failed to give correct average numbers of chromosomes in the various classes. It was concluded that the excess in number of E16 chromosomes detected in malignant human cells is a systematic artifact of the computer method of karyotyping.

4020 THE ABILITY OF TUMOR CELLS OF THE LYMPHO-RETICULAR SYSTEM TO GROW *IN VITRO*. (E.) Trujillo, J. M. (U. Texas M. D. Anderson Hosp. Tumor Inst., Houston), B. Drewinko and M. J. Ahearn. *Cancer Res* 32(5):1057-1065, 1972.

Cells from biopsies of lymph nodes (45 cases), spleen (seven cases), bone marrow (five cases) and peripheral blood (one case) of untreated patients with a variety of malignant diseases and from peripheral blood samples of two healthy donors were propagated in monolayer cultures or spinner flasks using Ham's F-10 medium supplemented with 20% fetal calf serum, vitamins, glutamine and penicillin. Cytological, electron microscope and chromosome studies were periodically performed while cultures remained viable. The growth span of cells was classified as short (< two months), early (two wk to six months) or long (> six months). A line was considered established when cells had been maintained in continuous culture for over one yr. Of the 58 cases, 96.5% grew as short-term cultures, 84.5% progressed to early cultures and 55.5% grew for longer periods. Only four cell lines were established as permanent cultures: T1, derived from the lymph node of a patient with lymphocytic lymphoma and maintained in culture over six yr; T3, from a lymph node of a patient with undifferentiated lymphoma; T4, from the bone marrow of a patient with acute leukemia; and T5, from a mixed lymphocytic culture from healthy donors. T1 and T4 produce immunoglobulin. As cultures became established, the cells changed from predominantly fusiform to a mixed population of round, elongated and polygonal cells which revealed morphological features of lymphocytoid, plasmacytoid and reticulum cells. Many of the round cells were intensely periodic acid-Schiff and pyronin positive. Most of the primary cultures had diploid or near-diploid karyotypes with occasional deletions or supernumerary chromosomes. Aneuploid cells in the near-tetraploid range began to emerge in long-term cultures. All four established lines were aneuploid. Cell lines which grew only for short periods maintained the ultrastructural characteristics of small lymphocytes (large N/C ratio, clumped chromatin, few organelles and sparse granules and vacuoles). Established lines, regardless of origin, had a small N/C ratio, finely dispersed chromatin, large nucleoli and numerous cytoplasmic organelles. C-type particles were seen in T1 cells and intranuclear herpes-like viral particles in T4 cells during the first few passages *in vitro*. However, subsequent cultures failed to exhibit viral particles. Cultures derived from malignancies generally grew for the longest periods (24 of 33 long-term cultures). Only one of eight cultures derived from normal tissues survived past eight months.

- 4021 HEMATOLOGIC AND CYTOGENETIC REMISSION OF BLASTIC TRANSFORMATION IN CHRONIC GRANULOCYTIC LEUKEMIA. (E.) Canellos, G. P. (Nat'l. Cancer Inst., Bethesda, Md.), V. T. DeVita, J. Whang-Peng and P. P. Carbone. *Blood* 38(6):671-679, 1971.

Thirty patients in the blastic phase of chronic granulocytic leukemia (CGL) were treated with a combination of vincristine (2 mg/sq m body surface/ i.v./wk) and prednisone (60 mg/sq m/orally/day). Increasing blast percentage and progressive leukocytosis are characteristic of this phase of CGL. Nine patients (30%) achieved complete or partial remission, eight a greater than 50% reduction in peripheral blast count only and 13 showed no antileukemic effects. A mean of 3.5 wk of therapy was required for remission to occur. In six patients achieving complete remission, the mean duration of the first remission was five months. Cytogenetic studies were performed on all patients in the chronic stage of the disease, and in 28 at the onset of the blastic transformation. All were Philadelphia chromosome-positive during the course of their disease. Nineteen patients entering the blastic phase showed a major aneuploid cell line (44-51 chromosomes) that was not present in the chronic stage. Complete hematologic remission was associated with the disappearance of the aneuploid cell lines and return of chromosomal number to that of the chronic phase. The findings in this series of patients indicate that hypodiploid cell lines are significantly more sensitive to the cytotoxic effects of vincristine and prednisone therapy. Subsequent relapse of the disease in previously remitted patients was associated with further degrees of aneuploidy, suggesting clonal evolution of a resistant cell line.

- 4022 DNA BIOSYNTHESIS BY ISOLATED MITOCHONDRIA STIMULATION BY CYTOPLASMIC FACTORS FROM NEOPLASTIC AND REGENERATING TISSUES. (E.) Kalf, G. F. (Jefferson Med. Coll., Philadelphia, Pa.), M. A. D'Agostino and G. R. Hunter. *Cancer Res* 31:2054-2058, 1971.

Postmicrosomal 105,000 x g supernatant fluids prepared from Walker R256 mammary carcinoma, mouse 6C3HED Gardner lymphosarcoma, 22 hr posthepatectomy regenerating rat liver and normal fetal and adult rat liver were studied with respect to their effect on the incorporation of radioactive thymidine triphosphate (dTTP) and deoxyadenosine triphosphate (dATP) into rat liver mitochondria *in vitro*. Incorporation into acid-insoluble material was stimulated by supernatant fractions from all tissues except normal adult rat liver. The stimulation was completely abolished by addition of ethidium bromide in low concentrations to the incubation mixture. The stimulatory activity was nondialyzable, heat labile, was not affected by DNase I, phosphodiesterase or RNase, and was precipitated by 30 to 50% ammonium sulfate. Fractionation of the crude rat hepatoma supernatant fraction on a DNA-cellulose column led to the separation of two active peaks which eluted at 0.15 and 0.30 M NaCl, resp. Analyses

of these proteins by polyacrylamide gel electrophoresis indicated that they were negatively charged at the pH at which they bound to the DNA-cellulose. Their ability to bind DNA in the presence of high salt concentrations indicated that the proteins recognized DNA as a specific substrate.

- 4023 DOPAMINE- β -HYDROXYLASE ACTIVITY IN MOUSE NEUROBLASTOMA TUMORS AND IN CELL CULTURES. (E.) Anagnoste, B. (New York U. Med. Ctr., N.Y.), L. S. Freedman, M. Goldstein, J. Broome and K. Fuxe. *Proc Nat Acad Sci USA* 69(7):1883-1886, 1972.

The activity of dopamine- β -hydroxylase was studied by radioassay and histochemical fluorescence in mouse C-1300 neuroblastoma tumors and in cultured cell lines derived from these tumors. Growing tumors possessed substantial hydroxylase activity which was proportional to the weight of the tumor. Hydroxylase activity in the serum of tumor-bearing A/J mice was markedly increased two wk after tumor implantation when compared with controls. Treatment of mice with 5-bromodeoxyuridine (3 mg/kg i.p. twice daily) caused a marked inhibition of tumor growth in the first two wk after the beginning of administration. Histochemical studies showed that 1-5% of the cells in the C-1300 neuroblastomas contained catecholamines and that catecholamine-containing processes terminated primarily around blood vessels of the tumor. Enzyme activity was also detected in two clonal lines of C-1300 neuroblastoma cells. The cell line which had the higher activity had the greater tendency to form axon-like processes. Tumors derived from mouse neuroblastoma cells maintained by continuous animal passage had a higher hydroxylase activity than did tumors derived from neuroblastoma cells cultured for prolonged periods *in vitro* and then implanted into mice.

- 4024 PROSTAGLANDIN PRODUCTION BY EXPERIMENTAL TUMOURS AND EFFECTS OF ANTI-INFLAMMATORY COMPOUNDS. (E.) Sykes, J. A. C. (Imperial Cancer Res. Fund, London, England) and I. S. Maddox. *Nature New Biol* 237(71):59-61, 1972.

BP8/P₁ ascites and solid tumor, and sarcoma 180 (S180) grown in male C3H/He and male Schneider mice, resp., were assayed for prostaglandin E₂-like activity by measuring the ability of purified tumor cell extracts to induce contraction of rat and chick gastrointestinal tissue. Prostaglandins were detected and estimated by gas-liquid chromatography. The mean prostaglandin E₂ content of two BP8/P₁ tumors was 1.98 ± 0.35 μ g/g wet weight of packed ascitic cells, and 2.29 ± 0.032 μ g/g of solid tumor. S180 tumor contained only 0.628 ± 0.132 μ g/g tumor. Daily i.p. injections of the anti-inflammatory agent indomethacin (5 mg/kg) reduced prostaglandin levels by 66% without appreciably affecting tumor growth. The effect of various anti-inflammatory compounds on prostaglandin synthesis was studied in an *in vitro* guinea pig system. Indo-

methacin (0.3 μ M) caused a 50% inhibition and fenclozic acid (ICI 54,450; 4 μ M) produced a 100% inhibition. However, an analog of fenclozic acid (ICI 54,501) which has no anti-inflammatory activity also completely inhibited prostaglandin synthesis, suggesting that inhibition of prostaglandin synthesis may not be the primary mode of action of anti-inflammatory compounds. Fenclozic acid at concentrations as high as 0.8 mM actually stimulated prostaglandin synthesis in BP8/P ascites cells.

4025 INCREASED EFFICIENCY OF EXOGENOUS MESSENGER RNA TRANSLATION IN A KREBS ASCITES CELL LYSATE. (E.) Metafora, S. (Coll. Phys. Surg., Columbia U., New York, N.Y.), M. Terada, L. W. Dow, P. A. Marks and A. Bank. *Proc Nat Acad Sci USA* 69(5):1299-1303, 1972.

10S mRNA's, purified by sucrose gradient centrifugation, from reticulocytes obtained from New Zealand rabbits, C57BL/6J mice treated with phenylhydrazine and humans with acquired hemolytic anemias were tested for their translation efficiency in a Krebs ascites cell S-30 lysate by measuring the rate of incorporation of isotopically labeled amino acids into acid-insoluble material. tRNA's from Krebs cells, rabbit reticulocytes and mouse liver showed similar abilities to increase protein synthesis by the Krebs lysate. Addition of mammalian tRNA increased protein synthesis by the Krebs lysate, both in the presence and absence of exogenous mRNA. Addition of a 0.5 M KCl wash fraction from rabbit reticulocyte ribosomes caused a three- to ten-fold increase in the extent of translation of natural mRNA's by Krebs S-30 lysates. In the presence of the wash fraction, one mole of rabbit or mouse 10S RNA directed the incorporation of 80 pmoles leucine into rabbit globin. Heating the wash fraction to 90 C for three min abolished its activity. Addition of human 10S RNA to the assay system including the wash fraction resulted in synthesis of equal amounts of α and β globin chains. Whereas addition of 1 A₂₆₀/ml of mouse 10S RNA resulted in the synthesis of five times more β than α chain, addition of 0.1 A₂₆₀/ml resulted in a symmetrical synthesis of the two chains. Stimulation by wash fraction was not specific for globin mRNA; it also increased the rate of protein synthesis in the endogenous system, and in the presence of encephalomyocarditis RNA and phage Q β RNA. A ribosomal wash fraction from Krebs ascites ribosomes inhibited protein synthesis, both with endogenous and exogenous mRNA. The rabbit reticulocyte wash fraction contained aminoacyl-tRNA synthetase activity, but results from amino acid incorporation studies indicated that the stimulation of protein synthesis by the wash fraction was probably due solely to aminoacyl-tRNA synthetase activity.

4026 THE EFFECT OF L-ASPARAGINASE ON THE NUCLEIC ACID METABOLISM AND CELL CYCLE OF HUMAN LEUKEMIA CELLS. (E.) Saunders, E. F. (Dept. Pediatrics, U. Toronto, Canada). *Blood* 39(4):575-580, 1972.

The effect of L-asparaginase on the cell cycle and on nucleic acid synthesis of leukemic cells was studied in four girls and one boy with acute lymphoblastic leukemia. L-asparaginase (2000 U/kg) was given i.v. over a 30 min period. Marrow samples were then taken and buffy coat volume and mitotic index were determined. DNA and RNA synthesis was assessed by autoradiography of marrow cells incubated *in vitro* with ³H-thymidine and ³H-uridine, resp. A rapid decline in buffy coat volume by 6 hr after drug administration indicated a lytic effect on leukemic cells which was too rapid to be cell-cycle dependent. More proliferating blasts were killed than were nonproliferating leukemia cells. Mitotic indices remained essentially unchanged for the first 6 hr but then decreased steadily to very low levels by 48 hr. In contrast, the mean ³H-thymidine labeling index decreased to less than 50% of the control during the first 6 hr. Thereafter, the labeling index and mitotic index curves declined in parallel. The fact that labeling indices decreased before mitotic indices indicated that L-asparaginase blocked the entry of leukemic cells into S phase. Cells already in S phase when the drug was administered appeared to continue into mitosis. In all patients, ³H-uridine labeling indices decreased to an average of 25% of control values by 48 hr. Uridine uptake was inhibited equally in both proliferative and nonproliferative blasts. Thus, the inhibition of RNA synthesis by L-asparaginase was independent of the proliferative activity of the marrow.

4027 GENETIC DETERMINANTS OF MORPHOLOGICAL DIFFERENTIATION IN HYBRID TUMORS. (E.) Weiner, F. (Dept. Tumor Biol., Karolinska Inst., Stockholm, Sweden), A. Cochran, G. Klein and H. Harris. *J Nat Cancer Inst* 48(2):465-486, 1972.

A hybrid cell line was produced by fusing cells of a line of L-cell-derived, fibroblastic, relatively non-tumorigenic cells (A9) with lymphocytic cells of a highly malignant, immunoresistant variant of an ascites lymphoblastoid lymphoma induced by Moloney leukemia virus (YACIR). The chromosome constitutions of the YACIR/A9 hybrid, and of tumors produced *in vivo* by hybrid cell inocula, were observed. Immediately after cell fusion the modal chromosome number of the YACIR/A9 hybrids was 92, almost exactly the sum of the modes of the two parent cells. During long-term (one yr) culture, the modal chromosome numbers of the hybrids fell progressively. YACIR/A9 hybrids had a low level of tumorigenicity compared to that of the YACIR parent cells. The tumors produced by the YACIR/A9 hybrid cells had chromosome patterns which fell into three groups. Group I tumors had relatively large chromosome numbers comparable with those of the hybrid line after reduction of chromosome number by long-term cultivation. Group II tumors had drastically reduced chromosome numbers (modes from 43-48). Group III tumors had a chromosome pattern intermediate between Groups I and II (modes between 50-68). The effects of chromosome loss on the morphology of tumors in Groups I, II and III were observed. Group III tumors

resembled the YACIR/A9 hybrids in being fibroblastic, some tumors showing lymphocytic as well as fibroblastic cells. Group II tumors showed a restored lymphocytic morphology resembling that of the YACIR parent line. Although lymphocytic morphology was suppressed when the lymphocytic YACIR cells were fused with fibroblastic A9 cells, the determinants of the lymphocytic morphology were apparently not lost in the hybrids. Rather, these determinants were carried cryptically from one generation to the next, until the loss of fibroblastic morphology permitted the lymphocytic differentiation to reappear.

4028 AMINO ACID ACTIVATION BY NUCLEOLI ISOLATED FROM THE NOVIKOFF ASCITES TUMOR. (E.)

Lamkin, A. F. (Dept. Biochem., U. Texas, Houston) and R. B. Hurlbert. *Biochim Biophys Acta* 272(2): 321-326, 1972.

The mechanism of the incorporation of amino acids into nucleolar protein was studied with nucleoli isolated by sucrose gradient centrifugation from homogenates of Novikoff ascites tumor cells. Each of 15 ^{14}C -labeled amino acids, added singly, was incorporated into acid insoluble material without need for added ATP, tRNA, complementary amino acids or other components of the cytoplasmic protein-synthesizing system. The activating enzymes corresponding to most of these amino acids (except proline and glutamic acid) were demonstrable by measuring the rate of amino acid hydroxymate formation when the nucleoli were incubated with the amino acid, NH_4OH and ATP. Thus, isolated Novikoff ascites tumor nucleoli appear to contain a tightly integrated protein synthesizing system which includes amino acid activating enzymes and tRNAs.

4029 DISTRIBUTION OF CERVICAL LYMPH NODE METASTASES FROM SQUAMOUS CELL CARCINOMA OF THE UPPER RESPIRATORY AND DIGESTIVE TRACTS. (E.)

Lindberg, R. (U. Texas M.D. Anderson Hosp., Houston). *Cancer* 29(6):1446-1449, 1972.

The topographical distribution of cervical lymph node metastases was determined in 1,155 patients with previously untreated squamous cell carcinomas of the head and neck. Subdiaphragmatic nodes were the most common site of metastases from primary tumors in the oral tongue and oropharynx. Nodes in the submaxillary triangle were the most common sites of metastases from tumors of the floor of the mouth. Tumors of the supraglottic larynx metastasized most commonly to the upper jugular nodes. Tumors of the nasopharynx metastasized most commonly to ipsilateral and contralateral nodes of the upper jugular. The incidence of cervical node metastasis increased as the size of the primary tumor increased in patients with tumors of the oral tongue, floor of mouth, retromolar trigone/anterior faucial pillar and soft palate. The incidence of nodal metastasis was not correlated with size of the primary tumor when the tumor was located in the tonsillar fossa, base of tongue, supraglottic larynx or hypopharynx.

4030 HISTOGENETIC BEHAVIOR OF TUMORS: III. POSSIBLE RELATIONSHIPS TO PATTERNS OF GLYCOLYSIS. (E.) Auersperg, N. (Cancer Res. Ctr., U. British Columbia, Vancouver, Canada). *J Nat Cancer Inst* 48(6):1589-1596, 1972.

Aerobic and anaerobic glycolysis was observed in two cell lines derived from a poorly differentiated squamous carcinoma of the human uterine cervix. One of the cell lines, C-4 I, resembled spinous cells and possessed more prominently than the other line (C-4 II) properties generally associated with malignancy. The less malignant line C-4 resembled normal basal cells. Under all conditions tested, aerobic and anaerobic, the glycolytic rate for C-4 I cells was higher than that for C-4 II cells. At cell densities ranging from early log phase to stationary phase, glucose utilization of C-4 I cells was 1.5-2.5 times higher than that of C-4 II cells; lactic acid accumulation of C-4 I cells was six to nine times higher than that of C-4 II cells at low cell densities and two to six times higher than that of C-4 II cells at higher densities. In C-4 I cells, lactic acid accumulation behaved as a fixed function of glucose utilization, independent of changes in the cell environment (e.g., changes in density, O_2 and CO_2 tension and pH). Changes in such environmental variables did modify glycolytic patterns in C-4 II cells. In addition, C-4 I cells evidenced anaerobic glycolysis. The greater glycolytic capacity of C-4 I cells was in keeping with the greater malignancy of these cells by other criteria.

4031 USE OF CELL SEPARATION AT 1 g FOR CYTOKINETIC STUDIES IN SPONTANEOUS AKR LEUKEMIA. (E.) Omine, M. (Natl. Cancer Inst., Bethesda, Md.) and S. Perry. *J Nat Cancer Inst* 48(3):697-704, 1972.

AKR strain mice with advanced spontaneous leukemia were injected once i.p. with 75-100 μCi ^3H -thymidine. At various times after injection, grossly enlarged thymuses were removed and prepared for 1-g sucrose gradient sedimentation. Cells were sedimented for two hr after which they were collected in 30 fractions of increasing cell size. The cohort of leukemic cells pulse-labeled with ^3H -thymidine showed consistent and continuous progress through the range of fractions of various cell sizes. A shift of radioactivity from larger to smaller cell fractions was seen by 12 hr after ^3H -thymidine injection. By 18 hr the major part of the leukemic cell cohort had completed a cell cycle (i.e., cell cycle time was 18 hr). From observations of cohort movement the average durations of the different cell cycle phases could be estimated. T_{G_1} was six hrs, the sum of the G2 and M phases was < four hrs, and T_{S} was a little more than eight hr. After multiple injections of ^3H -thymidine for 18 hr, most larger cells and nearly half the medium-sized cells were labeled, but most smaller cells remained unlabeled. Labeled cells made up about 60% of the whole population in multiple-labeling experiments. With longer labeling periods (to 87 hr) the labeling index of

the whole cell population increased as the number of labeled smaller cells increased. Some small cells remained unlabeled as the number of labeled smaller cells increased. However, some small cells remained unlabeled even after 87 hr of labeling.

4032 HUMAN LYMPHOBLASTOID CELL LINES: III. COCULTIVATION TECHNIQUE FOR ESTABLISHMENT OF NEW LINES. (E.) Steel, C. M. (Western Gen. Hosp., Edinburgh, Scotland). *J Nat Cancer Inst* 48(3): 623-628, 1972.

Cells from each of seven lymphoblastoid lines derived from patients with Burkitt lymphoma, infectious mononucleosis, viral gastroenteritis or chronic lymphatic leukemia were lethally irradiated (3,000 rads) and cocultivated with fresh blood leukocytes. The successful induction of cell lines from the mixed cultures was observed. Of the seven irradiated lines, all but three contained Epstein-Barr virus particles (EBV). The presence of EBV was correlated with effectiveness of irradiated cells as promoters of long-term growth in fresh leukocytes. None of the three EBV-negative lines was successful in establishing new cell lines; all of the EBV-positive lines were successful. With one exception, no new cell line was initiated from 24 mixed cultures using irradiated cells eight to 18 days postirradiation (the exception was a culture initiated using infectious mononucleosis cells nine days postirradiation). In contrast, 24 new lines were established from leukocytes mixed with irradiated cells on days zero to seven postirradiation. The likelihood of initiating a new cell line was not affected by the number of irradiated cells/5 ml mixed culture (within the range 0.5×10^6 – 5.0×10^6 irradiated cells). Likelihood of initiating a new line was improved, however, when the number of fresh leukocytes in mixed cultures exceeded 3×10^6 . Placental blood leukocytes grew more readily than those from older children or adults. Only eight of 23 new cell lines established showed EBV under the electron microscope. However, occult EBV infection was suspected in the other 15 lines. Of a total of 25 new cell lines established from mixed cultures, 22 were diploid (one was aneuploid and two were not examined cytogenetically). There was no evidence that EBV influenced the karyotypes of newly established lines.

4033 PROLIFERATIVE ACTIVITY OF HUMAN GRANULOCYTES, AS ESTIMATED QUANTITATIVELY BY IN VITRO COLONY FORMATION. (E.) Northup, J. D. (Nat'l Cancer Inst., Bethesda, Md.), J. M. Bull and P. P. Arbore. *J Nat Cancer Inst* 48(3):629-637, 1972.

Human marrow cells from normal subjects and patients with leukemia and anemia were cultured in a methylcellulose medium containing a colony-stimulating factor prepared from human embryo kidney cells. The number of colonies formed/10,000 nucleated marrow cells in cultures was observed after 10-12 days incubation. The number of colonies/10,000 nucleated mar-

row cells from ten normals was 0.9-5.8 (mean = 2.3). In patients with aplastic anemia, the range was 0-0.5 and in acute lymphoblastic leukemia patients the range was 0-10.1. Patients with acute myeloblastic leukemia showed 0-5.5 colonies/10,000 marrow-nucleated cells. Only a fraction of marrow cells in cultures were granulocyte precursors. The relationship between proportions of granulocyte precursors and the number of colonies produced was observed; as the proportion of granulocyte precursors increased the number of colonies/culture plate increased. Normals showed a mean of 6.0 colonies formed/10,000 granulocyte precursors. In acute lymphoblastic leukemia patients' marrow, the range of number of colonies/10,000 granulocytes was 0.4-126. The number of colonies formed/ml of marrow in ten normals' bone marrow cell cultures was 3,000-25,000/ml (mean = 12,000 colonies/ml). For patients with aplastic anemia or acute leukemia, the number of colonies/ml was normal or below normal.

4034 STUDIES ON THE GENETIC CONTROL OF CELL PROLIFERATION: I. CLEARANCE OF DNA-BOUND RADIOACTIVITY IN 19 INBRED STRAINS AND HYBRID MICE. (E.) Heiniger, H. J. (Jackson Lab., Bar Harbor, Me.), H. W. Chen, H. Meier, B. Taylor and L. S. Commerford. *Life Sci* 11(2):87-96, 1972.

Female mice of 19 different inbred strains and F₁ hybrids were given i.p. injections of tracer amounts of ¹²⁵I-5-iodo-2'-deoxyuridine (¹²⁵IUDR). Whole-body clearance of DNA-bound ¹²⁵I activity was observed from one min to 20 days after ¹²⁵IUDR injection. The DNA clearance curve was similar in shape for all strains, showing a continuous distribution of DNA turnover rates for all strains. Genetically related strains showed similar patterns of DNA clearance. On grouping strains for high and low rates of turnover, turnover was found to be associated with histocompatibility loci H-1, H-2 and H-4. No association was found between DNA turnover rate and occurrence, incidence or type of spontaneous tumorigenesis in mice.

4035 THE REPLICATION OF DNA IN MURINE LYMPHOMA CELLS (L5178Y). II. SIZE OF REPLICATING UNITS. (E.) Lehmann, A. R. (Chester Beatty Res. Inst., Sutton, England) and M. G. Ormerod. *Biochim Biophys Acta* 272(2):191-201, 1972.

The size of the replicating units of the DNA from murine lymphoma L5178Y cells was studied by direct measurement of the size of the growing DNA strands in sucrose gradients. Cells were pulse-labeled with ³H-thymidine and then irradiated with low doses of x-rays in order to introduce a small amount of DNA fragmentation, thus overcoming entanglement effects. Detailed analysis of the radioactivity profiles obtained on sedimentation of the resulting labeled DNA fragments in alkaline sucrose gradients has provided information about the size of the growing DNA strands. The results suggest that the replicating units have a single-strand molecular wt of

about 2×10^6 . Sometimes a much smaller population with a molecular wt of about 4×10^7 is also observed. On completion of replication the newly-synthesized strands are linked end-to-end, so that the molecular wt of the DNA strands in the G2 phase of the cell cycle is more than 10^9 , the upper limit of current measurement methods.

- 4036 METHYLATION OF DNA IN HUMAN CHRONIC GRANULOCYTIC LEUKEMIA CELLS. (E.) Tryfiates, G. P. (West Virginia U. Med. Ctr., Morgantown). *Life Sci* 11(5):229-236, 1972.

Methylation of DNA in human chronic granulocytic leukemic cells was studied. Granulocytes harvested from leukemic patients were incubated *in vitro* with ^3H -thymidine or methyl- ^3H methionine and the DNA was isolated and analyzed by CsCl centrifugation. DNA hydrolysates were analyzed by paper and Sephadex G-10 column chromatography for methylated bases using authentic methylated bases as standards. Upon incubation at 37°C , human leukemic granulocytes actively synthesized and methylated DNA. DNA synthesis occurred optimally after approximately one hr of incubation whereas DNA methylation was not maximal until about two hr of incubation, one hr after maximal DNA synthesis. The main DNA peak banded at $\rho = 1.6916 \text{ g/cm}^3$ from which an approximate guanine-cytosine content of 32.2% was calculated. Analysis of DNA hydrolysates showed the presence of 1-methyladenine and 5-methylcytosine. In addition, 1-methyl and/or 7-methylhypoxanthine, and 6-dimethylamino purine and/or 6-methyl mercaptopurine were tentatively identified.

- 4037 THE INFLUENCE OF THE THYMUS ON THE DEVELOPMENT OF TRANSPLANTED MAMMARY TUMOUR IN MICE. (E.) Belyaev, D. K. (USSR Acad. Sci., Novosibirsk) and E. V. Gruntenko. *Int J Cancer* 9(1):1-7, 1972.

High cancer C3H/He strain mice were thymectomized on the third day of life and given an engrafted C3H/He spontaneous mammary tumor at 60-75 days of age. The influence of thymectomy on tumor graft growth was observed. In thymectomized mice, tumor development was delayed and tumor weight was reduced. In a second set of experiments, C3H/He mice were given s.c. thoracic grafts of one, three or five thymuses from C3H/He mice ten days before receiving syngeneic mammary tumor grafts. Mice with one or three extra thymuses showed accelerated tumor growth. In the group with five extra thymuses, tumor growth was inhibited, suggesting that two factors exerting contrary effects on tumor development are present in the thymus. In a final group of experiments, five-day-old F_1 hybrids of matings between C3H/He females and C57BL (low cancer strain) males were thymectomized and the thymus was immediately replaced with a thymus from either a C57BL or a C3H/He donor. Tumors from C3H/He donors were grafted at two to three months of age. Replacement of the

hybrids' thymus by a C3H/He thymus did not effect the success of tumor grafting. Replacement of hybrid's thymus by a C57BL thymus significantly decreased grafting success; in 14 of 40 such mice, tumor grafts did not grow at all.

- 4038 CHROMOSOMAL MECHANISM FOR THE INDUCTION OF REVERSION IN TRANSFORMED CELLS. (E.) Block-Shtacher, N. (Weizmann Inst. Sci., Rehovoth, Israel), Z. Rabinowitz and L. Sachs. *Int J Cancer* 9(3):632-640, 1972.

A clone of hamster embryo cells transformed by polyoma virus was grown in culture at low cell density (10^3 cells/50 mm dish) at 41°C in the absence of a feeder layer to induce reversion of transformation. By six days of culture, the percentage of colonies in the cultured cells decreased from 79 to 33%, implying an increase in revertant cells, or cell variants. The increased frequency of variants was proportional to the increase frequency of aneuploid cells in reverting cultures. In six days of culture the percentage of diploid cells dropped from 78 to 33% and the percentage of aneuploid cells rose from 18 to 62%. Most aneuploid cells had chromosome numbers of 70-87. Changes in chromosome number and frequency of cell variants were not found in transformed cells seeded in culture at 10^5 cells/dish. The reverted state induced by growth at low cell density was unstable, but could be stabilized by incubation at 24°C . Chromosome numbers and percentage of colonies were not changed by incubation at 24°C . In studies of the number and size of nuclei in revertant cultures, it was found that binucleated cells developed which gave rise to cells with a large nucleus. The latter cells were apparently polyploid, and lost chromosomes to become aneuploid variant cells. Stabilization of the revertant state is probably associated with the production of the right type of stable aneuploid cells required for reversion.

- 4039 BONE MARROW RESPONSE TO ERYTHROPOIETIN IN POLYCYTHEMIA VERA AND CHRONIC GRANULOCYTIC LEUKEMIA. (E.) Zucker, S. (New England Med. Ctr. Hosp., Boston, Mass.), D. M. Howe and L. R. Weintraub. *Blood* 39(3):341-346, 1972.

The incorporation of exogenous iron into heme in bone marrow cells from four normals, three chronic granulocytic leukemia (CGL) patients and five polycythemia vera patients was observed. The effect of erythropoietin on iron incorporation was measured. Iron incorporation into heme by the normals' marrow ranged from $5.1-9.1 \mu\text{M}/10^6$ nucleated red blood cells. Iron incorporation into heme was above normal in all CGL and polycythemia vera patients. Erythropoietin (most effective dose = 0.6 U/ml marrow cells) increased heme incorporation of iron by 22.4-47.6% in normal marrows and by 35.5-38.4% in marrows of CGL patients. Erythropoietin did not significantly stimulate iron incorporation in marrows of polycythemia vera patients.

4040 L-ASPARAGINASE EFFECTS ON INTACT MURINE LEUKEMIA CELLS AND ON ISOLATED CELL PLASMA MEMBRANES. (E.) Kessel, D. (U. Rochester Med. Ctr., N.Y.) and H. B. Bosmann. *Biochem Biophys Res Commun* 48(1):35-40, 1972.

The effects of L-asparaginase were examined on intact and isolated membranes of asparaginase-sensitive L5178Y and resistant L5178Y/ASP lymphoma cells. Treatment of isolated L5178Y plasma membranes prelabeled *in vivo* with ^3H -L-fucose caused the release of small amounts of cell-surface glycoproteins into the supernatant fluid. Such a solubilization was not found using prelabeled intact L5178Y cells or prelabeled cells or plasma membranes of the resistant L5178Y/ASP line. Resistant L5178Y/ASP cells contained lower levels of cell-surface glycoprotein with papain-sensitive linkages than did the sensitive L5178Y cells, indicating that L-asparaginase resistance was a consequence of lower levels of plasma membrane glycoproteins. L-asparaginase (100 U/ml for 30 minutes) produced no alterations in intact or isolated L5178Y plasma membranes which could be seen using phase-contrast microscopy. Thus, the effect of asparaginase on sensitive cells could not be attributed to an immediate cell lysis resulting from an action of the enzyme on preformed membrane structures. The mechanism of asparaginase action may involve the inhibition of glycoprotein and protein synthesis required for the maintenance of membrane structure.

41 STIMULATING FACTORS FROM NORMAL AND LEUKEMIC CELLS LINES: SECRETION AND ACTION DURING ESTABLISHMENT OF A CELL LINE. (E.) Rosenfeld, (Paul-Brousse Hosp., Villejuif, France), A.-M. Guat and C. Choquet. *Rev Europ Etudes Clin Biol* (10):1036-1043, 1971.

11 lines from blood leukocytes of healthy donors and donors with acute myeloblastic, acute lymphoblastic and chronic lymphocytic leukemia were grown in medium 1640 RPMI. Stimulating factors were obtained in growth medium by growing normal or leukemic cells in it, and then centrifuging the conditioned medium. The presence of stimulating factors in supernatants of conditioned medium was demonstrated by inoculating supernatants with small numbers of homologous or homologous cells and observing their growth in conditioned medium. Inoculation of leukemic cells in new (unconditioned) medium and in conditioned medium which had supported autologous cells for three days showed that multiplication of leukemic cells is possible for inocula of less than 10^5 cells/ml in conditioned medium and that multiplication ceases in new media for inocula greater than 1×10^6 cells/ml. In general, conditioned media were able to support the growth of homologous or homologous normal and leukemic cells in small inocula which did not survive in unconditioned media. This effect was seen with supernatants of cell cultures incubated in medium with or without serum and in cell cultures incubated with medium alone, suggesting that stimulating factors in

conditioned medium were a cell product. The effect on cell growth of conditioned media was tested with media from normal and leukemic cultures 24 hr after initiation of culture, at various times during the descending phase which precedes establishment of cell culture and after establishment of cultures. Factors were produced by normal and leukemic cell cultures at the beginning of culture, but little or no factor was produced by cultures in the declining phase. After establishment of cultures, during the period of active culture growth, stimulating factors were again produced.

4042 FREQUENCY OF OCCURRENCE OF HEPATOCELLULAR CARCINOMA IN PATIENTS WITH PORPHYRIA CUTANEA TARDA IN LONG-TERM FOLLOWUP. (E.) Korđac, V. (Charles U., Prague, Czechoslovakia). *Neoplasma* 19(2):135-139, 1972.

Autopsies were performed on 36 patients with porphyria cutanea tarda (PCT), who had died over a 17-yr period at the Porphyric Dispensary, Prague. Of these, 33 were males. The average duration between clinical manifestation of the disease and death was 9 yr (a range of 2-20 yr). Cirrhosis of the liver was found in 63.9% of the autopsied cases. Hepatocellular carcinoma, which was invariably located in cirrhotic regions, was found in 47.2% of the cases, a rate 100 to 200 times that randomly found at autopsy in Czechoslovakia. The average duration of disease in PCT patients with cirrhosis and/or hepatocarcinoma was 11.7 yr, compared with 6.3 yr for those without liver disease at autopsy. These results tend to confirm the hypothesis that the extent of liver disease in PCT patients depends on the duration of the disease, although exceptions were observed.

4043 POLYNUCLEOTIDE LIGASE IN RAT TISSUES AND ASCITES HEPATOMA. (E.) Miyaki, M. (Cancer Inst., Tokyo, Japan) and T. Ono. *Cancer* 63(2):251-260, 1972.

DNA ligase and endonuclease activities were assayed concurrently in homogenates of regenerating rat liver and spleen and in sonicates of ascites hepatoma. ATP-dependent ligase activity, measured by the amount of covalently joined mixed ^3H -labeled dimer absorbed by hydroxyapatite, began to increase 15 hr after partial hepatectomy, reaching a value eight times that of normal liver by 37 hr. Endonuclease activity, determined by alkaline sucrose gradient centrifugation of native ^3H -DNA preincubated with tissue extract, was maximal in normal liver and minimal at 37 hr after partial hepatectomy. Up to a 2.5-fold higher ligase activity was observed in rat spleen and ascites hepatoma, AH-130 and AH-7974, than in regenerating liver. A reciprocal relationship between ligase and nuclease activities was also observed in these tissues. The ligase activity of nuclei was highest in both regenerating liver and AH-130, and the activities

of subcellular fractions of AH-130 were higher than those of corresponding fractions of regenerating liver. ATP-dependent ligase of regenerating liver and that of spleen were separated into two fractions by phosphocellulose column chromatography (eluting at 0.2 M and 0.3 to 0.35 M phosphate, resp.). Most of the ligase activity of ascites hepatoma AH-130, however, was recovered in a single peak eluting at 0.23 M phosphate. The ability of this fraction to rejoin nicked DNA in the absence of ATP suggested the presence of a ligase-AMP complex. The increase in ligase activity in regenerating liver at 37 hr corresponded to previously reported time of increased DNA synthesis and thymidine kinase activity, thus suggesting that ATP-dependent ligase may participate in DNA synthesis.

- 4044 OVARIAN TUMORS: AN EXTENSION OF THE PEUTZ-JEGHERS SYNDROME. (E.) Christian, C. D. (U. Arizona Coll. Med., Tucson). *Trans Amer Gynec Soc* 94:67-72, 1971.

The relationship between the Peutz-Jeghers syndrome and ovarian tumors is examined. In spite of the low incidence of occurrence of this syndrome, the coexistence of tumors in 15 of 125 reported cases is considered significant. A possible genetic defect reflected by the syndrome which in turn leads embryologically to either gastrointestinal polyposis or ovarian tumors is considered. Conceptually, data indicate that the embryological defect is thought to occur in the yolk sac entoderm which produces a primary germ cell which in turn induces a stromal proliferation resulting in the ovarian tumor. In light of a predilection for tumors in the presence of this syndrome, recommendation is made for continued documentation of the pathological nature of the ovarian tumors.

- 4045 JUVENILE THYROID CARCINOMA. (E.) Roeher, H. D. (U. Hosp., Heidelberg, Germany), R. Daum, M. Pieper and H. Rudolph. *J Pediatr Surg* 7(1): 27-31, 1972.

The diagnosis and treatment of nine juveniles with thyroid carcinoma are reported. The incidence, association with previous radiation therapy of the neck, and frequency of occurrence among juvenile females, in particular, are discussed. Treated children have relatively good prognosis with a satisfactory survival rate.

- 4046 SOME SIMILARITIES IN THE RESPONSES OF MICE TO PREGNANCY AND LEUKEMOGENESIS. (E.) Tyndall, R. L. (Oak Ridge Natl. Lab., Tenn.), J. A. Otten, M. R. Proffitt, N. D. Bowles and R. W. Tennant. *Int J Cancer* 9(3):584-594, 1972.

Pregnant BALB/c and AKR mice, AKR mice with spontaneous thymic lymphoma and mice of both strains with leukemia induced by inoculation with preparations of

Rauscher leukemia virus (RLV) were used as donors of serum and spleen cells for separation of serum proteins and nonspecific esterases by acrylamide gel electrophoresis. Serum protein patterns of RLV-infected leukemic mice and of spontaneously leukemic AKR mice resembled sera of pregnant normals in showing diminished second and third prealbumins, increased fourth prealbumin and increases in the protein migrating next to serum transferrin. Serum protein alterations in pregnant mice were similar to but more pronounced than those in leukemic mice. Sera from pseudopregnant mice, partially hepatectomized mice, mice inoculated with fetal tissue or mice infected with lactic dehydrogenase virus or pneumotropic mycoplasma did not show similar alterations, while sera of scalped mice did. Spleens from pregnant mice, like those of RLV-infected mice, showed marked hyperplasia in the red pulp. Germinal center formation was seen in spleen tissues from inbred (BALB/c) pregnant mice at 18-20 days of gestation and in postpartum spleens. Spleen esterases from RLV-infected mice showed decreased prealbumin and increased postalbumin esterase; a similar pattern was seen in esterases in spleens of pregnant mice. In related experiments, sera from pregnant or scalped rats and anti-murine leukemia virus rat serum showed a common precipitin line when reacted in double-diffusion tests with RLV from a variant RLV-infected JLS V5 cell line. Sera of virgin rats showed no such reactivity nor did cells from lines not infected with RLV.

- 4047 THE STIMULATION AND INHIBITION OF THE GROWTH CAPACITIES OF SPONTANEOUS TUMORS OF MAMMARY GLAND ORIGIN IN MICE (ADENOCARCINOMATA). (E.) Strong, L. C. (Leonell C. Strong Res. Fdn. Inc., San Diego, Calif.) and H. Matsunaga. *J Surg Oncol* 3(4):467-473, 1971.

A specially prepared liver extract with tumor-inhibiting powers was divided into two parts; one portion (REF) was stored in a refrigerator at -2.2 C and the other (ART) was stored at room temperature (22.2-28.9 C). Between 70-314 days after initial preparation of the liver extract, REF or ART was used to treat mice bearing spontaneous mammary adenocarcinomas. With each moiety there were obtained three reactions in regard to the growth capacity of spontaneous tumors over a 50 wk observation period. In sequence, these were (1) a stimulation of growth rate of tumors, (2) no effect on growth capacity of tumors and (3) a pronounced inhibition of tumor growth. REF given 262 or 314 days after its original preparation virtually abolished growth of tumors. The constituents of the tumor-inhibiting liver extract included adenosine, N^6 -methyladenosine and 5-methylcytidine.

- 4048 RETICULOSARCOMA AND AMYLOID DEVELOPMENT IN BALB/c MICE INOCULATED WITH SYNGENEIC CELLS FROM YOUNG AND OLD DONORS. (E.) Ebbesen, P. (Inst. Med. Microbiol. U. Copenhagen, Denmark). *J Nat Cancer Inst* 47(6):1241-1245, 1971.

Untreated BALB/c female mice (108) over 16 months old showed a markedly increasing risk of developing reticulosarcoma and leukemia with age increase; the mean survival time for the group was 20 months. Most of 116 males died with amyloidosis before reaching the age at which reticulosarcoma and leukemia became common in females, the mean survival time for males being 13 months. Intraperitoneal inoculation of one-month-old mice with 10^7 mixed viable thymus, spleen and lymph node cells from nonmalignant 4-month-old mice tripled the incidence of reticulum cell sarcomas and reduced the mean survival time. Mechanically disrupted cells from 14-month-old donors were less effective in inducing neoplasia. Inoculation one- and 14-month-old mice with viable cells from one-month-old donors did not increase tumor incidence. Extensive amyloid deposits were frequently seen in liver, kidney and thyroid of old mice, but were rarely observed in females. Inoculation of cells from old mice did not accelerate amyloid development.

49 INHIBITION OF LYMPHOCYTE TRANSFORMATION BY L-ASPARAGINASE IN ACUTE LEUKEMIA. (Sp.) Braudo Conesa, L. C. (Natl. Acad. Med. Buenos Aires, Argentina), S. Pavloski and J. C. Scornic. *Medicina* (5):434-439, 1971.

50 RHABDOMYOSARCOMA OF THE HEART. (E.) Bemis, E. L. (Deaconess Hosp., Milwaukee, Wis.), H. Pemberton and A. Lurie. *Cancer* 29(4):924-929, 1972.

1 AMELOBLASTOMA OF THE MANDIBLE WITH METASTASIS TO THE LUNGS AND LYMPH NODES. (E.) Ikemura, (Fac. Med., Kyushu U., Fukuoka, Japan), H. Tashiro, H. Ino, D. Ohbu and K. Nakajima. *Cancer* 29(4):930-940, 1972.

2 MALIGNANT LYMPHOMA, HISTIOCYTIC TYPE WITH SCLEROSIS (SCLEROSING RETICULUM CELL SARCOMA). (E.) Rosas-Urbe, A. (Dept. Path., Chicago, Ill.) and H. Rappaport. *Cancer* 29(4):953, 1972.

3 FIBROXANTHOSARCOMA OF THE SOFT TISSUES. A TYPE OF MALIGNANT FIBROUS HISTIOCYTOMA. Kempson, R. L. (Stanford U. Sch. Med., Calif.) and M. Kyriakos. *Cancer* 29(4):961-976, 1972.

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4057 CARCINOMA OF THE BILHARZIAL URINARY BLADDER. A STUDY OF THE ASSOCIATED MUCOSAL LESIONS IN 86 CASES. (E.) Khafagy, M. M. (Cancer Inst., Cairo U., Egypt), M. N. El-Bolkainy and M. A. Mansour. *Cancer* 30(1):150-159, 1972.

4058 ATYPICAL FIBROUS HISTIOCYTOMA, MALIGNANT FIBROUS HISTIOCYTOMA, MALIGNANT HISTIOCYTOMA, AND EPITHELIOID SARCOMA. A COMPARATIVE STUDY OF 65 TUMORS. (E.) Soule, E. H. (Mayo Clin. Mayo Fdn., Rochester, Minn.) and P. Enriquez. *Cancer* 30(1):128-143, 1972.

4059 PRIMARY COLONIC PLASMACYTOMA. (E.) Nielsen, S. M. (U. Nebraska Coll. Med., Omaha), J. R. Schenken and L. P. Cawley. *Cancer* 30(1):261-267, 1972.

4060 PNEUMATOSIS CYSTOIDES INTESTINALIS IN ACUTE LEUKEMIA. (E.) Jaffe, N. (Children's Hosp. Med. Ctr, Boston, Mass.), D. H. Carlson and G. F. Vawter. *Cancer* 30(1):239-243, 1972.

4061 HODGKIN'S DISEASE PRESENTING AS "IDIOPATHIC" THROMBOCYTOPENIC PURPURA. (E.) Rudders, R. A. (Harvard Med. Sch., Boston, Mass.), A. C. Aisenberg and A. L. Schiller. *Cancer* 30(1):220-230, 1972.

4062 BASAL CELL ADENOMA OF MINOR SALIVARY GLAND ORIGIN. (E.) Christ, T. F. (Ohio State U. Coll. Dentistry, Columbus) and D. Crocker. *Cancer* 30(1):214-219, 1972.

4063 CYTOMEGALOVIRUS INFECTIONS IN LEUKAEMIC CHILDREN. (E.) Caul, E. O. (Bristol Public Hlth. Lab., U. Bristol, England), V. A. Dickinson, A. P. Roome, M. G. Mott and P. A. Stevenson. *Int J Cancer* 10:213-220, 1972.

4064 MIDLINE MALIGNANT RETICULOSIS. A CLINICO-PATHOLOGIC ENTITY. (E.) Fechner, R. E. (Baylor Coll. Med, Houston, Texas) and D. W. Lamppin. *Arch Otolaryng* 95(5):467-476, 1972.

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- 4066 NEUROBLASTOMA: SYNCHRONIZATION OF NEURITE OUTGROWTH IN CULTURES GROWN ON COLLAGEN. (E.) Miller, C. A. (Albert Einstein Coll. Med., Bronx, N.Y.) and E. M. Levine. *Science* 177(4051): 799-802, 1972.
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ARONSON. S.A.
 3665, 3808, 3867
 ABE, K.
 4292*
 ABRAHAMSON, J.R.
 4241*
 ABRAMOVICH, A.B.
 4260*
 ACCAME, F.A.
 4202*
 ADAM, Y.G.
 4244*
 ADAMS, R.L.P.
 3992
 ADECHY-BENKOE, L.
 4077*
 ADELSBERGER, L.
 4195*
 DENIS, I.
 4139*
 DINOLFI, A.
 3849
 DINOLFI, M.
 3849
 HEARN, M.J.
 4020
 HERNE, W.
 4221*
 ISENBERG, A.C.
 4061*
 KSENOV, O.A.
 3826*
 IRRIGHT, N.L.
 3838
 ALEXANDER, J.A.
 4068*
 ALEXANDER, P.
 3873
 ELLEN, J.R.
 4169*
 ALLERTON, S.E.
 4228*
 AITWIN, J.E.
 4155*
 AMANO, M.
 4174*
 MATUZZI, D.S.
 3856
 AMKRAUT, A.
 3920*
 AMOURAUX, J.
 4295*
 MAGNOSTE, B.
 4023
 ANDERSEN, H.K.
 3884
 ANDERSON, P.S., JR.
 3740
 ANDERSON, R.J.
 3878
 ANDERSON, W.
 3607

ANDZHAPARIDZE, O.G.
 3760
 ANGLIO, E.
 3978*
 ANKI, T.
 3852, 4010
 APPELLA, E.
 3909
 ARASZKIEWICZ, H.
 4250*
 ARDERIU TORNER, R.
 4146*
 ARGAST, G.
 4156*
 ARGEMI, B.
 4077*
 ARICI, C.
 3918*
 ARKHIPOV, G.N.
 3661
 ARLEN, M.
 3736*
 ARLINGHAUS, R.B.
 3738
 ARNOULT, J.
 4151*
 ARON, M.
 3912*
 ARTHAUD, J.B.
 4232*
 ARTNER, J.
 4249*
 ATHANASIU, P.
 3833*
 ATKIN, N.B.
 4270*
 ATKINS, R.
 3906
 AUBERT, CH.
 4163*
 AUER, V.
 4116*
 AUERSPERG, N.
 4030
 AUMUELLER, G.
 4115*
 AURELIAN, L.
 3895
 AURICH, G.
 3847
 AVIV, H.
 3845
 AVRIN, E.
 4240*
 AVTANDILOV, G.G.
 3989
 AVTANDILOVA, L.I.
 3989
 AXEL, R.
 3774, 3803
 BABIN, PH.
 3626*

BABINKOV, V.J.
 3916*
 BADIA SERRA, J.
 3635*
 BAGLEY, C.M., JR.
 3994
 BAGLIONI, C.
 4238*
 BAGSHAW, K.D.
 4132*
 BAKAY, L.
 4290*
 BAKER, M.B.
 3817
 BAKER, R.E.
 3817
 BALAKRISHNAN, K.
 3932*
 BALASHEVA, I.I.
 3624*
 BALDWIN, R.W.
 3899
 BALHORN, M.
 4087*
 BALHORN, R.
 4087*
 BALNER, H.
 3727
 BANK, A.
 4025
 BANKOLE, R.O.
 3856
 BARAHONA, H.H.
 3757, 3781, 3822*, 3824*,
 3832*
 BARAN, L.A.
 3952*
 BARBARESCHI, G.
 4144*
 BARESCVA, M.
 3905
 BARGE, J.
 3664
 BARGELLES, A.
 3844
 BARKER, H.G.
 3910*
 BARR, K.J.
 3941
 BARRIE, J.
 4236*
 BARTKO, D.
 4118*
 BARTON, B.P.
 3928*
 BASMANN, H.B.
 4040
 BASSIN, R.H.
 3758
 BATES, H.A.
 3856
 BEARD, P.

3818
 BECK, C.
 3927*
 BECK, F.G.
 3617
 BECKER, F.F.
 3656
 BECKER, Y.
 3611
 BECKERS, J.P.
 4135*
 BEDA, R.
 4018
 BEFER, G.W.
 3740
 BEIRLE, J.
 4228*
 BEIYAFV, D.K.
 4037
 BELZER, F.O.
 4276*
 BEMIS, F.L.
 4050*
 BEN-BASSAT, H.
 3938
 BENDER, M.A.
 4019
 BENDITT, E.P.
 4227*
 BENINI, G.
 4105*
 BENJAMIN, S.P.
 4165*
 BENNETT, K.
 3700
 BENSON, K.G.
 3959*, 4216*
 BEREBBI, M.
 3694
 BERENDES, U.
 4140*, 4175*
 BERENOV, T.T.
 4147*
 BERGER, R.
 4177*
 BERGS, V.V.
 3800
 BERNARD, J.
 4176*
 BERTOLOTTI, R.
 4190*
 BERTRAND, F.
 4018
 BESKROVNI, A.M.
 3667
 BETTS, T.E.
 3645
 BEURTON, D.
 3613, 3614
 BHATHENA, D.
 3961*
 BILLITERI, A.

4119*
 BILLITERI, A.
 3915*
 BIRD, C.
 3691
 BISCHOFF, F.
 3642*
 BISHOP, J.M.
 3778
 BJERKNES, R.
 3957*
 BLACHF, R.
 4163*
 BLACK, P.H.
 3686
 BLAIR, P.B.
 3857
 BLAMEY, R.W.
 3911*
 BLAU, H.-J.
 4263*
 BLFIBERG, I.
 4238*
 BLOCK-SHTACHER, N.
 4038
 BLUMEL, G.
 4113*
 BOCK, F.
 4113*
 BOCK, F.G.
 3687
 BOLCK, F.
 4080*, 4272*
 BOMFORD, R.
 3772
 BONILLA-MUSOLES, F.
 4253*
 BOONE, C.W.
 3882, 3903
 BOOTHE, A.D.
 3737
 BOREK, C.
 3936
 BOTELLA LLUSIA
 4146*
 BOTTRO, A.
 4184*
 BOTTURA, C.
 4125*
 BOURGAUX, P.
 3827*
 BOVA, D.
 3875
 BOWIE, E.J.W.
 4242*
 BOWLES, N.D.
 4046
 BOYD, C.B.
 4218*
 BOYERS, R.C.
 4096*
 BRAMBILLA, G.

3662
 BRANDCHAFT, P.R.
 3903
 BRAY, D.M., III
 3948
 BRAYLAN, R.C.
 3733*
 BRAYTON, C.
 3739
 BREMER, A.
 4160*
 BRENNER, R.R.
 4206*
 BREWSTER, T.C.
 3621, 3650
 BRIGGS, E.M.
 4085*
 BRINCKER, H.
 4209*
 BRISCOE, W.T.
 4083*
 BROCHIER, J.
 3843
 BROCKHAUS, A.
 3617
 BRODETSKY, A.F.
 3941
 BROOME, J.
 4023
 BROTCHE, J.
 4264*
 BROWNLEE, G.G.
 4189*
 BRUCCHIERI, A.
 3915*, 4119*
 BRYAN, R.J.
 3703
 BUBENIK, J.
 3905
 BUCK, P.
 4221*
 BULL, J.M.
 4033
 BULL, J.M.C.
 4172*
 BULLON RAMIREZ, A.
 4284*
 BULLON SOPELANA, A.
 4284*
 BURGER, D.
 3761
 BURGER, H.G.
 3927*
 BURTIN, P.
 3628*
 BUSCH, H.
 4070*, 4084*
 BUSHUEV, YU.I.
 4121*
 BUTCHER, F.R.
 4161*, 4178*, 4271*
 BUTEL, J.S.

3755
 BUTLER, R.B.
 4228*
 BUTIER, R.F.
 4069*
 BUU-HOI, N.P.
 3699
 BYFIELD, J.
 3919*
 CACHIN, Y.
 4138*
 CAUSSI, M.
 4204*
 CAJAL, N.
 3830*
 CALAFAT, J.
 3767
 CALLE, R.
 4137*
 CAMARRI, E.
 3949
 CAMERON, H.M.
 3876
 CAMILLERI, J.P.
 3664
 CAMPBELL, J.A.
 3815
 CANELLOS, G.P.
 4021
 CANTARANO, G.
 4255*
 CANTOR, C.R.
 3705
 CAPPA, A.P.M.
 3978*
 CARACENI, C.F.
 3662
 CARBONE, P.P.
 4021, 4033, 4172*
 CARES, H.L.
 4290*
 CARLSON, D.H.
 4060*
 CARLTON, W.W.
 4193*
 CARMONA, A.
 3842
 CARRERAS RUIZ, O.
 3979*
 CARSTENS, H.B.
 4054*
 CARTER, R.L.
 3680
 CASTELLANOS, H.
 3822*
 CASTOLDI, G.L.
 4275*
 CASTORIANO, I.M.
 3728
 CATTANEO, C.
 4106*
 CATTAROSSO, E.

4288*
 CAUL, E.O.
 4063*
 CAULT, T.
 3664
 CAULIN, CH.
 4295*
 CAVANNA, M.
 3662
 CAWLEY, J.
 3785
 CAWLEY, L.P.
 4059*
 CAYLA, J.
 4136*
 CERIANI, R.L.
 4173*
 CERNA, H.
 3810
 CERNY, L.
 3937
 CHAFFEY, J.T.
 3734*
 CHAKRABARTI, S.
 4229*
 CHALKLEY, R.
 4087*
 CHAMORRO, A.
 3765
 CHAN, B.W.B.
 4213*
 CHAN, P.C.
 3668
 CHANANA, A.D.
 4013
 CHANDRA, P.
 3787
 CHARRIT, A.
 3725
 CHARDONNET, Y.
 3828*
 CHARLES, A.H.
 4170*
 CHAUDHRY, A.P.
 4100*
 CHAUVERGNE, J.
 3625*
 CHAVALDRA, N.
 3725
 CHAVELET, F.
 4176*
 CHEDD, G.
 3622*
 CHEEVER, A.W.
 3944
 CHEN, C.-H.
 3926*
 CHEN, H.W.
 4034
 CHESNEY, C.F.
 4169*
 CHIN, C.-K.

3928*
 CHITALE, A.R.
 4300*
 CHO, H.Y.
 3703, 3756
 CHOPPRA, H.
 3750
 CHOPRA, H.C.
 3800
 CHOQUET, C.
 4041
 CHRETIEN, P.B.
 3907
 CHRIST, T.F.
 4062*
 CHRISTIAN, C.D.
 4044
 CHRISTOPHERSON, W.M.
 4220*
 CHRISTOV, K.
 3735*
 CHU, S.-H.
 3926*
 CHU, T.M.
 3846
 CHURG, J.
 3601
 CIRNU-GEORGIAN, L.
 4164*
 CITOLER, P.
 3724*
 CIVIDALLI, G.
 4098*
 CLAUDIO, F.
 4185*
 CLEMENTE, S.
 4145*
 CLIFFORD, P.
 3876, 3942
 CLINE, M.J.
 3853
 COBO, A.
 4243*
 COCHRAN, A.
 4027
 COCHRAN, A.J.
 3897
 COHEN, A.M.
 3935*
 COHEN, S.
 3849
 COLE, P.
 3971
 COLLIMEDAGLIA, P.
 4288*
 COLMERAUER, M.E.M.
 3733*
 COMBES, P.F.
 3725
 COMMERFORD, L.S.
 4034
 CONRAD, E.

3704
 CONFESSIO, G.P.
 4173*
 COOPER, I.A.
 4166*
 COOPER, T.W.
 4009
 CORY, J.G.
 4212*
 COSTIN, C.
 3967, 3970
 COTCHIN, F.
 4268*
 COUPPEZ, F.
 3939
 COURTENAY, V.D.
 4168*
 COUTINHO, V.
 4125*
 COUTURAUD, M.
 4136*
 CRAIG, J.M.
 4226*
 CRAMER, H.-J.
 4111*
 CRARY, D.D.
 4067*
 CRAVINTO, H.
 3700
 CRICHLOW, R.W.
 3966
 CROCKER, D.
 4062*
 CRONKITE, F.P.
 4013
 CROOKE, S.T.
 4084*
 CUKIER, J.
 3613, 3614
 CULLITON, B.J.
 3615
 CURRIE, G.A.
 3873
 CURTIS, H.J.
 3732
 CYSEWSKI, S.J.
 3649
 D'AGOSTINO, M.A.
 4022
 D'OLIVEIRA, J.J.G.
 3982*
 DABROWSKI, J.
 3793
 DAHLIN, D.C.
 4093*
 DAIBER, A.
 3842
 DALTON, A.J.
 3783
 DAMLE, S.R.
 4298*
 DANIEL, B.G.
 3675, 3697
 DANIEL, M.O.
 3757, 3781, 3822*, 3824*,
 3832*
 DANISOVA, J.
 4118*
 DANNA, K.J.
 3741, 3776
 DAQUST, R.
 3654
 DARBY, N.B., JR.
 3770
 DARZYNKIEWICZ, Z.
 3731
 DAUM, R.
 4045
 DAVIS, H.J.
 3895
 DAY, F.D.
 3841
 DAY, N.E.
 3744
 DE BARBIERI, A.
 3850
 DE BRUX, J.
 3939
 DE CHIRICO, T.
 4184*
 DE GIORGI, L.S.
 4225*
 DE LUCA, C.
 3997
 DE MAEYER-GUIGNARD, J.
 3834*
 DE MICCO, PH.
 3694
 DE SAINT-MAUR, P.
 4136*
 DE SCHRYVER, A.
 3876
 DE VITA, V.T.
 4021
 DEHNEN, W.
 3617
 DEINHARDT, F.
 3806, 3823*
 DELAITRE, B.
 4162*
 DELARUE, J.
 3664
 DELARUE, N.C.
 3607
 DELMON, G.
 3626*
 DELORMIER, A.A.
 4276*
 DEMANY, M.A.
 4075*
 DEMETRIUS, J.
 3697
 DEMOISE, C.F.
 3756
 DEMPO, K.
 3714
 DEPLANU, A.
 4203*
 DETTER, J.
 4243*
 DEVITA, V.T., JR.
 3994
 DI FRANCO, F.
 3886
 DI MARCO, A.T.
 3921*
 DI PACLO, J.A.
 3646
 DIAZ, M.
 4207*
 DICKINSON, V.A.
 4063*
 DIDISHEIM, P.
 4242*
 DIEBOLD, J.
 3664, 4079*
 DIJKSTRA, J.
 3688
 DIPPLE, A.
 3671
 DIXON, B.
 3682
 DIXON, F.J.
 3852
 DIXON, J.A.
 3974
 DMOCHCWSKI, L.
 3784
 DONATH, K.
 4129*
 DONOVAN, P.J.
 3646
 DORFMAN, N.A.
 3870
 DOUCHEZ, J.
 3725
 DOW, L.W.
 4025
 DOWD, J.E.
 3968
 DRACH, J.C.
 3754
 DREL, K.A.
 3987
 DRESDEN, M.H.
 3990
 DREWINKO, R.
 4020
 DREYFUSS, F.
 3969
 DRIESSENS, J.
 4139*
 DROBNICA, L.
 4246*
 DRONOVA, O.M.
 4181*

U PLOOY, M. 3688	ENRIQUEZ, P. 4058*	FIALA, S. 3682
URE, D.K. 4229*	ENZINGER, F.M. 4219*	FIALKOW, P.J. 3942, 4243*
UREUIL, R. 3886	EPPINGER, S. 4144*	FICHIDJAN, R.S. 3831*
URURS, G.J. 3723*	EPSTEIN, J.H. 3641*	FILATOVA, A.S. 3720*
UFF, R. 4083*	EPSTEIN, S.M. 3717*	FILEV, L.V. 4101*
UFOR, M. 3699	ERICKSON, R.R. 3712	FILIPPOVA, N.A. 3950
UH, F.G. 3756	ERLANDSON, R.A. 4054*	FINCH, M.D. 3901
UNLOP, N. 3986	ESTELIN, R. 4138*	FINE, B.S. 4076*
UNN, J.F., JR. 3693	ESTES, M.K. 3809	FINKLESTEIN, J.Z. 3919*
UPERRAY, R. 3658	ESTES, P.C. 3947	FINOGENOVA, I.A. 4130*
UTTERA, M.J. 4172*	EVANS, D.M.D. 3911*	FISCHBERG, M. 3934*
VORAK, M. 3810	FADEEVA, L.L. 3753	FISCHINGER, P.J. 3758
WYER, A.C. 3823*	FALCETTI, E. 4255*	FISHER, B. 3859
AGEN, M. 3690	FALK, L.A. 3806	FISHER, E.R. 3859
BBESEN, P. 4048	FANTERIA, E. 3949	FLEISHMAN, YE.V. 4182*
CHAVE LLANOS, J.M. 4205*	FANTOLI, U. 4106*	FLEMANS, R. 3785
ODGINGTON, T.S. 4241*	FARBER, E. 3717*	FONT, R.L. 4076*
OWARDS, G.S. 3673	FARRON, F. 4004	FOOTE, F.W., JR. 4006
FFIER, D.B. 4165*	FARROW, G.M. 4014	FORBES, J.F. 3891
GOZCUE, E. 3779	FECHNER, R.E. 4064*, 4217*	FORTIS, P.A. 4159*
ISEMAN, B. 3906	FEEMSTER, J. 4192*	FOUSSARD-BLANPIN, O. 4149*
L-BOLKATNY, M.N. 4057*	FELDMAN, G.R. 3963*	FOX, R.R. 4067*
LIOTT, S.C. 3791	FENOGLIO, J. 3962*	FRABLE, W.J. 3637*
MUND, G.K. 3621	FEORINO, P. 3747	FRANCESCHI, C. 3921*
SON, L.A. 3645	FERENCZY, A. 3962*	FRANKEL, J.W. 3762
MANOIL-RAVICOVITCH, R. 3794	FERNANDEZ-BRITTO RODRIGUEZ, J.F.4142*	FRANKFURT, O.S. 3644
MBLETON, M.J. 3881	FEROLDI, CH. 3828*	FRANKS, L.M. 4009
MMFLOT, P. 3715*	FERRELL, H.W. 3637*	FRASER, C.E.O. 3757, 3781, 3822*
MMONS, R.W. 3823*	FETHERSTON, W.C. 3610	FRAZER, J.W. 3726
DDO, H. 4248*	FETTIG, O. 4287*	FREEDMAN, L.S. 4023
NG, C.P. 3885	FIALA, A.E. 3682	FREEMAN, A.E. 3713

FREEMAN, A.I.	GERICKE, D.	GOMPEL, C.
4230*	3787	4245*
FRENKEL, J.K.	GERMANOV, A.B.	GORDON, R.J.
3729	3753	3703
FRIBERG, S., JR.	GERTNER, H.R.	GORIN, N.C.
3851, 3858, 3874	3907	4079*
FRIDLENDER, R.	GHOSE, N.	GORISHEK, W.M.
3766	4267*	3974
FRIEDRICH-FREKSA, M.	GIACOMELLI, G.	GORLIN, R.J.
3715*	4013	4291*
FRIIS, R.R.	GIBBS, C.J., JR.	GOULD, N.S.
3778	3750	4227*
FU, Y.-S.	GIRLETT, E.R.	GOULD, V.E.
3958*	4243*	4227*
FUJINO, H.	GIRSON, R.	GRAHAM, C.K.
4051*	3968	3649
FUJISAKA, T.	GILDEN, R.	GRAHAM, S.
3696	3903	3968
FUKUI, H.	GILDEN, R.V.	GRANOFF, A.
3811	3602, 3875, 3902	3759
FUSHIMI, K.	GILLESPIE, C.A.	GRANT, C.K.
3707	3817	3873
FUXE, K.	GILLESPIE, D.	GRANT, D.W.
4023	3802	3650
GABRIANI, G.	GILLESPIE, D.M.	GRAY, L.A.
3958*	4016	4220*
GAERTNER, H.V.	GILLETTE, E.L.	GREEN, M.
4282*	4188*	3602, 3745, 3782
GAFTA, J.	GILSON, J.C.	GREENBERG, M.L.
4230*	3616	4013
GAJDUSEK, D.C.	GIOELI, R.P.	GREENBLATT, M.
3750	3997	3653
GALIAN, A.	GIORDANO, F.	GREER, J.
4295*	4105*	3906
GALLAGER, H.S.	GIRAUD-DOZIAS, C.	GRENEY, H.
4171*	4149*	4116*
GALLO, R.C.	GIRAUD CONESA, L.C.	GRESSER, I.
3742, 3790, 3799, 3802	4049*	3995
GARCIA, F.G.	GLAVES, D.	GRIFFIN, A.C.
3781, 3822*	3899	4083*
GARCIA, H.	GODRICK, E.A.	GRIGOR, M.R.
3708	4074*	4237*
GARCIA, L.	GOEKAY, E.	GROSS, S.K.
4145*	3918*	3796
GARDNER, M.B.	GOETZ, A.	GROTE, J.
3703	3787	4115*
GARGIULO, F.A.	GOLDMAN, M.	GROUPE, V.
4100*	3814	3762
GARRIDO, S.	GOLDSCHMIDT, B.M.	GROVER, P.L.
4146*	3647	3709
GATAULLIN, K.D.	GOLDSTEIN, M.	GROVES, J.N.
3951*	4023	4187*
GAZDAR, A.F.	GOLWEITZ, J.	GROVES, L.K.
3764	4074*	4165*
GELBOIN, H.V.	GOLEBIOWSKA, D.	GRUNBERGER, D.
3678	4251*	3705
GENORE, PH.	GOLOSOVA, T.V.	GRUNTENKO, E.V.
3914*	4180*	4037
GERARD-MARCHANT, R.	GOLUB, S.H.	GRUSOVIN, G.D.
4138*	3888	4275*
GERGELY, Z.	GOMENIUK, I.P.	GUCCION, J.G.
4157*	4262*	4219*

BUELF, J.
 3623*
 BUEYER, H.
 4115*
 BUEYER, J.
 4295*
 BUIBERT, D.
 3658
 BUIATI, S.C.
 3803
 BUIPTA, P.K.
 4273*
 BURG, C.
 3782
 BUSBERG, S.B.
 3681
 BUSEV, V.A.
 4147*
 BUTIFREZ ESTARLI, F.
 4142*
 BUTMANN, H.R.
 3712
 BASS, J.F.
 3960*
 BACKETT, A.J.
 3770
 BADI-AZIMI, I.
 3934*
 BADILOV, D.
 3711
 BADLER, H.I.
 3675, 3697
 BAGEL, F.
 4141*
 BAGEMAN, P.C.
 3767
 BAGGERTY, D.
 4206*
 BAGLIO, K.G.
 4258*
 BAHN, E.C.
 3752
 BAJDU, S.I.
 4006, 4224*, 4244*
 BAJDUKIEWICZ, Z.
 4112*
 BALAMA, J.
 4199*
 BALEVI, H.S.
 3969
 BALGAS, W.
 4278*
 BALTER, H.M.
 3684
 BALTERMAN, R.
 3908
 BALOKA, T.
 3863
 BALAZAKI, Y.
 3807
 BAL, D.
 4162*

HAMMOND, E.C.
 3601
 HAMPE, J.F.
 4268*
 HAMPERL, H.
 3956*
 HANAFUSA, H.
 3743
 HANDLER, E.E.
 4186*
 HANDLER, E.S.
 4186*
 HANKS, C.T.
 4100*
 HANSEN, D.
 3955*
 HANSEN, H.J.
 3846, 3910*
 HAPALOV, N.P.
 3618
 HARAN-GHERA, N.
 3775, 4089*
 HARE, J.D.
 3771
 HAREL, J.
 3777
 HARGIS, B.J.
 3866
 HARRIS, A.W.
 3853
 HARRIS, C.C.
 3685
 HARRIS, H.
 3858, 4027
 HARRISON, T.M.
 4189*
 HARTWICH, G.
 4286*
 HASEGAWA, H.
 3773
 HASENCLEVER, H.F.
 4086*
 HASHINOTSUME, M.
 4010
 HAUCK-GRANTH, R.
 4089*
 HAUTEFEVILLE, P.
 4295*
 HAYE, C.
 4137*
 HAYHOE, F.G.J.
 3785
 HAYS, E.F.
 3751
 HEATH, J.C.
 3702
 HEBERLING, R.L.
 3825*
 HECKER, E.
 3680
 HEIDELBERGER, C.
 3672, 3709, 3881

HEILMAN, S.A.
 3990
 HEIMANN, R.
 4117*
 HEIMPEL, H.
 3964*
 HEINE, J.W.
 3821
 HEINE, U.I.
 4007
 HEINIGER, H.J.
 4034
 HELBICH, P.
 3905
 HELLER-SCHOECH, G.
 3986
 HELLMAN, S.
 3734*, 3963*
 HELM, R.M.
 3791
 HEMPLING, H.G.
 4186*
 HENDERSON, B.E.
 3744
 HENDERSON, E.S.
 4086*
 HENLE, G.
 3744, 3876
 HENLE, W.
 3744, 3876
 HENRY, M.
 3632*
 HENSON, E.
 3865
 HEPPNER, G.H.
 3879
 HERBERMAN, R.B.
 3835, 3871, 3880
 HERRERA, F.M.
 3790
 HERRERA, I.
 4146*
 HERRMANN, E.C., JR.
 3786
 HERSH, E.M.
 3878
 HERTER, F.
 3910*
 HEWETSON, J.F.
 3888
 HIASA, Y.
 3695
 HIBBS, J.B., JR.
 3839
 HICKEY, R.C.
 4171*
 HIERARDT-HIEBSCH, CH.
 4289*
 HIGASHINO, K.
 4010
 HIGINBOTHAM, N.
 3736*

HILGARTH, M.	HOSOI, K.	INOSE, M.
4287*	4223*	4003
HILGERS, J.	HOWE, D.M.	INUI, N.
3784	4039	3677
HILGERT, I.	HOYT, W.F.	IRIE, R.F.
3894	4200*	3840, 3930*
HILL, D.I.	HOZUMI, M.	IRINO, S.
3660	3840, 4092*	3773
HILL, G.	HSU, H.H.T.	IRVING, C.C.
3906	4004	3716*
HILL, M.	HU, F.	IRVING, D.N.
3813	4088*	3903
HILLOVA, J.	HUANG, C.C.	ISAAC, J.-P.
3813	3812	3912*
HINS, C.	HUANG, E.-S.	ISHII, Y.
4160*	3809	3666
HIRAKI, K.	HUBERMAN, E.	ISSELBACHER, K.J.
3773	3646, 3709	3640*
HIRAO, F.	HUFBNR, R.J.	ITO, K.
3696	3703, 3902	4279*
HIRONAKA, Y.	HUEPER, W.C.	ITO, N.
4154*	3620	3695
HIRONO, I.	HUHN, D.	ITO, T.I.
3707	4153*	3684
HIRSCH, M.S.	HULL, R.N.	IVINS, J.C.
3686	3823*	4093*
HITOTSUMACHI, S.	HUMPHRIES, K.C.	IWANAMI, Y.
3683	4017	4003
HOFKSTRA, J.	HUNT, R.D.	IYPE, P.T.
3806	3822*	3899
HOFERNI, B.	HUNTER, G.R.	JABARA, A.G.
3625*	4022	4268*
HOFFMAN, M.	HURLBERT, R.B.	JABLONSKA, S.
3715*	4005, 4028	3793
HOFFMANN, D.	HURTADO, R.	JABRE, E.
3604	4207*	4136*
HOLBOROW, F.J.	HUTCHISON, D.J.	JACKSON, C.D.
3860	4008	3716*
HOLLAND, J.F.	HUTCHISON, G.	JACKSON, F.E.
4091*	3638*	3685
HOLLANDE, E.	HUVOS, A.G.	JACOBY, B.
3632*	4244*	4132*
HOLLMANN, K.H.	HUVOS, A.J.	JACQUIGNON, P.
3606	3736*	3699
HOLMAN, I.	HUYNH, T.	JAFFE, N.
3710	3777	4060*
HOLMES, A.W.	IEVLEVA, E.S.	JAKOUBKOVA, J.
3823*	3870	3905
HOLZNER, J.H.	IKEMURA, K.	JAKUBOWICZ, K.
4249*	4051*	3793
HOM, P.H.	IKONOPISOV, R.L.	JANICKI, K.
3693	3883	3977*
HOOKS, J.	IL ⁹ IN, V.S.	JANIK, P.
3750	3998	3887
HOPKINS, T.	IMAGAWA, D.T.	JARRETT, O.
3702	3919*	3805
HORIO, T.	IMAMOGLU, I.	JARRETT, W.F.H.
4223*	4143*	3805
HORNSLETH, A.	INBAR, M.	JAYANT, K.
3864	3938	4297*
HORWITZ, M.S.	INBERG, M.V.	JENKINS, B.A.G.
3739	4065*	4196*

JOHNSON, G.S.	KAZANTSEVA, I.A.	4027
4222*	4108*	KLEIN, M.
JOHNSON, R.E.	KFARNEY, W.H.	3900
3763	3966	KLEMENTAYEVA, L.S.
JONES, H.W., JR.	KEEFER, L.	4265*
3940	3708	KLUSKENS, L.
JUNG, G.	KEISSLING, R.	3929*
4156*	3897	KNAPP, R.C.
KACIAN, D.L.	KELLY, G.	3963*
3769	3906	KNAPPER, W.H.
KAFUKO, G.W.	KEMPSON, R.L.	4236*
3744	4053*	KNOX, W.E.
KALF, G.F.	KENZY, S.G.	4004
4022	3761	KOGA, M.
KALIFAT, R.	KFSSEL, D.	3789
4295*	4040	KOKOLIS, N.
KALTENBACH, F.J.	KHAFAGY, M.M.	3991
4287*	4057*	KOLLER, L.D.
KALTER, S.S.	KHARLAMPOVICH, S.I.	3749
3825*	4293*	KOLLER, P.C.
KANFKO, A.	KHEIR, S.	3643*
3714	4171*	KONDO, S.
KANG, K.-Y.	KHVATOVA, N.V.	3666
4010	4181*	KONIKOVA, E.
KAPITULAKIY, B.B.	KIDESS, E.	3855
3720*	4156*	KOOS, W.
KAPLAN, F.L.	KIKUCHI, H.	4113*
3966	4012	KOPAC, M.J.
KAPLAN, H.S.	KIKUCHI, K.	4073*, 4133*
3608	3868	KORABELNIKOVA, N.I.
KAPLAN, J.H.	KIKUCHI, Y.	3753
4187*	3868, 4095*	KORDAC, V.
KAPULLER, L.L.	KIMBALL, R.F.	4042
4256*	3657	KOSHEL, I.V.
KARA, J.	KIMMEL, C.B.	4183*
3810	4247*	KOSTRABA, N.C.
KARDON, P.	KING, N.W.	4090*
3681	3781, 3822*, 3832*	KOTNER, L.M.
KARON, H.	KINGSLEY, S.	4094*
4126*, 4128*	3923*	KOUNTZ, S.L.
KARPAS, A.	KINOSHITA, N.	4276*
3785	3678	KOVALEVA, L.G.
KASABJAN, S.S.	KIRCHNER, H.	4260*
4078*	3917*	KOVALEVA, T.P.
KASHTANOV, N.F.	KIRICUTA, I.	3826*
3976*	4110*	KOVARIK, V.
KASTENBAUM, M.A.	KIRSCHSTEIN, R.L.	4252*
4019	3669, 3872	KOVNER, F.YA.
KATAYAMA, K.P.	KIRYA, B.G.	3998
3940	3744	KOYAMA, K.
KATO, D.	KISELEVA, N.S.	3840
4280*	3722*	KOZAKIEWICZ, J.
KATSUTA, H.	KITAGAWA, M.	4278*
4211*	3863	KOZHEVNIKOVA, I.N.
KATZ, C.	KIZER, D.E.	4121*
3647	3710	KOZLOV, YU.P.
KATZ, R.	KLAUBER, M.R.	3721*
3842	3974	KOZLOWSKI, H.
KAUFMAN, D.G.	KLEIN, E.	4278*
3685	3869, 3897	KRAIN, L.S.
KAYE, G.I.	KLEIN, G.	3984*
3958*	3858, 3876, 3888, 3942,	KRAKORA, P.

3905
 KRASNICKA, Z.
 4055*
 KRAUS, H.
 4113*
 KRINITZ, K.
 4283*
 KRIPALANI, I.
 4236*
 KRISTOFOVA, H.
 3894
 KROES, R.
 3670
 KROH, H.
 4055*
 KROLLS, S.O.
 4096*
 KRONMAN, B.S.
 3933*
 KRIEGER, G.R.
 4007
 KRUGLOVA, I.S.
 3989
 KUCHINO, Y.
 4248*
 KUDRYAVTSEVA, G.T.
 4293*
 KUERSCHNER, F.
 4082*
 KUIMKUMADJIAN, V.A.
 3831*
 KUIMSARS, K.K.
 3723*
 KUINTZ, R.F.
 3944
 KURMAN, R.J.
 4226*
 KURMASHOV, V.I.
 4183*
 KUROKI, T.
 3672, 3709
 KUSCH, F.
 4266*
 KUSHIBI, M.
 4099*
 KUWAHARA, A.
 3701
 KUZ'MINYKH, A.I.
 3720*
 KYRIAKOS, M.
 4053*
 KYRLF, P.
 4150*
 LACOUR, F.
 3777
 LACOUR, J.
 4208*
 LAFFARGUE, F.
 4077*
 LAFFARGUE, P.
 4077*
 LAIRD, H.M.

3805
 LAMBERT, L.H., JR.
 3839
 LAMKIN, A.F.
 4028
 LAMON, E.W.
 3869
 LAMPPIN, D.W.
 4064*
 LANCINI, G.
 3790
 LANDRY, M.
 4215*
 LANE, W.T.
 3702
 LANGER, W.
 4282*
 LAPOTNIKOV, V.A.
 4101*
 LARSON, C.L.
 3817
 LASTER, W.R., JR.
 3660
 LATTES, R.
 3958*
 LAVI, S.
 3816
 LAVRIN, D.H.
 3835, 3871
 LAW, L.W.
 3909
 LAWLEY, P.D.
 3674
 LAWRENCE, J.
 4236*
 LAZAREV, I.M.
 4124*
 LE GAL, Y.
 4116*
 LEA, M.A.
 3996
 LEARY, P.
 3995
 LEBEDEVA, N.P.
 4101*
 LEBLANC, L.
 3993
 LEBRAS, M.
 4018
 LEDER, P.
 3845
 LEE, H.W.
 3988
 LEE, K.M.
 3758
 LEE, P.N.
 3698
 LEE, Y.-T.N.
 3980*
 LEGER, L.
 4162*
 LEHMANN, A.R.

4035
 LEIFER, C.
 4100*
 LEMAIGRE, G.
 4162*
 LENNETTE, E.H.
 3823*
 LEPAGE, R.
 4210*
 LESCH, R.
 4285*
 LESPINATS, G.
 3893
 LEVAN, A.
 4191*
 LEVAN, G.
 4191*
 LEVENTHAL, B.
 3908
 LEVER, C.S.
 4019
 LEVIN, F.B.
 4147*
 LEVIN, M.L.
 3968
 LEVINE, E.M.
 4066*
 LEVINE, G.D.
 3959*, 4216*
 LEVINSON, W.
 3778
 LEVY, N.L.
 3841
 LEWIS, J.L., JR.
 3892
 LEWIS, M.
 3750
 LEWMAN, L.V.
 4075*
 LIAO, K.T.
 4235*
 LIAU, M.C.
 4005
 LIEBERMAN, P.H.
 4006
 LIJINSKY, W.
 3653, 3704, 3708
 LILIENTFELD, A.
 3968
 LILIENTFELD, A.M.
 3973
 LIM, R.
 3929*
 LIN, T.-Y.
 3926*
 LINDAHL, P.
 3995
 LINDBERG, R.
 4029
 LINDEN, G.
 3693
 LIPSETT, M.B.

4277*
 LISKER, R.
 4243*
 LITTLEJOHN, K.
 3906
 LITVINOVA, S.N.
 3719*
 LO GERFO, F.
 3910*
 LO GERFO, P.
 3910*
 LOCALIO, S.A.
 3933*
 DEBEL, F.
 4207*
 DJDA, L.
 3937
 ONGHINO, C.
 4159*
 DO, J.
 3708
 OPS, M.
 4184*
 DRIF, YU.I.
 4130*, 4181*
 DURI, D.B.
 4086*
 U WANG, C.-7.
 4247*
 UNGU, M.
 3833*
 UPULESCU, A.
 4218*
 URIE, A.
 4050*
 UTCHER, C.L.
 3928*
 UTTON, J.D.
 4073*, 4133*
 YONS, G.
 4192*
 YSOV, V.V.
 3826*
 AC KAY, B.
 4171*
 AC MAHON, B.
 3639*, 3971
 AC PHERSON, B.R.
 3898
 ACKEY, I.J.
 3805
 ADDOX, I.S.
 4024
 ADEN, B.E.H.
 4015
 AFKAWA, K.
 4099*
 AGAZANNIK, R.L.
 4256*
 AHALEY, M.S., JR.
 3841
 AHLBERG, U.

3955*
 MAJNO, G.
 3958*
 MAKAROV, M.R.
 4265*
 MALAISE, E.P.
 3725
 MALAMUD, N.
 4200*
 MALASKOVA, V.
 3905
 MALEK, R.S.
 4014
 MALKIEL, S.
 3866
 MALMGREN, R.A.
 3797
 MANN, D.L.
 3908
 MANN, M.
 3693
 MANNING, J.S.
 3770
 MANOLOV, G.
 3795
 MANOLOVA, Y.
 3795
 MANSOUR, E.G.
 3648
 MANSOUR, M.A.
 4057*
 MARANTZ, C.
 4239*
 MARCULLO GASPAR, E.
 3635*
 MARK, J.
 4191*, 4214*
 MARKS, P.A.
 4025
 MARQUARDT, H.
 3709
 MARQUET, E.
 4240*
 MARROCU, F.
 4203*
 MARSA, G.W.
 3763
 MARSHALL, N.
 3730, 4188*
 MARSHALL, S.
 3802
 MARTIN, D.P.
 3872
 MARTIN, G.M.
 3942
 MARTIN, I.
 4202*
 MARTIN, M.L.
 3747
 MARTIN, R.G.
 4171*
 MARTYNOVA, V.A.

4180*
 MASALAWALA, K.S.
 4300*
 MASSEYEFF, R.
 3993
 MATALCN, M.
 3972
 MATHEWS, M.B.
 4189*
 MATOLO, N.M.
 3974
 MATSUNAGA, H.
 4047
 MATYUSHINA, YE.D.
 3954*
 MAUNOURY, R.
 4151*
 MC ALLISTER, R.M.
 3602
 MC BRIDE, C.M.
 3878
 MC BRIDE, J.A.
 4213*
 MC CORMACK, L.J.
 4165*
 MC CORMICK, G.M., II
 3655
 MC KIBBIN, J.B.
 4011
 MEARES, E.M., JR.
 4085*
 MEDZIHRADESKY, J.
 3855
 MEIER, H.
 4034, 4067*
 MELENDEZ, L.V.
 3757, 3781, 3822*, 3824*,
 3832*
 MELNICK, J.L.
 3755
 MERCHAN CIFUENTES, J.
 4284*
 MERKOW, L.P.
 3717*
 METAFORA, S.
 4025
 MEUNIER, J.
 3914*
 MEYER, A.T.
 3948
 MEYER, H.W.
 4080*
 MEYERS, A.
 3610
 MICHEAU, C.
 4138*, 4208*
 MICHELSON, A.M.
 3659
 MIGNOT, J.
 3664
 MIKO, M.
 4246*

MILIEVSKAYA, I.L.	MORRIS, H.P.	NASO, R.B.
3722*	3988, 3996, 4001, 4072*,	3738
MILLER, C.A.	4087*, 4092*, 4178*, 4210*,	NASTAC, E.
4066*	4271*	3829*
MILLER, R.W.	MORRIS, P.J.	NATAF, B.M.
3630*, 3740, 3975	3890, 3891	4173*
MILSTEIN, C.	MORROW, R.H.	NATHANS, D.
4189*	3744	3741, 3776
MINOWADA, J.	MORTON, D.L.	NEEMEH, J.A.
3746, 3812	3797	4242*
MIRVISH, S.S.	MOSKALIK, I.G.	NELSON, D.S.
3690	4101*	3609
MISDORP, W.	MOTOI, M.	NELSON, J.H.
4268*	3811	3705
MITCHELL, J.C.	MOTCIU-RAILEANU, I.	NELSON, L.W.
3726	3627*	4193*
MITCHELL, M.S.	MOTT, M.G.	NELSON, M.
3854	4063*	3609
MITCHEN, J.R.	MOTTFRAM, R.	NETH, R.
3746	4166*	3986
MITCHLEY, B.C.V.	MUELLER, D.	NEUMANN, H.
3680	4282*	3775, 4089*
MITFLAMAN, F.	MUIR, C.S.	NEWBERNE, P.M.
4191*	3619	3673
MITROPOLSKY, A.N.	MULLER, S.A.	NIELSEN, S.M.
4107*	3786	4059*
MIWA, T.	MUNOZ, G.M.R.	NISHIKAWA, K.
3707	3744	4223*
MIYAKE, S.	MURAO, T.	NISHIMURA, S.
3840	3807	4248*
MIYAKI, M.	MURPHY, E.D.	NIWAYAMA, G.
4043	3943	4254*
MIYATA, S.	MURPHY, P.	NIYOSHI, I.
4003	3996	3773
MIYRAHI, A.	MYERS, B.	NCMURA, S.
3746	3784	3758
MIZUNO, F.	MYERS, B.J.	NCNOYAMA, M.
3840	3944	3792
MODAN, B.	MYERS, G.H., JR.	NORTHUP, J.D.
3972	3838	4033
MODAN, M.	MYLONAS, N.	NOVOTNA, L.
3972	3991	3855
MOKYR, M.B.	MYSZEWSKI, M.E.	NCWAKOWSKI, E.
3854	3791	3823*
MONACON, A.P.	NACHTIGAL, M.	NUGENT, C.A.
3686	3830*	4292*
MOORE, D.H.	NAEGELE, R.F.	NURYAGDYEV, S.K.
3804	3759	4109*
MOORE, G.F.	NAGAMATSU, A.	NYDEGGER, U.E.
3746	3701	4069*
MOORE, M.	NAGASE, H.	O'CONOR, G.T.
3896	4274*	3865
MOORE, R.R.	NAIRN, R.C.	O'Rourke, C.M.
3928*	3924*	4005
MORGAN, J.F.	NAKAJIMA, K.	OBBERMAN, H.A.
3885	4051*	4097*
MORI, H.	NAKAMURA, S.	OGAWA, K.
3707	3913*	3811
MORI, L.H.	NAKAMURA, T.	OHBU, D.
3726	4223*	4051*
MORIMONT, M.	NASH, R.E.	OHNUMA, T.
4135*	4205*	4091*

OHATA, H.	PAJDAK, W.	PERRY, S.
4274*	4158*	4031
OHTSUKI, H.	PALEKAR, L.	PERTIZ, E.
4174*	3700	3969
OKADA, S.	PALMER, E.L.	PETERSON, J.A.
4070*, 4084*	3747	4259*
OKAMOTO, T.	PANERO, M.	PETO, R.
3668	3978*	3680, 3698
OKANO, H.	PANICKER, K.N.S.	PETRICCIANI, J.C.
3789	4299*	3872
OL'SHEVSKAYA, L.V.	PANOPOULOUS, C.	PETRUNYAKA, V.V.
3950	3939	3950
OLAH, Z.	PANSE, T.B.	PHILLIPS, J.M.
4134*	4298*	3679
OLDSTONE, M.B.A.	PAPIERZ, W.	PHILLIPS, M.E.
3852	4112*	3868
OLINICI, C.D.	PARANJPE, M.S.	PIEPER, M.
4110*	3882	4045
OLISCHLAEGER, A.	PARDO, M.	PIER, A.C.
3964*	3717*	3649
OLURIN, O.	PARKER, J.C., JR.	PIKE, M.C.
3983*	4056*	3744
OMINE, M.	PARKS, W.P.	PILCH, B.Z.
4031	3867	3907
ONO, T.	PARMENTIER, R.	PILCH, Y.H.
4043	4160*	3898
ONOE, T.	PARODI, S.	PINKARD, K.J.
3714	3662	4166*
ONUSHCHENKO, I.A.	PASQUALINI, C.D.	PIOVANETTI, E.
4101*	3733*	4200*
ORDER, S.F.	PASSEY, R.D.	PITENKO, N.N.
3963*	3645	4122*
RESTANO, F.	PASTAN, I.	PIZZI, T.
4155*	4222*	4207*
RMEROD, M.G.	PASZTOR, L.M.	PLENERT, W.
4035	4088*	3847
ROSZLAN, S.	PAVILANIS, V.	PLENGVANIT, U.
3875	3986	4257*
RR, D.J.	PAVLOSKI, S.	PLUZANSKA, A.
3674	4049*	3925*
SSKE, G.	PAZ, B.	PCCHON, F.
4102*	3972	3659
TANI, T.T.	PEARSON, G.	PODWORSKI, H.
4001	3800	4127*
TSUKA, H.	PECK, E.R.	POIRIER, L.A.
3701, 3789	3981*	4210*
TEN, J.A.	PECK, R.M.	POIRIER, M.C.
4046	3981*	4210*
TEN, C.A., JR.	PECKHAM, M.J.	POLISHCHUK, R.F.
4242*	4234*	3721*
ER, H.I.	PEDERSEN, S.N.	POLLIACK, A.
3768	3864	4098*
CHFCO, H.	PEDIO, G.	PONSAN, X.
3658	3780	3626*
DEH, B.	PEGG, A.E.	PONZ DE POSADAS, G.
3683	4002	4206*
GANO, J.S.	PEKER, J.	PORIES, W.J.
3792, 3809	4179*	3648
IGE, W.S.	PEMBERTON, A.H.	PORRO, R.S.
3698	4050*	4006
IK, W.K.	PERIMAN, P.	POSTIGLIONE, G.
3988	3844	4159*

POTDAR, G.G.
4299*
POTT, F.
3617
POTTER, C.W.
3904
POTTER, M.
3946
POTTER, V.R.
4072*, 4161*, 4178*, 4271*
POUPON, M.-F.
3893
POWARS, D.R.
4228*
PRATT, R.C.
3697
PRATT, R.D.
4237*
PREAUX, J.
3953*
PREISLER, H.D.
4086*
PRESTON, E.
3940
PREUD'HOMME, J.L.
3900
PRICE, P.J.
3713
PRIDAN, H.
3973
PRINCE, J.F.
3726
PRODI, G.
3921*
PROFFITT, M.R.
4046
PUMPHREY, J.G.
3946
QUETISSER, U.
3964*
QUETISSER, W.
3964*
QUIF, P.G.
3837
RABINOWITZ, Z.
3683
RABSON, A.S.
3669
RABSTEIN, L.
3703
RACHMILEWITZ, E.A.
4098*
RADEMACHER, R.
3937
RADOM, S.
4251*
RAHI, A.H.S.
3889
RAI, K.R.
4013
RAICHEV, R.
3735*

RAIKHLIN, N.T.
3950, 4123*
RAITCHEVA, E.
3644
RAN, M.
3862
RAPOPORT, S.
4289*
RAPOPORT, S.I.
3954*
RAPP, F.
4083*
RAPP, H.J.
3877
RAPPAPORT, H.
4052*
RASCHKE, E.
4152*
RASKA, K., JR.
3798
RASKAS, H.J.
3748
RATH, F.W.
4103*
RAY, R.
3782
REBINOWITZ, Z.
4038
REFS, R.C.
3904
REINGOLD, I.M.
4231*
REITZ, M.S.
3790
REMINGTON, J.S.
3839
RENKAWEK, K.
4055*
REYNES, M.
3664
REYNOLDS, R.D.
4072*
REYNOSO, G.
3846
RHIM, J.S.
3703, 3756, 3902
RIBI, E.E.
3877
RICHARD, J.L.
3649
RICHARDSON, L.S.
3755
RICHART, R.M.
3962*, 4233*
RICHERT, N.J.
3771
RICHTER, C.B.
3947
RIGBY, P.G.
3836
ROBBINS, G.F.
4236*

ROBBINS, P.W.
3796
ROBIN, M.S.
3745
ROBINS, A.B.
4168*
RODEY, G.E.
3837
RODRIGUEZ LOECHEZ FERNANDEZ, J.
4142*
ROE, F.J.C.
3680
ROEHER, H.D.
4045
ROGENTINE, G.N.
3908
ROGENTINE, G.N., JR.
3861
ROIZMAN, B.
3821
RONDIER, J.
4136*
ROOME, A.P.
4063*
ROSAS-URIBE, A.
4052*
ROSENFELD, C.
4041
ROSS, A.E.
3708
ROSS, J.
3867
ROTH, D.G.
4239*
ROTH, J.
4080*, 4272*
ROTH, J.A.
3994
ROUJEAU, J.
4295*
ROY, S.C.
4229*
ROZENSTRAUCH, L.S.
4256*
RUBINSTEIN, L.J.
3603
RUDDERS, R.A.
4061*
RUDDON, R.W.
3999
RUDNEVA, I.A.
3753
RUDOLPH, H.
4045
RUEHL, H.
3917*
RUSTEN, G.W.
3669
RUTTNER, J.R.
3780
SAAL, F.
3733*

SABBADINI, F.
 3922*
 SACHATELLO, C.
 4230*
 SACHNAZAROV, N.
 3830*
 SACHS, I.
 3683, 3938, 4038
 SAFKI, H.
 4012
 SAFFER, F.A.
 3859
 SAFFIOTTI, U.
 3685
 SAKIYAMA, H.
 3796
 SALA, L.
 4288*
 SALERNO, R.A.
 3848
 SALIM, M.
 4015
 SALM, R.
 4196*
 SALZBERG, S.
 3748
 SANCHEZ, R.
 4145*
 ANDERS, B.G.
 3941
 ANDERS, D.
 3607
 ANKALE, M.
 3993
 ANTESSON, L.
 3876
 ANZ ESPONERA, J.
 4284*
 ANZHAROVSKAYA, N.K.
 4296*
 ATO, E.
 4292*
 ATO, S.
 4095*, 4211*
 AUNDERS, F.F.
 4026
 AVIC, B.
 4152*
 AWADA, H.
 4194*, 4198*
 APOLI, G.L.
 4275*
 HACHTSCHABEL, D.O.
 4082*
 SHADE, R.O.K.
 4269*
 SHAEFER, A.F.
 4186*
 SHAISSON, G.
 4176*
 SHAKI, R.
 3683

SCHARFF, M.D.
 3844
 SCHEELE, C.M.
 3743
 SCHENKEN, J.R.
 4059*
 SCHERER, E.
 3715*
 SCHIFFER, L.M.
 4013
 SCHILLER, A.L.
 4061*
 SCHINDEL, J.
 3728
 SCHLOM, J.
 3774, 3804
 SCHMALZL, F.
 4153*
 SCHMELZ, U.O.
 3969
 SCHMID, F.A.
 4008
 SCHMIDT, J.D.
 3990
 SCHMITZ, R.
 4129*
 SCHOECH, G.
 3986
 SCHOLLE, H.
 3917*
 SCHRENK, K.-H.
 4141*
 SCHUBERT, G.
 4282*
 SCHULZ, D.
 4152*
 SCHUMAN, L.
 3968
 SCHWAAB, G.
 4138*
 SCHWARZ, R.
 4240*
 SCHWEIZER, R.T.
 4276*
 SCOLNICK, E.M.
 3867
 SCORNIC, J.C.
 4049*
 SCOTT, D.F.
 4072*, 4178*, 4271*
 SCOTT, J.F.
 3788
 SEHON, A.H.
 3922*
 SEIDMAN, I.
 3647
 SEIFERT, G.
 4129*
 SEKIGAWA, H.
 4281*
 SELIGMANN, M.
 3900, 4176*

SELIKOFF, I.J.
 3601
 SELIVANOV, A.A.
 3826*
 SELKIRK, J.K.
 3709
 SETLOW, J.K.
 3657
 SGIBNEWA, O.W.
 4078*
 SHABAD, L.M.
 3652, 3719*
 SHAH, I.C.
 3736*
 SHAH, K.V.
 3612
 SHAH, N.K.
 4230*
 SHAH, S.A.
 3674
 SHAMBERGER, R.J.
 4092*
 SHAPIRA, Y.
 4098*
 SHAPIRO, A.M.
 3916*
 SHAPIRO, H.M.
 3933*
 SHARMA, J.M.
 3761
 SHARMA, R.K.
 4071*
 SHARPINGTON, C.
 4167*
 SHEN, M.-F.
 3926*
 SHIBUYA, C.
 3707
 SHIMIZU, K.
 4211*
 SHIMIZU, M.
 3707
 SHIPKEY, F.H.
 3948
 SHIPMAN, C., JR.
 3754
 SHIU, G.
 3835
 SHOJI, K.
 4154*
 SHUBIK, P.
 3690
 SIDOROV, K.A.
 4107*
 SIEVERS, B.-U.
 4294*
 SILVERBERG, S.G.
 4225*
 SIMONS, M.J.
 3890
 SIMS, H.L.
 3764

SIMS, P.	SPECKHARD, M.E.	STRONG, L.C.
3709	3610	4047
SIN, Y.M.	SPEHLER, H.	STRONG, R.P.
3922*	4116*	3605
SINGH, S.	SPENCER, E.S.	STRUCK, R.F.
3888, 3942	3884	3660
SINKS, L.F.	SPIEGELMAN, S.	STRYCKMANS, P.A.
4230*	3769, 3774, 3803, 3804	4013
SIRSAT, S.M.	SPINELLI, M.	SUGARBAKER, E.V.
4299*	4184*	3935*
SKURZAK, H.M.	SPORN, M.B.	SUGIHARA, R.
3869	3685	3695
SIADF, T.A.	SPRATT, J.S., JR.	SUGIMURA, T.
3671	3980*	3677, 3840, 4095*, 4211*
SIEPOV, M.I.	SPRENT, J.	SUIT, H.D.
3663	3853	3730, 4188*
SILFINKIN, M.	SPYCHALSKI, E.	SUK, W.A.
3717*	4250*	3713
SMIRNOV, G.A.	STANTON, M.F.	SUKENC, T.
3652	3676	4012
SMITH, H.G.	STARR, J.	SUKHENKO, V.M.
4074*	3607	3952*
SMITH, J.K.	STAVROU, D.	SUMMERS, D.F.
4086*	4258*	4015
SMITH, J.M.	STEEL, C.M.	SUSSENBACH, J.S.
3685	4032	3819
SMITH, I.D.	STEEL, G.G.	SUZUKI, H.
3710	3887, 4234*	4154*
SMITH, I.L.	STEINBERG, A.D.	SVEDMYR, E.A.J.
3928*	3764	3888
SMITH, P.G.	STEINITZ, R.	SWAIM, W.R.
3744	3967, 3970	3856
SMITH, R.G.	STENDARDO, R.	SWAN, D.
3790	4185*	3845
SMITH, S.H.	STEPANOVA, L.G.	SYKES, J.A.C.
3754	3760	4024
SMOLYANSKAYA, A.Z.	STEPANOVA, YE.I.	SZNAJD, J.
4181*	3624*	4158*
SNYDER, F.	STEPHENS, P.J.	TACA, H.
4237*	4097*	4160*
SORFL, H.	STEPHENSON, J.R.	TACCONI DE ALANIS, M.J.
4240*	3808	4206*
SORENSEN, R.	STEPHENSON, M.L.	TACHE JALAK, M.
3842	3788	4142*
SOKOLOV, M.I.	STEPINA, V.N.	TAGI-ZADE, S.B.
3753	3870	4000
SOLOMON, G.F.	STEVENS, D.F.	TAKAGI, M.
3920*	4016	4154*
SOLONOV, G.YA.	STEVENSON, P.A.	TAKAHASHI, Y.
3760	4063*	4010
SOSNIK, H.	STILLER, D.	TAKAOKA, T.
4131*	4080*, 4272*	4211*
SOULF, F.H.	STOYANOV, S.	TAKATSU, K.
4058*	3894	3863
SOUTHAM, C.M.	STRAIN, W.H.	TAKEMCRI, N.
3868	3648	3820
SPANFDDA, R.	STRANDBERG, J.D.	TAKEMCTO, K.K.
4275*	3895	3871
SPANOS, P.K.	STROBER, S.	TALAVDEKAR, R.V.
4192*	3909	4298*
SPFAR, P.G.	STROHL, W.A.	TALWAR, G.P.
3821	3798	3932*

TANAKA, T.
 4201*
 TANNOCK, I.F.
 3730
 TARRIN, D.
 3945
 ASHIRO, H.
 4051*
 TASSI, G.C.
 3850
 TAYLOR, R.
 4034
 TAYLOR, J.S.
 3718*
 TAYLOR, W.
 4083*
 TAZAWA, K.
 3985
 TEGTMEYER, P.
 3768
 TELLESKI, S.
 4261*
 TENNANT, J.R.
 3923*
 TENNANT, R.W.
 3947, 4046
 TEPLITZ, R.L.
 3941
 TERADA, M.
 4025
 TERASAKI, P.I.
 3892
 TEXLER, M.
 3953*
 TEYSSTIER, P.
 3993
 THAMM, R.
 4289*
 THOMAS, C.
 3724*
 THOMAS, J.A.
 3632*
 THOMAS, L.R.
 3994
 THOMPSON, J.H.
 4242*
 THORBECK, R.
 3787
 THASHER, T.V.
 4233*
 THURSTON, J.R.
 3649
 THURLEY, J.
 3732
 THING, A.
 3890
 THING, C.-C.
 3835, 3871
 THING, R.C.
 3742, 3790, 3871
 THITTLE, K.
 3919*

TODARO, G.J.
 3867
 TOMATIS, L.
 3658
 TOMINGAS, R.
 3617
 TOMITA, M.
 3840
 TONI, R.
 3875
 TORGUSHINA, N.S.
 4121*
 TORLINSKI, L.
 4126*, 4128*
 TORRES, F.O.
 3982*
 TOSETTI, D.
 4120*
 TOTH, B.
 3692
 TOTTEN, R.S.
 3960*
 TRALKA, T.S.
 3865
 TRICHOPOULOS, D.
 3971
 TRINCI, M.
 4255*
 TRODAHL, J.N.
 4096*
 TRUJILLO, J.M.
 4020
 TRYFIATES, G.P.
 4036
 TSUBOTA, T.
 3773
 TSUBURA, E.
 3696, 4010
 TSUCHIDA, H.
 4292*
 TSUCHIDA, N.
 3745
 TSUIKI, S.
 4012
 TU, A.T.
 3621
 TUBIANA, M.
 3725
 TUCKER, D.F.
 3901
 TUCKERMAN, E.
 3785
 TUKEI, P.M.
 3744
 TULUNAY, O.
 4143*
 TURNER, C.N.
 4166*
 TURNER, H.C.
 3902
 TURNER, W.
 3800

TURUSOV, V.
 3658
 TYNDALL, R.L.
 4046
 UCHIDA, T.
 4197*
 UEDA, K.
 4104*
 UKITA, T.
 3840
 ULORIKIS, J.R.
 3723*
 UNDERWOOD, J.C.E.
 3965
 UNTERMAN, D.H.
 4231*
 URBAN, J.A.
 4224*
 URIZ, N.
 3635*
 USHIJIMA, R.N.
 3817
 UTZ, D.C.
 4014
 VAAGE, J.
 3931*
 VALDES, E.
 4114*
 VALENCIAK, E.
 4113*
 VAN DE BOGART, R.
 3704
 VAN DEN BOGAERT, P.
 4148*
 VAN DEN BRENN, H.A.S.
 4167*
 VAN DEN ECKHAUT, J.
 4135*
 VAN DER HEDEN, R.
 4160*
 VAN DER MAATEN, M.J.
 3737
 VAN DER VLIET, P.C.
 3819
 VAN DUUREN, B.L.
 3647
 VAN HOYE, W.
 4148*
 VANWIJCK, R.R.
 4074*
 VARGA, M.
 4157*
 VARMUS, H.E.
 3778
 VASILENKO, V.KH.
 3954*
 VASUDEVAN, D.M.
 3932*
 VAUPEL, P.
 4115*
 VAWTER, G.F.
 4060*

VAZQUEZ, M.
 3961*
 VEDRENNF. CL.
 4151*
 VFKSLFR. S.A.
 3987
 VFLASCO, M.
 3842
 VFLENA, A.H.
 3723*
 VFNUAT, A.-M.
 4041
 VFRIN, PH.
 3914*
 VFRMA, K.
 4273*
 VFRNON, M.L.
 3902
 VFRRDUST, P.
 3900
 VFSTERGAARD, R.F.
 3864
 VIGIER, P.
 3801
 VIKARI, S.J.
 4065*
 VIKLICKY, V.
 3905
 VILADIU QUEMADA, P.
 3635*
 VILAIN, C.
 3632*
 VILDOSOLA, J.
 4207*
 VINCENT, P.C.
 4013
 VLAEMINCK, M.N.
 4139*
 VOGEL, C.L.
 3865
 VOLKOVA, M.A.
 4182*
 VON HEYDEN, H.W.
 3746
 VON SANDERSLEBEN, J.
 4268*
 VUORI, J.
 4065*
 WAGNER, J.C.
 3651
 WAGNER, M.M.F.
 3651
 WAGNEROVA, M.
 4118*
 WALIGUNDA, J.
 4091*
 WALLACE, A.C.
 3924*
 WALLACE, R.E.
 3872
 WALLCAVE, L.
 3690

WALTERS, J.L.
 3946
 WANG, C.C.
 4094*
 WANG, C.S.
 3738
 WANG, J.J.
 4230*
 WANG, T.Y.
 4090*
 WARD, D.C.
 4017
 WARNER, N.L.
 3853
 WARZOK, R.
 4102*
 WASHIDA, H.
 4104*
 WATERS, T.D.
 3740
 WATSON, K.F.
 3769
 WATTERBERG, L.W.
 3689
 WEBB, M.
 3702, 3706
 WEF, G.B.
 3890
 WEIDENBACH, W.
 4258*
 WEIGENT, C.E.
 4192*
 WEIKEL, J.H., JR.
 4193*
 WEINER, F.
 4027
 WEINSTEIN, A.J.
 3764
 WEINSTEIN, I.B.
 3705, 3772, 4017
 WEINTRAUB, L.R.
 4039
 WEINZIERL, S.M.
 3706
 WEISBURGER, J.J.
 3670
 WEISE, W.-R.
 4286*
 WEISENTHAL, L.M.
 3999
 WEISGERBER, CH.
 4176*
 WEISS, E.
 3700
 WEISS, M.C.
 4190*, 4259*
 WEISS, R.A.
 3778
 WEISSBACH, A.
 3766
 WEISSLEDER, H.
 4081*

WELLER, T.H.
 3605
 WELSH, R.A.
 3948
 WESSEL, W.
 3724*
 WHANG-PENG, J.
 4021, 4172*
 WHEELER, G.P.
 4068*
 WHITEHOUSE, J.M.A.
 3860
 WHITFORD, T.W., JR.
 4212*
 WHITMIRE, C.E.
 3848
 WICKS, W.D.
 4011
 WIERCINSKI, J.
 4131*
 WILBANKS, G.D.
 3815
 WILLIAMS, A.O.
 3983*
 WILLIAMS, D.E.
 3896
 WILLIAMS, E.H.
 3744
 WILLIAMS, T.
 3957*
 WILLIAMS, W.C.
 3784
 WILLIAMSON, E.O.
 4220*
 WILMANN, W.
 4282*
 WILSON, C.B.
 4200*
 WILSON, H.R.
 3729
 WILSON, J.F.
 3763
 WILSON, K.J.
 3775, 4089*
 WILSON, R.E.
 4074*
 WINKELMANN, R.K.
 3786, 4215*
 WINKLER, K.
 3986
 WINOCOUR, E.
 3816
 WIRTHLIN, L.S.
 3788
 WISEMAN, C.
 4235*
 WITTE, S.
 4141*
 WITZ, I.P.
 3862
 WOGAN, G.N.
 3673

OHLEB, W.
4179*
OLFF, L.G.
3806
OLFF, J.-P.
3629*
OD, M.L.
3686
ODRUFF, J.D.
3940
ONIAK, A.K.
4283*
ONCH, C.
3676
OIGHT, C.-S.
3928*
OIGHT, P.W.
3909
ONDERLICH, J.R.
3861
ONDER, F.L.
3604, 3668
OMOTO, R.S.
3670
OMOTO, T.
3633*
OMURA, Y.
3696, 4010
ASHITA, U.
3863
G, S.S.
3742, 3790
KEF, R.A.
3861
MAKOVA, G.L.
4180*
HIDA, T.O.
3869
DA, I.F.
3952*
NOVA, T.I.
3826*
CHEROTTI, L.
3949
DELA, F.
3699
CNIK, P.C.
3788
ANELL, E.
150*
FRER, M.
238*
LA, C.
243*
B.
3877
HIN, R.
288*
ROVA, N.P.
121*
RMANE, A.A.
723*

ZIEGLER, I.
3991
ZILJFYAN, V.N.
3831*
ZIMMERMAN, H.A.
4075*
ZIMMERMAN, L.E.
4076*
ZINTL, F.
3847
ZITOUN, R.
4079*
ZUCKER, S.
4039
ZULAWSKA, M.
4251*
ZUNINO, F.
3787

- ACANTHOMA
HISTOLOGY, NAEVUS-SEBACEOUS-LIKE FORMATIONS, CASE REPORTS (4111)*
ICHTHYOSIS, LOWER LIMBS, HISTOLOGY, CASE REPORTS (4215)*
- N-ACETOXY-N-2-FLUORENYLACETAMIDE
MUTATION, TRANSFORMATION, MAMMALIAN CELLS (3646)
- N-ACETYL-4-AMINOBIIPHENYL
MITOCHONDRIAL INTERACTION, RAT LIVER (3675)
- N-2-ACETYLAMINOFLUORENE
RNA MODIFICATION, CIRCULAR DICHROISM, PROTON MAGNETIC RESONANCE (3705)
- 2-ACETYLAMINOFLUORENE
LIVER TUMORS, INDUCTION MECHANISM, RAT (3716)*
- ADENOCARCINOMA
CARCINOEMBRYONIC ANTIGEN, HUMAN (3846)
ENDOMETRIUM, HYPERPLASIA, CHROMOSOMAL ANOMALIES, HUMAN (4253)*
LUNG, PSAMMOMA BODIES, HUMAN (4231)*
MAMMARY GLAND, ESTROGEN, MONKEY (3669)
VAGINA, STILBESTROL, HUMAN, REVIEW (3610)
- ADENOMA
MORPHOLOGY, SALIVARY GLAND, HUMAN (4062)*
OVARY, HYPERPLASIA, DEVELOPMENT, MOUSE (3943)
PROSTATE, EPITHELIAL GROWTH IN VITRO, (4155)*
RETINAL PIGMENT EPITHELIUM, ULTRA-STRUCTURE, CASE REPORT (4076)*
THYROID, LUNG METASTASIS, HISTOLOGY, CASE REPORT (4268)*
- ADENOSINE 3',5'-PHOSPHATE
TUMOR IMMUNITY, MOUSE (3836)
- ADRENAL GLAND
CORTEX, CARCINOMA, HISTOPATHOLOGY, CASE REPORTS (4112)*
- AFLATOXIN
COMPLEMENT ACTIVITY, BLOOD TITERS, GUINEA PIG (3649)
EXCRETIONS, ASPERGILLUS FLAVUS, FROGS (3650)
POTENT FOOD POISONS, CARCINOGENIC COMPOUNDS, REVIEW (3621)
TOXICITY, CARCINOGENICITY, RAT, DUCK (3673)
- AGE FACTOR
BREAST CANCER, SEX CHROMATIN, HUMAN (4281)*
- AGGLUTINATION
CONCAVALIN A, TUMORIGENICITY, HAMSTER CELLS, CELL HYBRIDS (3694)
- AIR POLLUTION
CARCINOGENIC SUBSTANCES, STANDARDIZATION, INDUSTRIAL PREMISES (3720)*
- ALKYLATING AGENT
N-METHYL-N-NITROUREA, DIMETHYL SULFATE, DNA, ALKYLATION SITE, 3-METHYLGUANINE (3674)
- ALPHA FETOPROTEIN
LIVER CANCER, HUMAN (3993)
- ALPHA GLOBULIN
FETAL, ISOLATION, CHARACTERIZATION, HUMAN (3849)
- AMELOBLASTOMA
MANDIBLE, LUNG METASTASIS, CASE REPORT (4051)*
- O-AMIDOPHENOL
CONVERSION FROM N-HYDROXY-2-FLUORENYL-ACETAMIDE, STEREOCHEMISTRY, MECHANISM, RAT LIVER (3712)
- AMINO ACID
DELTA-AMINOLEVULINIC ACID EXCRETION, MALIGNANT LYMPHOMA, HUMAN (4202)*
2-DEOXY-D-GLUCOSE, TRANSPORT, NORMAL AND MALIGNANT CELLS, REVIEW (3640)*
LEUKEMIC CELL REQUIREMENTS, HUMAN, IN VITRO (4091)*
SERUM, ACUTE LEUKEMIA, HUMAN (4260)*
TRANSPORT, TYROSINE AMINOTRANSFERASE, MORRIS HEPATOMA, LIVER, RAT (4072)*
MORRIS HEPATOMA, RAT (4271)*
- AMMONIUM HYDROXIDE
MAMMARY TUMORIGENESIS, MOUSE (3692)
- AMYLOIDOSIS
RETICULOSARCOMA, SYNGENEIC CELL INOCULATION, MOUSE (4048)
- ANTIBODY
CIRCULATING, MAMMARY TUMOR VIRUS, IMMUNOSUPPRESSION, MOUSE (3857)
BINDING, T43 CARCINOMA SUBLINES, MOUSE (3874)
EPSTEIN BARR VIRUS
INCIDENCE, CHILDREN, UGANDA (3744)
KIDNEY TRANSPLANT, HUMAN (3884)
SERUM
CANCER PATIENT (3876)
LYMPHOCYTIC LYMPHOMA, HUMAN (3814)
- FLUORESCENT, HERPES VIRUS, IDENTIFICATION, PRIMATE (3757)
HERPESVIRUS HUMANIS, ADENOVIRUS, CERVICAL CARCINOMA, HUMAN (3864)
RECEPTOR, INHIBITION, MACROPHAGE, LEUKEMIA, ISOANTIBODY, MOUSE (3854)
SMOOTH MUSCLE, MALIGNANT DISEASE,

HUMAN (3860)
 SPLEEN CELL PROLIFERATION, EHRICH
 TUMOR, MOUSE (3913)*
 SURFACE ANTIGEN BINDING, GROSS VIRUS,
 LYMPHOMA, RAT (3903)

ANTIGEN
 ACUTE LEUKEMIA, DETECTION, RABBIT
 (3908)
 ASTROCYTOMA, IMMUNOLOGICAL SPECIFICITY
 IN VITRO (3929)*
 AUSTRALIAN, PRIMARY LIVER CANCER,
 HUMAN (3842)
 CANCER, HUMAN, REVIEW (3628)*
 CARCINOEMBRYONIC, ADENOCARCINOMA,
 HUMAN (3846)
 C-TYPE VIRUS GROUP-SPECIFIC,
 3-METHYLCHOLANTHRENE TUMOR INDUCTION
 MOUSE (3848)
 CELL SURFACE, GROSS VIRUS, RAUSCHER
 VIRUS, LEUKEMIA CELLS, MOUSE, RAT
 (3880)
 COLON CARCINOMA, HUMANS (3910)*
 DETECTION, IMMUNODIFFUSION, CANCER
 PATIENT URINE (3912)*
 FETAL, PAPOVA TUMOR VIRUS, DIMETHYL-
 BENZANTHRACENE, MOUSE (3835)
 GROUP-SPECIFIC, INTERSPECIES SPECIFIC,
 IMMUNOGLOBULINS, C-TYPE VIRUS (3875)
 HAPTEN ISOLATION, NEOPLASM, RABBIT
 (3850)
 HERPESVIRUS SAIMIRI, INFECTED LYMPHO-
 CYTE, MARMOSSET (3806)
 HISTOCOMPATIBILITY, ALLOGENEIC TUMOR
 GROWTH, IMMUNOLOGIC ENHANCEMENT,
 MOUSE (3909)

HL-A
 FREQUENCY, MALIGNANT LYMPHOMA,
 HUMAN (3891)
 GESTATIONAL CHORIOCARCINOMA, HUMAN
 (3892)

HL-A COMPATIBILITY, CYTOTOXICITY,
 LYMPHOCYTE, HUMAN (3861)
 HL-A DISTRIBUTION, CHINESE, MALAY,
 INDIAN, SINGAPORE (3890)
 HSU-2, BIOPSIED CERVICAL TUMOR CELLS,
 LATENCY, HUMAN (3895)

H-2
 LEUKEMIA VIRUSES, MOUSE (3870)
 TUMOR GROWTH RATE, RADIATION,
 MOUSE (3894)

H-2 COMPLEX, MAMMARY CARCINOMA CELL,
 HYBRID, MOUSE (3858)
 KIDNEY TUMOR, HUMANS (3924)*
 MEMBRANE, LIVER, RAT CELL (3899)
 METHYLCHOLANTHRENE-INDUCED LIPOSARCOMA

GUINEA PIG (3838)
 MURINE LEUKEMIA VIRUS, MAMMARY TUMOR
 VIRUS, MAMMARY TUMOR, MOUSE (3784)
 PROSTATE CELL, TRANSFORMATION, MOUSE
 (3881)
 SURFACE, ANTIBODY BINDING, GROSS VIRUS
 LYMPHOMA, RAT (3903)
 TRANSPLANTATION, MURINE SARCOMA VIRUS,
 NONPRODUCER TRANSFORMED CELL, MOUSE
 (3808)
 TUMOR-SPECIFIC, POLYOMA VIRUS TUMOR
 CELL, MOUSE (3871)
 VIRUS, SPONTANEOUS TRANSFORMATION, RAT
 (3902)

ANTIGENICITY
 ALTERATIONS, SPONTANEOUS PULMONARY
 METASTASES, SARCOMA, MOUSE (3935)*

ANTIOXIDANT
 TUMORIGENESIS INHIBITION, FORESTOMACH,
 MAMMARY GLAND, SKIN, 7,12-DIMETHYL-
 BENZ(A)ANTHRACENE, MOUSE, RAT (3689)

ANTISERUM
 CONCENTRATION, CYTOTOXICITY, IMMUNE
 LYMPHOCYTE, MOLONEY SARCOMA VIRUS,
 MOUSE (3869)
 LYMPHOMA CELL, MIGRATION, INHIBITION,
 MOUSE (3897)
 REVERSE TRANSCRIPTASE INHIBITION,
 AVIAN VIRUS, MURINE VIRUS (3867)

ANUS
 CLOACAL CARCINOMA, ANAL CANAL,
 ULTRASTRUCTURE, CLINICAL-HISTOLOGIC-
 AL STUDY (4171)*

ARABINOFURANOSYL ADENINE
 DNA SYNTHESIS, INHIBITION, ROUS
 SARCOMA VIRUS, TRANSFORMATION, RAT
 (3754)

AROMATIC HYDROCARBON
 POLYCYCLIC, BINDING, DNA, RNA AND
 PROTEIN, TRANSFORMED CELLS, HAMSTER
 (3672)

ASBESTOS
 AMOSITE, CARCINOGENICITY, HUMAN,
 REVIEW (3601)
 HEALTH HAZARDS, REVIEW (3616)
 MESOTHELIOMA INDUCTION, PLEURA, RAT
 (3676)

ASCITES
 EHRICH TUMOR, INHIBITION, EXOGENOUS
 RNA, MOUSE (4099)*
 FORMATION, LYMPHATIC OBSTRUCTION,
 MURINE OVARIAN CARCINOMA, MOUSE
 (3963)*
 TUMOR CELL METABOLISM, CO₂ FORMATION,
 CATALASE, MOUSE (4289)*

- ASCITES TUMOR
 EHRlich, THYMUS-DERIVED CELL, HELPER
 ACTIVITY SUPPRESSION, MOUSE (3863)
 NOVIKOFF, PROTEIN SYNTHESIS, NUCLEOLUS
 (4026)
 SERUM CHANGE, HAMSTER (4018)
 TUMOR-SPECIFIC IMMUNITY, NONTUMOR-
 IGENIC TUMOR CELL, MOUSE (3885)
- ASCORBIC ACID
 N-NITROSO COMPOUNDS, NITROSATION
 INHIBITION (3690)
- L-ASPARAGINASE
 CARCINOGENIC ACTIVITY, MOUSE (3662)
 CELL CYCLE, NUCLEIC ACID SYNTHESIS,
 ACUTE LYMPHOBLASTIC LEUKEMIA, HUMAN
 (4026)
 LYMPHOMA, PLASMA MEMBRANE,
 GLYCOPROTEIN (4040)
- AZATHIOPRINE
 CARCINOGENIC ACTIVITY, MOUSE (3662)
- AZO DYE
 CARCINOGENESIS
 LIVER, ACID PHOSPHATASE CHANGE,
 RAT (3714)
 POLYADENYLIC ACID, HYDROLASES,
 LIVER, RAT (3654)
- BACILLUS CALMETTE-GUERIN
 CELL WALL, OIL DROPLET, TUMOR
 SUPPRESSION, HEPATOMA, GUINEA PIG
 (3877)
- BENZ(A)ANTHRACENE
 MACROMOLECULE BINDING, K-REGION
 EPOXIDE, HAMSTER CELL (3709)
- 7,8-BENZOFILAVONE
 ARYL HYDROCARBON HYDROXYLASE, INHIBI-
 TION, SKIN TUMORIGENESIS,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 MOUSE (3678)
- BENZO(A)PYRENE
 ENVIRONMENTAL POLLUTION, AIRCRAFT
 ENGINES (3652)
 LUNG CARCINOMA, DUST, RAT (3617)
 SQUAMOUS METAPLASIA, TRACHEA, HAMSTER
 (3665)
- BESNOITIA JELISONI
 INFECTION, IMMUNITY TRANSFER,
 RADIATION, HAMSTER (3729)
- BILE DUCT
 EXTRAHEPATIC, CARCINOMA, NOMENCLATURE
 (4152)*
- BIS(DIOXO)PIPERAZINE
 IMMUNOSUPPRESSION, MOUSE (3901)
- BLADDER
 CANCERS, ETIOLOGY, HUMAN, REVIEW
 (3614)
- EPITHELIAL NEOPLASMS, SCHISTOSOMA
 HEMATOBIUM INFECTION, MONKEY (3944)
- BLASTOMOGENESIS
 TRANSPLACENTAL, NITROSO COMPOUNDS, RAT
 (3618)
- BLOCKING ACTIVITY
 CELLULAR IMMUNITY, MAMMARY TUMOR,
 MOUSE (3879)
- BLOOD
 ABO GROUP, CANCER, INDIA (4297)*
 ATYPICAL MICROBIAL AGENTS, SEROLOGICAL
 CHARACTERISTICS, LEUKEMIA PATIENTS
 (4180)*
- CELLS
 CHRONIC MYELOID LEUKEMIA, CASE
 REPORTS (4130)*
 HEMOLYSIS, CARCINOMA PATIENTS
 (4195)*
 HYALURONIDASE, HYDATID MOLE, CHORIO-
 EPITHELIOMA, HUMAN (4262)*
- BONE
 CHONDROBLASTOMA, PATHOLOGY, HUMAN
 (4093)*
 DETERIORATION, TUMOR GROWTH, MOUSE
 (4103)*
 EWING'S SARCOMA, ULTRASTRUCTURE, CASE
 REPORTS (4299)*
 EWING'S TUMOR, PATHOLOGY, CHILDREN
 (4230)*
 MYELOFIBROSIS, ACUTE LEUKEMIA, HUMAN
 (4079)*
 NEOPLASM, URINARY HYDROXYPROLINE SERUM
 ALKALINE PHOSPHATASE, PHOSPHORUS,
 CALCIUM, HUMAN (4251)*
 OSTEOGENIC SARCOMA, HEAD AND NECK,
 RADIATION THERAPY-INDUCED, CASE
 REPORTS (3736)*
 OSTEOSARCOMA, INDUCTION, MOUSE (3765)
 SPONTANEOUS OSTEOGENIC SARCOMA, MONKEY
 (4169)*
- TUMORS
 ATOMIC BOMB RADIATION, JAPAN,
 REVIEW (3633)*
 FIBROUS DYSPLASIA, HUMAN (4300)*
- BONE MARROW
 CHANGES, LEUKEMIA, 7,8,12-TRIMETHYL-
 BENZ(A)ANTHRACENE-INDUCED, RAT
 (3691)
 CYTOGENETICS, PROLIFERATION, SIDERO-
 BLASTIC ANEMIA, CASE REPORT (4241)*
 ERYTHROPOIETIN, LEUKEMIA, POLYCYTHEMIA
 VERA, HUMAN (4039)
 KARYOTYPE, LYMPHOSARCOMA, COW (3937)
 STEM CELLS, RADIATION EFFECT, CELL
 CYCLES, MOUSE (3734)*

THYMOCYTE, CYTOTOXICITY, ALLOGRAFT
IMMUNITY, LYMPHOMA, MOUSE (3873)

AIN

CELL CULTURE, SPONTANEOUS TRANSFORMA-
TION, C-TYPE VIRUS, HUMAN (3750)

SARCOMA, MORPHOLOGY, CASE REPORTS
(4250)*

SPECIFIC PROTEINS, TUMOR, N-METHYL-
NITROSUREA, RAT (4258)*

TUMORS

CELL MEDIATED IMMUNITY, HUMAN
(3841)

CEREBROSPINAL FLUID PROTEINS,
HUMAN (4118)*

MORPHOLOGY, IN VITRO, MOUSE
(4055)*

AST

CANCER

BLOOD ESTROGENS, HUMAN (4277)*

SOFT TISSUE METASTASES, GROWTH
RAT (3980)*

CANCER RISK, MENOPAUSE, UNITED STATES
(3971)

CARCINOMA

AGE FACTOR, SEX CHROMATIN, HUMAN
(4281)*

CELLULARITY, MORPHOMETRIC ANALYSIS
HUMAN (3965)

CHILDHOOD, RECURRENCE (4097)*

GROWTH PATTERNS, HUMAN (4217)*

EPITHELIOMA, INVOLUTION, DOG (4116)*

LYMPHOMA, HISTOLOGY, PATHOLOGY, HUMAN
(4235)*

MALIGNANCY, METASTATIC BONE DISEASE,
HUMAN (4236)*

TUBULAR CARCINOMA, ULTRASTRUCTURE,
HUMAN (4054)*

ROMOMETHYLBENZ(A)ANTHRACENE

DNA, DOUBLE HELICER, CROSS-LINKING
(3659)

DERIVATIVES, CARCINOGENICITY, MOUSE
(3671)

NCHIUM

CARCINOID ADENOMA, CUSHING'S SYNDROME,
ACTH, HUMAN (4292)*

KITT'S LYMPHOMA

CELL CHARACTERIZATION, ACIDIC NUCLEAR
PROTEIN PROFILE, HUMAN (3999)

CELL LINE ESTABLISHMENT, EPSTEIN-BARR
VIRUS (4032)

CELLULAR RESPIRATION, MICRO-CARTESIAN
DIVER TECHNIQUE (4133)*

CHROMOSOME 14, MARKER BAND (3795)

LEUKEMIA, DIMETHYLSULFOXIDE KINETICS,
IN VITRO (4254)*

TUMOR CELL, AUTOCHTHONOUS LEUKOCYTE
REACTION, CELL STIMULATION, HUMAN
(3888)

ULTRASTRUCTURE, CYTOLOGY, CASE REPORT
(4207)*

CAMPTOTHECIN

ADENOVIRUS TYPE 2 FORMATION, INHIBI-
TION (3739)

CANCER

ADENOVIRUS, ETIOLOGY, HUMAN, REVIEW
(3602)

ANTIGEN, HUMAN, REVIEW (3628)*

BLOOD GROUP RELATIONSHIP, INDIA
(4297)*

CELL DIFFUSION, EMBRYONATED EGG,
CHICKEN (4139)*

COLON, IMMUNOLOGY, HUMAN (3933)*

CONGENITAL MALFORMATION, PINEAL TUMORS
EPIDEMIOLOGICAL STUDY, JAPAN (3975)

EPIDEMIOLOGY, INCIDENCE, INTERNATIONAL
REVIEW (3636)*

IMMUNITY, HUMAN, REVIEW (3634)*

METASTASES TO THE BREAST, HISTOLOGY,
HUMAN (4224)*

ONCOGENIC VIRUSES, HUMAN, REVIEW
(3643)*

PRIMARY, LIVER, HEPATITIS, CIRRHOSIS,
EPIDEMIOLOGY, DAKAR (4018)

SCAR, CHRONIC ULCERATION, HUMAN
(3953)*

SURVIVAL, LUNG, SMOKING, HUMAN (3693)

TISSUE PROTEOLYSIS, ENZYMES, REVIEW
(3623)*

TISSUE TRANSPLANTATION, XENOPUS LAEVIS
(3934)*

VIROLOGY, BREAST CANCER VIRUS,
MORPHOLOGIC DEVELOPMENT, TRANS-
MISSION MECHANISMS, REVIEW (3632)*

CARBOHYDRATE

TUMOR CELL, ELECTRON MICROSCOPY,
CONCANAVALIN A, MOUSE (4080)*

CARCINOGENESIS

AFLATOXIN, RAT, DUCK (3673)

DIAZONIRENZOPYRENE, MOUSE (3699)

DIETHYLNITROSAMINE, RAT (3670)

DIMETHYLAMINOAZOBENZENE, POLYADENYLIC
ACID HYDROLASE, LIVER, RAT (3654)

DIMETHYLCARBAMYL CHLORIDE, MOUSE
(3647)

ETHYLNITROSUREA, NEURINOMA, TISSUE
CULTURE, RAT (3700)

MAMMARY ADENOCARCINOMA, ESTROGEN,
MONKEY (3669)

PSYCHOLOGICAL FACTOR, REVIEW (4204)*

CARCINOGENICITY

- TUMOR CELL NUCLEIC ACIDS, HUMAN, MOUSE (3829)*
- CARCINOID
ORGAN DISTRIBUTION, STATISTICS, VIENNA (4150)*
- CARCINOMA
ADRENOCORTEX, CYCLIC NUCLEOTIDE PHOSPHODIESTERASE, RAT (4071)*
BREAST, CHILDHOOD, RECURRENCE (4097)*
CELL TUMORIGENICITY, ANTILYMPHOCYTE GLOBULIN, MONKEY, HUMAN (3872)
CERVIX, INCIDENCE, ISRAEL, EPIDEMIOLOGICAL STUDY (3973)
CLOACAGENIC, ANAL CANAL, ULTRASTRUCTURE, CLINICAL-HISTOLOGICAL STUDY (4171)*
DUODENUM, POLYPOSIS, CASE REPORT (4294)*
EXTRAHEPATIC BILE DUCT SYSTEM, NOMENCLATURE (4152)*
HEMOLYTIC PROCESSES, HUMAN (4135)*
LIVER, PATHOLOGY (4257)*
- LUNG
BRONCHIA, MORPHOLOGY, HUMAN (4285)*
CALCIFIED BODIES, CYTOPATHOLOGY, CASE REPORTS (4273)*
MEDULLARY, THYROID, HISTOLOGY, CASE REPORT (4142)*
OVARY, ENDOMETRIOSIS, HUMAN (4226)*
PAROTID GLAND, MORPHOLOGY, INCIDENCE, ALASKA (4232)*
RENAL PARENCHYMA, MORPHOLOGY, HUMAN (4143)*
SALIVARY DUCT, ULTRASTRUCTURE, HUMAN (4129)*
STOMACH, PATHOLOGY, HUMAN (4065)*
URINARY BLADDER, BILHARZIASIS, HUMAN (4057)*
UTERINE CERVIX, STROMAL INVASION, PATHOLOGY (4249)*
VULVA, CHROMOSOME, HUMAN (3940)
WALKER'S, CHROMATIN TRANSCRIPTION, DNA REPRESSION, TRANSFORMATION PROCESS (4090)*
- CAROTID BODY
TUMOR, SEX CHROMATIN, CASE REPORT (4280)*
- CELL
BALB/3T3, SENSITIVITY TO VIRAL INFECTION, POLYCATION EFFECT (3770)
CANCER, DIFFUSION, EMBRYONATED EGG, CHICKEN (4159)*
CULTURE, HEPATOMA, LIVER TISSUE BREAKDOWN TECHNIQUES (4206)*
- CV-1, SV40 RESISTANT (3752)
EHRlich CARCINOMA, ACCUMULATION OF EXOGENOUS ENZYMES, OUS, (4147)*
ELECTRICAL POTENTIAL DIFFERENCE, ION DISTRIBUTION, SHAY CHLOROBLASTIC TUMOR (4186)*
FUNCTION, CHEMICAL CARCINOGENESIS, MOUSE (3656)
HELA, LYSOSOME, ADENOVIRUS TYPE 7 (3828)*
HYBRIDS, RAT HEPATOMA-MOUSE FIBROBLAST ALBUMIN SYNTHESIS (4259)*
KINETICS, RETICULUM CELL SARCOMA, SCALP, CASE REPORT (4234)*
LUNG, DIFFERENTIATION, GROWTH IN VITRO NEOPLASIA, ULTRASTRUCTURE, HUMAN EMBRYO (4009)
MAMMALIAN, VIRAL DNA GENOMES, CARCINOGENESIS MECHANISM, ORGANIZATION, REVIEW (3611)
- METABOLISM
EHRlich ASCITES TUMOR, ASCITES SERUM ADDITION, IN VITRO (4246)*
INTRACRANIAL TUMORS, HISTOENZYMOL-OGY, HUMAN (4204)*
MORPHOLOGY, PLANT CELLS RESEMBLING, TUMOR CELLS (4240)*
NUCLEI ISOLATION, ASCITES HEPATOMA, RAT (4174)*
POLYNUCLEAR ENDOTHELIUM, VEIN, MALIGNANT TUMORS (4279)*
POPULATION KINETICS, NEUROBLASTOMA, NEPHROBLASTOMA, HUMAN (4221)*
- RESPIRATION
BURKITT LYMPHOMA, MICRO-CARTESIAN DIVER TECHNIQUE (4133)*
MAMMARY GLAND CARCINOMA, MOUSE (4188)*
THECA-GRANULOSA TUMORS, PROLIFERATIVE ENDOMETRIAL RESPONSE, HUMAN (3681)
TUMOR, LYMPHORETICULAR SYSTEM, GROWTH, IN VITRO (4020)
- CELL CYCLE
ACUTE LYMPHOBLASTIC LEUKEMIA, L-ASPARAGINASE, HUMAN (4026)
- CELL MIGRATION
INHIBITION, LYMPHOMA, ANTISERA, MOUSE (3897)
- CERVIX
BIOPSIED CERVICAL TUMOR CELLS, HSIU-2 ANTIGENS, LATENCY, HUMAN (3895)
- CARCINOMA
ANTIBODY, HERPESVIRUS HUMAN, ADENOVIRUS, HUMAN (3864)
GLYCOLYSIS, HISTOGENESIS, HUMAN

(4030)
 IMMUNOGLOBULINS, HUMAN (3932)*
 INCIDENCE, ISRAEL, EPIDEMIOLOGICAL
 STUDY (3973)
 EPITHELIAL ATYPIA, PREGNANCY,
 INCIDENCE, CASE REPORTS (3939)
 HERPESVIRUS HOMINIS, INFECTED CELL,
 ULTRASTRUCTURE, HUMAN (3815)
 PROTEIN SYNTHESIS, SUBCELLULAR
 FRACTIONS, NORMAL AND MALIGNANT
 TISSUE, HUMAN (4229)*
 MICAL CARINOGENESIS
 CELL FUNCTION, MOUSE (3656)
 STATISTICAL ANALYSIS, CONTINUOUS
 APPLICATION, MOUSE SKIN (3698)
 TRANSPLACENTAL, HUMAN, REVIEW (3630)*
 ORAMPHENICOL
 MITOCHONDRIAL FUNCTION INHIBITOR, ROUS
 SARCOMA VIRUS REPLICATION,
 MALIGNANT TRANSFORMATION, CHICK
 EMBRYO CULTURE (3771)
 TUMOR TISSUE, PTERIDINE, RIBOFLAVIN,
 RAT (3991)
 RICCARCINOMA
 GESTATIONAL, HL-A ANTIGENS, HUMAN
 (3892)
 SERUM HYALURONIDASE, HYDATID MOLE,
 HUMAN (4262)*
 ROID
 METASTASIS, PRIMARY CANCER OF THE
 BREAST, HUMAN (4137)*
 OMATIN
 SARCOMA, LIVER PYRUVATE KINASE
 ISOENZYMES, RAT (4223)*
 TRANSCRIPTION, TRANSFORMATION,
 WALKER'S CARCINOMA (4090)*
 OMOSOME
 ABERRATIONS
 LEUKEMIA, LYMPHOPROLIFERATIVE
 DISEASE, MULTIPLE MYELOMA REVIEW
 (3627)*
 N-MEHTYL-N'-NITRO-N-NITROSOGUANI-
 DINE, TRANSFORMATION, HAMSTER,
 CELL (3677)
 ANOMALIES, ENDOMETRIAL ADENOCARCINOMA,
 HUMAN (4253)*
 E16, MALIGNANCY, DATA PROCESSING
 METHOD, HUMAN (4019)
 HERPES SIMPLEX VIRUS, HEMATOPOIETIC
 CELL, HUMAN (3812)
 HYBRID CELL, MORPHOLOGIC DIFFERENTIA-
 TION, TUMOR (4027)
 KARYOTYPE
 ACUTE LEUKEMIA, HUMAN (4125)*
 BONE MARROW, LYMPHOSARCOMA, COW
 (3937)
 MARKER BAND, BURKITT'S LYMPHOMA (3795)
 NEURINOMA, NEUROSARCOMA, HUMAN (4214)*
 NUMBER, TRANSFORMED CELL PROPERTY,
 REVERTANT VARIANT, HAMSTER CELL
 (3683)
 OSTEOSARCOMA-DERIVED CELL LINE, HUMAN
 (4151)*
 PATTERN, 7,12-DIMETHYLBENZ(A)ANTHRA-
 CENE-INDUCED TUMOR, ROUS SARCOMA
 VIRUS TUMOR, HAMSTER (4191)*
 RAUSCHER'S MURINE LEUKEMIA, V-CFL, L,
 MOUSE (3779)
 SPLEEN CELL, SEQUENTIAL CHANGES,
 FRIEND VIRUS LEUKEMIA, MOUSE (3791)
 TRANSFORMED CELL, REVERSION, HAMSTER
 CELL (4038)
 VULVAR NEOPLASM, CONDYLOMA ACUMINATUM,
 PAGET'S DISEASE, CARCINOMA,
 MALIGNANT MELANOMA, HUMAN (3940)
 CICATRIZATION
 WOUND, CANCER, RAT (4149)*
 CLONE
 HEAD AND NECK, TUMOR ORIGIN, HUMAN
 (3942)
 COLON
 CANCER, IMMUNOLOGY, HUMAN (3933)*
 CARCINOMA, ANTIGEN, HUMANS (3910)*
 MULTIPLE PRIMARY MALIGNANT TUMORS,
 PATHOLOGY, CASE REPORT (4192)*
 PLASMACYTOMA, MORPHOLOGY, CASE REPORT
 (4059)*
 CONCANAVALIN A
 BINDING, RNA VIRUS, MOUSE (3767)
 CARBOHYDRATE VISULIZATION, TUMOR CELL,
 ELECTRON MICROSCOPY, MOUSE (4080)*
 TUMORIGENICITY, AGGLUTINABILITY,
 HAMSTER CELL (3694)
 CONDYLOMA ACUMINATUM
 VULVA, CHROMOSOME, HUMAN (3940)
 CREUTZFELDT-JAKOB DISEASE
 BRAIN CELL, SPONTANEOUS TRANSFORMATION
 C-TYPE VIRUS, HUMAN (3750)
 CROTON OIL
 TUMOR PROMOTION, EPITHELIUM, DNA
 SYNTHESIS, MOUSE (3644)
 CULTURE
 MURINE LEUKOSIS VIRUS, HELA CELL,
 L CELL (3807)
 CYCLOPHOSPHAMIDE
 ENZYME METABOLISM, TOXIC METABOLITE,
 LIVER, MOUSE (3660)
 CYTOCHEMISTRY
 ACUTE LEUKEMIAS, REVIEW (3624)*
 CYTOGENETICS

- GUERIN T8 ASCITES TUMOR, EXTENDED PASSAGES IN VITRO (4164)*
WALKER'S CARCINOMA, METASTASES, RAT (4110)*
- CYTOLOGY
TUMOR, HAMSTER CHEEK POUCH (4141)*
TUMOR CELL, MURINE SARCOMA VIRUS GENOME, HAMSTER (3785)
- CYTOLYSIS
IMMUNE LYMPHOCYTE, LIPOSARCOMA, OSTEOSARCOMA, GUINEA PIG (3898)
- CYTOPATHOLOGY
SPONTANEOUS, C-TYPE VIRUS PARTICLE, RAT EMBRYO CELLS (3800)
- CYTOTOXICITY
IMMUNE LYMPHOCYTE, ANTISERUM CONCENTRATION, MOLONEY SARCOMA VIRUS, MOUSE (3869)
LYMPHOCYTE, HL-A COMPATIBILITY, HUMAN (3861)
RNA SYNTHESIS INHIBITION, SERUM, MALIGNANT MELANOMA, HUMAN (3883)
THYMOCYTE, BONE MARROW, ALLOGRAFT IMMUNITY, LYMPHOMA, MOUSE (3873)
- DALNOMYCIN
DNA POLYMERASE INHIBITION, RNA TUMOR VIRUS, MOUSE, CHICKEN (3787)
- 2-DEOXY-D-GLUCOSE
AMINO ACID, TRANSPORT, NORMAL AND MALIGNANT CELLS, REVIEW (3640)*
- DIAZOBENZOPYRENE
CARCINOGENESIS, MOUSE (3699)
- DIBENZ(A,H)ANTHRACENE
MACROMOLECULE BINDING, K-REGION EPOXIDE, HAMSTER CELL (3709)
- DIBENZ(A,H)ANTHRACENE METABOLITE
MITOCHONDRIAL VOLUME CHANGE, ATP, LIVER, RAT (3697)
- DIETHYLNITROSAMINE
ALTERED LIVER CELL FOCI, PARTIAL HEPATECTOMY, QUANTITATIVE STUDY, RAT (3715)*
CARCINOGENESIS, RAT (3670)
LIVER, HEMANGIOENDOTHELIAL SARCOMA, HISTOLOGY, RAT (3711)
- DIGESTIVE TRACT
CARCINOMA, LYMPH NODE, METASTASIS DISTRIBUTION, HUMAN (4029)
- N,N-DIMETHYLAMINOAZOBENZENE
METABOLISM, LIVER, RAT (3688)
- DIMETHYLBENZANTHRACENE
MAMMARY CARCINOMA, REGRESSION, NURSING PERIOD, RAT (3655)
TUMOR, FETAL ANTIGEN, MOUSE (3835)
TUMOR PROMOTER, EPITHELIUM, DNA SYNTHESIS, MOUSE (3644)
7,12-DIMETHYLBENZ(A)ANTHRACENE
SKIN TUMORIGENESIS, ARYL HYDROCARBON HYDROXYLASE, INHIBITION, 7,8-BENZO-FLAVONE, MOUSE (3678)
TUMORIGENESIS INHIBITION, STOMACH, MAMMARY GLAND, SKIN, ANTIOXIDANT, MOUSE, RAT (3689)
UV RADIATION, SKIN, MOUSE (3719)*
9,10-DIMETHYL-1,2-BENZANTHRACENE
MAMMARY GLAND TUMOR, VITAMIN B15, RAT (3667)
DIMETHYLCARBAMYL CHLORIDE
CARCINOGENESIS, MOUSE (3647)
DIMETHYLNITROSAMINE
HEMANGIOMAS, RETICULOENDOTHELIAL SYSTEM, MOUSE (3701)
IN VIVO PRODUCTION, AMINOPYRINE, NITRITE, RAT (3653)
DIMETHYL SULPHATE
DNA, ALKYLATION, 3-METHYLGUANINE (3674)
- DNA
BREAST CARCINOMA, CHROMOSOME NUMBER, SURVIVAL RATE, HUMAN (4270)*
7-BROMOMETHYLBENZ(A)ANTHRACENE
TREATMENT, DOUBLE HELICER, CROSS LINKING (3659)
COMPLEMENT SYNTHESIS, NATURAL RNAS, GENERAL APPROACH (3769)
EPITHELIAL CELLS, GASTRIC MUCOSA, ULCER, CANCER, HUMAN (3954)*
METHYLATION, SYNTHESIS, CHRONIC GRANULOCYTIC LEUKEMIA, HUMAN (4036)
MITOCHONDRIA, SYNTHESIS, STIMULATION, CYTOPLASMIC FACTOR, TUMOR, RAT (4022)
NITROSOGUANIDINE-TREATED, INDUCED MUTATIONS, HAEMOPHILUS INFLUENZAE (3657)
ONCOGENIC RIBOVIRUSES, CHICKEN, MOUSE (3794)
POLYMERASE
RNA-DEPENDENT, VIRUSES, CELLS (3799)
TUMOR VIRUS, ETHIDIUM BROMIDE EFFECT, SYNTHETIC TEMPLATES (3766)
POLYMERASE INHIBITION, DAUNOMYCIN, RNA TUMOR VIRUS, MOUSE, CHICKEN (3787)
POLYOMA VIRUS, REPLICATION, MOUSE EMBRYO (3827)*
REPAIR SYNTHESIS, ERYTHROCYTES, HETEROKARYONS, CHICKEN (3731)

REPLICATING UNITS, MURINE LYMPHOMA (4035)
 REPLICATION, INITIATION POINT, SV40 (3776)
 REVERSE TRANSCRIPTASE, AVIAN VIRUS, MURINE VIRUS, INHIBITION, ANTISERUM (3867)
 SV40, HOST CELL, HOMOLOGY, MONKEY CELL (3816)
 SV40 STRAIN DIFFERENCE (3741)
 SYNTHESIS
 FRAGMENTATION, EPSTEIN-BARR VIRUS INFECTION, RAJI CELLS (3792)
 GROSS VIRUS LEUKEMIA, IMMUNOLOGY, MOUSE (3719)*
 INHIBITION, ARABINOFURANOSYL ADENINE, TRANSFORMATION, ROUS SARCOMA VIRUS, RAT (3754)
 METHYLATION, FIBROBLASTS, MOUSE (3992)
 POLYNUCLEOTIDE LEAGASE, ASCITES HEPATOMA, RAT (4043)
 SKIN, TUMOR PROMOTER, DIMETHYLBENZANTHRACENE, MOUSE (3644)
 SYNTHESIS STIMULATION, AVIAN MYELOBLASTOSIS VIRUS, CHICKEN FIBROBLASTS (3777)
 TRANSFORMATION, DIFFERENTIAL INACTIVATION, 4-HYDROXYAMINOQUINOLINE-1-OXIDE, BACILLUS SUBTILIS (3666)
 TURNOVER, MOUSE (4034)
 VIRAL DNA SYNTHESIS, ADENOVIRUS-INFECTED KB CELLS (3819)
 VIRAL GENOMES, MAMMALIAN CELL ORGANIZATION, CARCINOGENESIS MECHANISM, REVIEW (3611)
 ENUM.
 POLYPOSIS, CARCINOMA, CASE REPORT (4294)*
 ICH ASCITES TUMOR
 CELL METABOLISM, ASCITES SERUM ADDITION, IN VITRO (4246)*
 RIBONUCLEOTIDE REDUCTASE, DNA SYNTHESIS, MOUSE (4212)*
 TROPHORESIS
 TUMOR HISTONES, PHOSPHORYLATION, CELL REPLICATION RATE (4087)*
 METRIUM
 ADENOCARCINOMA
 HYPERPLASIA, CHROMOSOMAL ANOMALIES HUMAN (4253)*
 ULTRASTRUCTURE, HUMAN (4233)*
 CARCINOMA
 ALDOLASE, LACTATE AND MALATE DEHYDROGENASE, HUMAN (4156)*
 ULTRASTRUCTURE, GLANDULAR CELL, HUMAN (4245)*
 ENVIRONMENT
 CARCINOGENIC POLLUTION, BENZO(A)PYRENE AIRCRAFT ENGINEER (3652)
 ENVIRONMENTAL HAZARD
 CHEMICAL CARCINOGEN, MUTAGENS, TERATOGENS, REVIEW (3620)
 ENZYME
 ACID PHOSPHATASE, LEUKOCYTE, CHRONIC GRANULOCYTIC LEUKEMIA, HUMAN (4158)*
 ACID PHOSPHATASE CHANGE, AZO DYE CARCINOGENESIS, LIVER, RAT (3714)
 ACCUMULATION, EHRlich CARCINOMA CELLS, MOUSE (4147)*
 ADENOSINE 3',5'-MONOPHOSPHATE ADENYL CYCLASE, LIVER, RAT (4161)*
 ALDOLASE, LACTATE, MALATE DEHYDROGENASES, ENDOMETRIAL CARCINOMA, HUMAN (4156)*
 ALDOLASE C, GLIOBLASTOMA, CELL CULTURE MOUSE (4211)*
 ALKALINE PHOSPHATASE
 LEUKEMIA, MOUSE (4089)*
 LUNG CANCER TISSUE, HUMAN (4010)
 ALKALINE PHOSPHATASE ACTIVITY, VIRUS-INDUCED THYMIC LYMPHOMA, MOUSE (3775)
 AMINOTRANSFERASES, ASPARTATE AND ALANINE, SARCOMAS, RAT (3998)
 AMP DEAMINASE, 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE, BINDING, LIVER, RAT (3710)
 ARYL HYDROCARBON HYDROXYLASE
 INHIBITION, SKIN TUMORIGENESIS, 7,8-BENZOFLAVONE, 7,12-DIMETHYLBENZ(A)ANTHRACENE, MOUSE (3678)
 RIBOFLAVIN DEFICIENCY, EPITHELIAL NEOPLASIA, MOUSE (3668)
 L-ASPARAGINASE
 CELL CYCLE, NUCLEIC ACID SYNTHESIS, ACUTE LYMPHORASTIC LEUKEMIA, HUMAN (4026)
 LYMPHOMA, PLASMA MEMBRANE, GLYCOPROTEIN (4040)
 ATPASE, PLASMATIC CELL MEMBRANE, HEPATOMA, MOUSE (4123)*
 ATPASE ACTIVITY, CYTOPLASMIC MEMBRANE, HEPATOMA CELL, MOUSE (3950)
 CATALASE, LIVER, BLOOD, TUMOR-BEARING, MOUSE (4187)*
 COLLAGENOLYTIC, NEOPLASMS, HUMAN (3990)
 CYCLIC NUCLEOTIDE PHOSPHODIESTERASE, ADRENOCORTEX, CARCINOMA, RAT (4071)*

- DNA POLYMERASE
RNA-DEPENDENT, VIRUSES CELLS
(3799)
TUMOR VIRUS, ETHIDIUM BROMIDE
EFFECT, SYNTHETIC TEMPLATES
(3766)
DOPAMINE- β -HYDROXYLASE, NEUROBLASTOMA,
MOUSE (4023)
FETAL-TYPE ISOENZYMES, HEPATIC AND
NONHEPATIC TUMORS, RAT (4004)
GLUTAMIC-OXALACETIC TRANSAMINASE,
ISOZYME PATTERNS, HEPATOMAS, GROWTH
RATE, RATS (4001)
GLUTAMIC-PYRUVIC TRANSAMINASE, ISOZYME
PATTERNS, HEPATOMAS, GROWTH RATE,
RAT (4001)
GLUTATHIONASE, HEPATOMA, RAT, MOUSE
(3682)
GUANYLATE-SPECIFIC TRANSFER RNA
METHYLASE, ASCITES HEPATOMA, RAT
LIVER (4248)*
HEXOKINASE, SARCOMAS, RAT (3998)
HEXOKINASE ISOZYMES, UTERINE CARCINOMA
HUMAN (4095)*
HYDROLASE ACTIVITY, TRNA, HUMAN TUMORS
RAT TISSUES (3986)
LACTIC DEHYDROGENASE, ISOZYME PATTERN,
HEPATOMAS, GROWTH RATE, RAT (4001)
LUNG CANCER CAVERNS, NEOPLASTIC
AUTOPHAGY, HUMAN (4106)*
LYSOSOMAL AND NONLYSOSOMAL, MORRIS
HEPATOMA, RAT (4092)*
MALATE DEHYDROGENASE, ISOZYME PATTERN,
HEPATOMAS, GROWTH RATE, RAT (4001)
MURAMIDASE, MONOCYTIC LEUKEMIA, HUMAN
(4274)*
PHOSPHOENOLPYRUVATE CARBOXYKINASE,
DIBUTYRYL CYCLIC AMP, HEPATOMA
(4011)
POLYADENYLIC ACID HYDROLASE, CARCINO-
GENESIS, DIMETHYLAMINOAZOBENZENE,
LIVER, RAT (3654)
POLYNUCLEOTIDE LIGASE, POLYOMA VIRUS,
MOUSE CELL (3818)
PROTEIN METHYLASE, HEPATOMAS, RAT
(3968)
REVERSE TRANSCRIPTASE
DNA POLYMERASE, RAUSCHER MURINE
LEUKEMIA VIRUS, RIFAMYCIN (3790)
INHIBITOR, RIFAMYCIN, MURINE
SARCOMA VIRUS (3782)
MURINE LEUKEMIA VIRUS, RAUSCHER
LEUKEMIA VIRUS, RIFAMYCIN (3742)
ONCOGENE HYPOTHESIS, REVIEW
(3622)*
RNA-DEPENDENT DNA POLYMERASE
HEPATOMA, LIVER, RAT (4017)
ROUS SARCOMA VIRUS, MITOCHONDRIA,
TUMOR, CHICKEN (3810)
RNA-DIRECTED DNA POLYMERASE, MAMMARY
CARCINOMA, MOUSE (3803)
SURFACE 3'-EXONUCLEASE, NOVIKOFF
HEPATOMA ASCITES CELL (4084)*
TISSUE PROTEOLYSIS, CANCER, REVIEW
(3623)*
TRANSFER RNA METHYLASES, NOVIKOFF
ASCITES HEPATOMA CELLS, RAT (4005)
TRANSDROGENASE, CELL ACTIVITY,
HEPATOMA, RAT (3997)
TRANSPLANTED NERVE TUMOR, RAT (4141)*
TYROSINE AMINOTRANSFERASE, AMINO ACID
TRANSPORT, MORRIS HEPATOMA, RAT
(4271)*
EPIDEMIOLGY
CANCER, INCIDENCE, INTERNATIONAL,
REVIEW (3636)*
HEPATITIS, CIRRHOSIS, PRIMARY LIVER
CANCER, DAKAR (4018)
KAPOSI'S SARCOMA, RANTU OF MOZAMBIQUE
(3982)*
MULTIPLE PRIMARY MALIGNANT NEOPLASIA,
ITALY (3978)*
UTERINE CERVIX CANCER, CUPA (3979)*
EPIDERMODYSPLASIA VERRUCIFORMIS
PAPOVAVIRUSES, ONCOGENESIS (3793)
EPITHELIOMA
BREAST, REGRESSION, DOG (4116)*
KROMPECHER, INVOLUTIONAL ELASTOSIS,
MORPHOLOGY, HUMAN (4278)*
OROPHARYNX, LARYNX, SARCOMATOUS STROMA
HUMAN (4138)*
PAROTID GLAND, PATHOLOGICAL ANATOMY,
CASE REPORT (4208)*
EPITHELIUM
BASAL LAYER, ABNORMAL CLONE SPREAD,
STOCHASTIC MODEL (3957)*
ERYTHROCYTE
DNA REPAIR SYNTHESIS, HETEROKARYONS,
CHICKEN (3731)
GLYCOLYSIS, MORRIS HEPATOMA TRANSPLANT
RAT (4126)*
PHOSPHORUS COMPOUNDS, TRANSPLANTED
MORRIS HEPATOMA, RAT (4128)*
ERYTHROPOIETIN
BONE MARROW, LEUKEMIA, POLYCYTHEMIA
VERA, HUMAN (4039)
ESTROGEN
CARCINOGENESIS, MAMMARY ADENOCARCINOMA
MONKEY (3669)
ETHIDIUM BROMIDE

MITOCHONDRIAL FUNCTION INHIBITOR,
ROUS SARCOMA VIRUS REPLICATION,
MALIGNANT TRANSFORMATION, CHICK
EMBRYO CULTURE (3771)

IONINE
LIVER CARCINOGENESIS, ULTRASTRUCTURE,
RAT (3717)*
LIVER CARCINOMA, ULTRASTRUCTURE, RAT
(3695)

INIC GROUP
CHINESE, MALAY, INDIAN, HL-A ANTIGEN
DISTRIBUTION, SINGAPORE (3890)

HYLNITROSUREA
NEURINOMA, TISSUE CULTURE, RAT (3700)

IOLOGY
CANCER, UTERINE CERVIX, REVIEW (3629)*
HODGKIN'S DISEASE, REVIEW (3625)*
LIVER CANCER, REVIEW (3631)*
SARCOIDOSIS, HODGKIN'S DISEASE,
IMMUNOLOGY, HUMAN (4209)*
SKIN CANCER, HUMAN (3952)*
THYROID CARCINOMA, CHILDREN (4045)

ING'S TUMOR
PATHOLOGY, CHILDREN (4230)*

ADENOMA OF RETINAL PIGMENT EPITHELIUM,
ULTRASTRUCTURE, CASE REPORT (4076)*
CANCER, IMMUNOLOGY, REVIEW, CASE
REPORT (3914)*
ORBITO-OCULAR TUMOR, INCIDENCE, AFRICA
(3963)*
UVEAL MELANOMA, AUTOIMMUNE SERUM,
HUMAN (3889)
UVEAL TRACT MELANOMA, MORPHOLOGY,
HUMAN (4134)*

BROADENOMA
MAMMARY GLAND, SEX CHROMATIN, HUMAN
(4122)*

ROBLAST
GROWTH, MORPHOLOGY, PROSTAGLANDINS,
MOUSE EMBRYO, IN VITRO (4222)*

ROSARCOMA
CELLS, STIMULATION OR SUPPRESSION OF
METASTASES, MOUSE (4074)*
HUMAN, REVIEW (3637)*
RADIATION RESPONSE, IMMUNE RESPONSE,
VITAMIN A, MOUSE (3730)

ROUS GLASS
MESOTHELIOMA INDUCTION, PLEURA, RAT
(3676)

-FLUORENYLACETAMIDE
LIVER CARCINOMA, ULTRASTRUCTURE, RAT
(3695)

LUOROURACIL
CARCINOGENIC ACTIVITY, MOUSE (3662)

GAMMA GLOBULIN
SYNTHESIS, SECRETION, IGA ASSEMBLY,
MYELOMA CELLS, MOUSE (3844)

GASTRIC CARCINOMA
INCIDENCE, COAL MINING REGION (3974)

GENETICS
CHRONIC MYELOCYTIC LEUKEMIA, MARROW
CELLS, HUMAN (4243)*
KARYOTYPE, CHROMOSOMAL ABERRATIONS,
MYELOID MONOCYTIC LEUKEMIA, CHILDREN
(4177)*
MULTIPLE SKIN TUMOR, HUMAN (4140)*
SKIN TUMORS, MULTIPLE LEIOMYOMA, BLUF
RUBBER-BLEB NEVUS SYNDROME (4175)*

GENITAL TRACT
BENIGN MESOTHELIOMA, ADENOMATOID TUMOR
ULTRASTRUCTURE, CASE REPORTS (3962)*

GLIOBLASTOMA
ALDOLASE C, CELL CULTURE, MOUSE
(4211)*
INTRACRANIAL, FIBRINOLYSIS, HUMAN
(4113)*
MULTIFORME, CRANIO-ORBITAL INVOLVEMENT
CASE REPORTS (4200)*

GLIOMA
MORPHOLOGY, HISTOCHEMISTRY, MOUSE,
IN VITRO (4055)*

GLUCOSAMINE
TRANSFORMATION TO GLYCOGEN AND LACTATE
ASCITES TUMOR CELLS, RAT, MOUSE
(4012)

GLYCOGEN
HISTOCHEMISTRY, UTERINE CERVIX
CARCINOMA, HUMAN (4078)*
METABOLISM, REGENERATING LIVER, LIVER
NEOPLASMS, RAT, MOUSE (3996)

GLYCOLIPID
SYNTHESIS, VIRUS TRANSFORMED AND
NORMAL CELL LINES, HAMSTER (3796)

GLYCOLYSIS
CANCER, PROSTATE, HUMAN (4298)*
CERVICAL CARCINOMA, HISTOGENESIS,
HUMAN (4030)
EHRlich ASCITES TUMOR CELLS, IN VITRO
(4082)*
OXYGEN UPTAKE, KIDNEY CARCINOSARCOMA,
RAT, IN VIVO (4115)

GONADOBLASTOMA
ULTRASTRUCTURE, HISTOCHEMISTRY, HUMAN
(4077)*

GRANULOCYTE
ALKALINE PHOSPHATASE, LIVER NEOPLASM,
HUMAN (4266)*
BASOPHILIC, EOSINOPHILIC, QUANTITATIVE
FEATURES, LEUKEMIA, CHILDREN (4263)*

KINETICS, PERIPHERAL BLOOD, CHRONIC
 MYELOCYTIC LEUKEMIA, HUMAN (4197)*
 GRANULOMA
 MIBLINE, MALIGNANT RETICULOSIS, CASE
 REPORTS (4064)*
 GRANULOSA CELL TUMOR
 THECA-, PROLIFERATIVE ENDOMETRIAL
 RESPONSE, HUMAN (3681)
 GROWTH
 ALLOGENEIC TUMOR, IMMUNOLOGIC ENHANCE-
 MENT, HISTOCOMPATIBILITY ANTIGENS,
 MOUSE (3903)
 BREAST CARCINOMA, HISTOLOGY, HUMAN
 (4217)*
 GENERATION TIME, LEUKEMIC MYELOBLAST,
 HUMAN (4013)
 HERPES SIMPLEX VIRUS, LYMPHOID CELLS,
 HUMAN (3746)
 INHIBITION, LIVER EXTRACT, MAMMARY
 TUMOR, MOUSE (4047)
 LYMPHOMA, LUCITE CYLINDER IMPLANTATION,
 ALLOGENEIC MICE (3733)*
 LYMPHORETICULAR TUMOR CELLS, IN VITRO
 (4020)
 MORPHOLOGY, FIBROBLASTS, PROSTAGLANDIN
 MOUSE EMBRYO, IN VITRO (4222)*
 NEOPLASTIC, INHIBITION, TRACE ELEMENTS
 REVIEW (3648)
 PLASMACYTOMA, PERITONEUM, MINERAL-OIL
 CONDITIONING, MOUSE (3946)
 RETARDATION, CELL CYCLE TIME, TRANS-
 PLANTED TUMOR (3887)
 STIMULATING FACTOR, LEUKEMIC CELL
 CULTURE, HUMAN (4041)
 TUMOR
 HYPERGLYCEMIA, RAT (4000)
 VASCULARIZATION, CHEMICAL
 CARCINOGENESIS, CHEEK POUCH,
 HAMSTER (3664)
 TUMOR CELL, DIFFERENTIATION, ULTRA-
 STRUCTURE, MOUSE (4272)*
 TUMOR METHYLCHOLANTHRENE, SPLEEN SIZE,
 IMMUNE RESPONSE, RAT (3911)*
 HEAD AND NECK
 TUMOR, CLONAL ORIGIN, HUMAN (3942)
 HEART
 RHABDOMYOSARCOMA, CASE REPORT (4050)*
 HEMANGIOMA
 DIMETHYLNITROSAMINE, RETICULOENDO-
 THELIAL SYSTEM, MOUSE (3701)
 HEMATOPOIETIC CELL
 HERPES SIMPLEX VIRUS, CHROMOSOME,
 HUMAN (3812)
 HEMATOPOIETIC TUMOR
 LYMPHOSARCOMA, FELINE LEUKEMIA VIRUS,
 CAT (3805)
 HEMOCYTOBLASTOSIS
 RNA SYNTHESIS, HUMAN DIPLOID CELLS
 (3760)
 HEMOGLOBIN
 MYELOID LEUKEMIA, FETAL ERYTHROPOIESIS
 CHILD (4098)*
 HEPATOCELLULAR CARCINOMA
 PORPHYRIA CUTANEA TARRA, FREQUENCY,
 HUMAN (4042)
 HEPATOMA
 ASCITES, CELL NUCLEI, ISOLATION, RAT
 (4174)*
 1-CARBON GROUP METABOLISM, WALKER'S
 CARCINOMA, RAT (4210)*
 CELL HYBRIDS, LIVER ALCOHOL DEHYDRO-
 GENASE, RAT (4190)*
 CELL CULTURE, LIVER TISSUE BREAKDOWN
 TECHNIQUES (4206)*
 GLUTATHIONASE, MOUSE, RAT (3682)
 GUANYLATE-SPECIFIC TRANSFER RNA
 METHYLASE, RAT LIVER (4248)*
 MORRIS
 AMINO ACID TRANSPORT, TYROSINE
 AMINOTRANSFERASE, RAT (4271)*
 CYCLIC AMP, ENDOCRINE CONTROL, RAT
 (4178)*
 LYSOSOMAL AND NONLYSOSOMAL
 ENZYMES, RAT (4092)*
 TRANSPLANTATION
 ERYTHROCYTIC GLYCOLYSIS, RAT
 (4126)*
 ERYTHROCYTIC PHOSPHORUS COMPOUND
 RAT (4128)*
 TYROSINE AMINOTRANSFERASE, AMINO
 ACID TRANSPORT, LIVER, RAT
 (4072)*
 NOVIKOFF, EXOGENOUS RNA UPTAKE,
 IN VITRO (4070)*
 NOVIKOFF ASCITES CELL, SURFACE
 3'-EXONUCLEASE (4084)*
 PHOSPHOENOLPYRUVATE CARBOXYKINASE
 DIBUTYRYL CYCLIC AMP (4011)
 PROTEIN METHYLASE, RAT (3988)
 RNA-DEPENDENT DNA POLYMERASE, LIVER,
 RAT (4017)
 YOSHIDA ASCITES, MITOTIC PROCESSES,
 RAT (4120)*
 TRANSPLANT, CELL LINES, MORPHOLOGY,
 MODEL (4205)*
 HERPES ZOSTER
 HODGKIN'S DISEASE, CLINICAL, HISTO-
 LOGIC AND IMMUNOLOGIC, CORRELATION
 (3763)
 HISTOCHEMISTRY

ACANTHOMA, ICHTHYOSIS, LOWER LIMBS,
CASE REPORTS (4215)*
ATPASE, PLASMATIC CELL MEMBRANE,
HEPATOMA, MOUSE (4123)*
CHONDROBLASTOMA, ULTRASTRUCTURE, CASE
REPORT (4216)*
ENZYMES, NERVE TUMOR, RAT (4141)*
GLYCOGEN, UTERINE CERVIX CARCINOMA,
HUMAN (4078)*

TOGENESIS
CERVICAL CARCINOMA, GLYCOLYSIS, HUMAN
(4030)
GRANULAR CELL TUMOR, VULVA, ULTRA-
STRUCTURE, REVIEW (3626)*
INSULIN-SECRETING PANCREATIC TUMOR,
AMYLOID STROMA, A CELL ADENOMAS,
CASE REPORT (4295)*

TOLOGY
ACANTHOMA, NAEVUS-SEBACEOUS-LIKE
FORMATIONS, CASE REPORTS (4111)*
FIBROUS HISTIOCYTOMA, SOFT TISSUES,
HUMAN (4058)*
LEIOMYOSARCOMA, UTERUS, HUMAN (4220)*
MALIGNANT FIBROUS HISTIOCYTOMA, SOFT
TISSUES, HUMAN (4053)*
OVARIAL CYSTOADENOFIBROMA, CASE REPORT
(4267)*
RECTAL CANCER, CYTOLOGY, HUMAN (4124)*
URETER CARCINOMA, CASE REPORT (4104)*

TOPATHOLOGY
BILATERAL BRENNER TUMOR, CASE REPORT
(4131)*
CARCINOMA, ADRENAL GLAND CORTEX, CASE
REPORTS (4112)*
MALIGNANT LYMPHOGRANULOMA, CASE REPORT
(4114)*
OVARIAL TUMOR STROMA, HUMAN (4121)*

SKIN'S DISEASE
CHRONIC LYMPHOCYTIC LEUKEMIA,
PERIPHERAL LYMPHOCYTES, ZINC
STIMULATION IN VITRO, HUMAN (3917)*
ETIOLOGY, REVIEW (3625)*
HERPES ZOSTER, CLINICAL, HISTOLOGIC
AND IMMUNOLOGIC CORRELATIONS (3763)
IDIOPATHIC THROMBOCYTOPENIC PURPURA,
PATHOLOGY, HUMAN (4061)*
LEUKEMIA, ASSOCIATION, CASE REPORTS
(4213)*
LEUKOCYTE, CYTOPLASMIC IMMUNO-
FLUORESCENCE, HUMAN (3856)
LIVER BIOPSY, HUMAN (3994)
PURINE AND PYRIMIDINE EXCRETION,
CLINICAL-HISTOLOGICAL STUDY (4166)*
SARCOIDOSIS, ETIOLOGY, IMMUNOLOGY,
HUMAN (4209)*

STAGING, EPIDEMIOLOGICAL CONSIDERA-
TIONS, REVIEW (3638)*, (3639)*
SYSTEMIC SPREAD, SPINAL CORD INVOLVE-
MENT, CASE REPORT (4056)*

HORMONE
ADRENOCORTICOTROPIC, CUSHING'S
SYNDROME, BRONCHIAL CARCINOID
ADENOMA, HUMAN (4292)*
BLOOD ESTROGENS, BREAST CANCER, HUMAN
(4277)*
ESTROGENS, MAMMARY GLAND CARCINOMA,
VAGINAL CYTOLOGY, HUMAN (4145)*
GROWTH, IMMUNOREACTIVE, LUNG AND
STOMACH CANCER, HUMAN (3927)*
INSULIN, ALDOSTERONE, PROGESTERONE,
MAMMARY GLAND TISSUE GROWTH, IN
VITRO (4173)*
PROGESTOGENS, MAMMARY NEOPLASM, DOG
(4193)*

HYBRID
MAMMARY CARCINOMA CELL, H-2 ANTI-
GENICITY, MOUSE (3858)
TUMOR CELL, CHROMOSOME, MORPHOLOGIC
DIFFERENTIATION (4027)

HYDRAZINE
LUNG TUMORIGENESIS, MOUSE (3692)

HYDROCARBON
AROMATIC POLYCYCLIC, BINDING, DNA,
RNA AND PROTEIN, TRANSFORMED CELLS,
HAMSTER (3672)

4-HYDROXYAMINOQUINOLINE-1-OXIDE
DNA TRANSFORMATION, DIFFERENTIAL
INACTIVATION, BACILLUS SUBTILIS
(3666)

N-HYDROXY-2-FLUORENYLACETAMIDE
CONVERSION TO O-AMIDOPHENOLS, STEREO-
CHEMISTRY, MECHANISM, RAT LIVER
(3712)

HYPERGLYCEMIA
TUMOR GROWTH, RAT (4000)

HYPERIMMUNIZATION
CHRONIC, ASSOCIATED PERTUSSIS-
DIPHTHERIA-TETANUS VACCINE, LEUKEMIA
MOUSE (3916)*

HYPERNEPHROMA
METASTASIS, NASAL SINUS, HUMAN (4135)*

HYPERPLASIA
LARYNGEAL EPITHELIUM, TUMOR, SH-GROUPS
(4108)*

HYPERSENSITIVITY
DELAYED, SV40, MOUSE (3882)

IMMUNE REACTION
CYTOLYSIS, LIPOSARCOMA, OSTEOSARCOMA,
IMMUNE LYMPHOCYTE, GUINEA PIG (389A)
GRAFT-VERSUS-HOST, IMPAIRMENT, SPLEEN

- CELL, TUMOR, RAT (3855)
 UVEAL MELANOMA, AUTOCHTHONOUS SERA,
 HUMAN (3889)
- IMMUNE RESPONSE
 DEPRESSION, SPLEEN CELL, 4-NITRO-
 QUINOLINE 1-OXIDE, MOUSE (3679)
 SUPPRESSION, PHYTOHEMAGGLUTININ,
 GUINEA PIG (3907)
- IMMUNITY
 ADOPTIVE TRANSFER, BESNOITIA JELLYSONI
 RADIATION, HAMSTER (3729)
 ALLOGRAFT, THYMOCYTE, BONE MARROW CELL
 CYTOTOXICITY, LYMPHOMA, MOUSE (3873)
 BRAIN TUMORS, CELL MEDIATED, HUMAN
 (3841)
 CANCER, HUMAN, REVIEW (3634)*
 CELL-MEDIATED, MACROPHAGE MIGRATION
 INHIBITION, PLASMACYTOMA, MOUSE
 (3893)
 CELLULAR, BLOCKING ACTIVITY, MAMMARY
 TUMOR, MOUSE (3679)
 CYTOTOXICITY, LYMPHOCYTE,
 HL-A COMPATIBILITY, HUMAN (3861)
 GRAFT VS HOST REACTIVITY, ANAPHYLAXIS,
 LEUKEMIA, AKR MOUSE (3866)
 LYMPHATIC LEUKEMIA, LEUKOCYTES, MOUSE,
 FIG (3906)
 RENAL CARCINOMA, CELLULAR, MAN (3905)
 TUMOR, ADENOSINE 3',5'-PHOSPHATE,
 MOUSE (3836)
 TUMOR-SPECIFIC, NONTUMORIGENIC TUMOR
 CELL, ASCITES TUMOR, MOUSE (3885)
 TUMOR SUPPRESSION, BACILLUS CALMETTE-
 GUERIN, CELL WALL, OIL DROPLET,
 HEPATOMA, GUINEA PIG (3877)
 TRANSPLANTATION, ENHANCEMENT, MYCOBAC-
 TERIUM BUTYRICUM, MOUSE (3904)
- IMMUNIZATION
 SV40 VIRUS, ROUTE OF INOCULATION,
 HAMSTER (3886)
- IMMUNOGENICITY
 LEUKEMIA ISOTRANSPLANT SYSTEM,
 CELLULAR AND CELL-FREE PREPARATIONS,
 MOUSE (3923)*
 OSTEOSARCOMA, RADIATION, MOUSE (3896)
- IMMUNOGLOBULIN
 ANTIGENIC REACTION, GROUP-SPECIFIC,
 INTERSPECIES SPECIFIC, C-TYPE VIRUS
 (3875)
 CARCINOMA, CERVIX, HUMAN (3932)*
 IGG2, TUMOR ELUATE, TUMOR TRANSPLANTA-
 TION, MOUSE (3862)
 KREBS II ASCITES, MESSENGER RNA TRANS-
 LATION, CELL-FREE SYSTEM (4189)*
 MEMBRANE-BOUND MONOCLONAL, CHRONIC
 LYMPHOCYTIC LEUKEMIA (3900)
 RECEPTOR, 4 LYMPHOCYTE, PLASMACYTOMA,
 MOUSE (3853)
- IMMUNOLOGY
 ANTIBODY RESPONSE, MURINE LEUKEMIA
 VIRUS, SPONTANEOUS INFECTION, MOUSE
 (3852)
 ASTROCYTOMA, ANTIGEN SPECIFICITY,
 IN VITRO (3929)*
 CANCER, LYMPHOCYTE TRANSFORMATION
 IN VITRO, HUMANS (3925)*
 CYTOMEGALOVIRUS INFECTION, LEUKEMIA,
 CHILDREN (4063)*
 EYE CANCER, HUMANS (3414)*
 GROSS VIRUS LEUKEMIA, DNA SYNTHESIS,
 MOUSE (3919)*
 HAPTEN ISOLATION, NEOPLASM, RABBIT
 (3850)
 HOST RESISTANCE, FREUND'S ADJUVANT,
 PRETREATMENT, NEOPLASM, MOUSE (3839)
 HYPERSENSITIVITY RESPONSE, CANCER,
 COLON, HUMAN (3937)*
 IMMUNOLOGIC MECHANISMS, HUMAN
 ONCOGENESIS, REVIEW (3608)
 LEUKEMIA, CANDIDIASIS, HUMAN (4086)*
 MAMMARY GLAND CANCER, MOUSE, REVIEW
 (3606)
 MAMMARY GLAND TUMOR, ASCITES TUMOR,
 ANTIGEN CROSS-REACTIVITY, MOUSE
 (3930)*
 MOLONEY SARCOMA, STRESS, MOUSE (3920)
 NASOPHARYNGEAL CARCINOMA, HUMAN,
 REVIEW (3609)
 TUMOR TISSUE, MOUSE (3931)*
- IMMUNOSENSITIVITY
 TA3 CARCINOMA SUBLINES, MOUSE (3874)
- IMMUNOSUPPRESSION
 ANTIBODY, MAMMARY TUMOR VIRUS, MOUSE
 (3857)
 ANTILYMPHOCYTE GLOBULIN, CARCINOMA
 CELL TUMORIGENICITY, MONKEY, HUMAN
 (3872)
 BISDIOXOPIPERAZINE, MOUSE (3901)
 RENAL MALIGNANCY, RENAL TRANSPLANTA-
 TION, HUMAN (4276)*
 URETHAN, RAT (3921)*
- IMMUNOSUSCEPTIBILITY
 MAMMARY CARCINOMA CELL, SURLINE,
 TRANSPLANTABILITY, MORPHOLOGY,
 KARYOTYPE, MOUSE (3851)
- INDUCTION
 FOCUS-FORMING VIRUS, 5-BROMODEOXY-
 URIDINE, MURINE SARCOMA VIRUS-
 INDUCED (3665)
 OSTEOSARCOMAS, MOUSE (3765)

TUMOR, MURINE SARCOMA VIRUS, POLY-
RIBINOSINIC-POLYRIBOCYTIDYLIC ACID,
MOUSE (3764)

SECTION

SV40-RELATED, HUMAN, REVIEW (3612)

INTERFERON

CYTOTOXICITY, LYMPHOCYTES, MOUSE
(3995)

DEPRESSION OF PRODUCTION, LEUKEMIA,
MOUSE (3834)*

INDUCTION, HERPES SIMPLEX VIRUS (3753)

LINE

THYROID CARCINOGENESIS, HAMSTER
(3735)*

XANTHOPTERIN

TUMOR TISSUE, PTERIDINE, RIBOFLAVIN,
RAT (3991)

OSI'S SARCOMA

IMMUNOLOGY, PATHOLOGY, CHILDREN
(4199)*

YOTYPE

E16 CHROMOSOME, MALIGNANCY, DATA
PROCESSING METHOD, HUMAN (4019)

LEUKEMIA, MULTIPLE HEMOPATHIES, PARA-
PROTEINEMIA, CASE REPORT (4275)*

MAMMARY CARCINOMA CELL, SUBLINE,
IMMUNOSUSCEPTIBILITY, MOUSE (3851)

NEY

ADENOVIRUS TYPE 2 AND 4, INTERFERENCE
WITH ADENOVIRUS TYPE 12, GUINEA PIG
(3826)*

CARCINOSARCOMA, GLYCOLYSIS, OXYGEN
UPTAKE, RAT, IN VIVO (4115)*

LUCKE RENAL ADENOCARCINOMA, VERTICAL
TRANSMISSION, FROG (3759)

PARENCHYMA, CARCINOMA, MORPHOLOGY,
HUMAN (4143)*

RENAL CARCINOMA, CELLULAR IMMUNITY,
MAN (3905)

TRANSPLANTATION, WILM'S TUMOR, IMMUNO-
SUPPRESSION, HUMAN (4276)*

TUMOR, ANTIGENS, HUMANS (3924)*

YINX

CANCER, HISTOENZYMATIC CHARACTERISTICS
HUMAN (3989)

MALIGNANT TUMOR, METASTASES, HUMAN
(4296)*

OROPHARYNX, EPITHELIOMA WITH
SARCOMATOUS STROMA, HUMAN (4138)*

OMYOSARCOMA

HUMAN, REVIEW (3637)*

PRIMARY RENAL VEIN, CASE REPORT
(3961)*

KEMIA

ACUTE

L-ASPARAGINASE, LYMPHOCYTE TRANS-
FORMATION, HUMAN (4049)*

BACTERIA FLORA, PATIENTS (4181)*

CELL PROLIFERATION, PRELEUKEMIC
STATE, CYTOPHOTOMETRY, AUTO-
RADIOGRAPHY, CASE REPORT (3964)*

CYTOCHEMISTRY, REVIEW (3624)*

CYTOGENETICALLY ABNORMAL CELLS,
HUMAN (4172)*

GENETICS, HUMAN (4125)*

MYELOFIBROSIS, HUMAN (4079)*

PNEUMATOSIS CYSTOIDES INTESTINALIS
PATHOLOGY, CASE REPORTS (4060)*

PROLONGED REMISSION, CHILDREN
(4183)*

SERUM AMINO ACIDS, HUMAN (4260)*

STATISTICS, PATHOLOGY, HUMAN
(4286)*

ACUTE ERYTHROCYTIC, POLYCYTHEMIA VERA,
CASE REPORT (4148)*

ACUTE LYMPHOBLASTIC, CELL CYCLE,
NUCLEIC ACID SYNTHESIS, L-ASPARAGIN-
ASE, HUMAN (4026)

AKR MOUSE, GRAFT VS HOST REACTIVITY,
ANAPHYLAXIS (3866)

ALKALINE PHOSPHATASE, KINETICS, MOUSE
(4089)*

AMINO ACID CELL REQUIREMENTS, HUMAN,
IN VITRO (4091)*

ANTIBODY RECEPTOR, INHIBITION,
MACROPHAGE, ISOANTIBODY, MOUSE
(3854)

ASSOCIATED ANTIGEN DETECTION, RABBIT
(3908)

BASOPHILIC AND EOSINOPHILIC GRANULO-
CYTES, QUANTITATIVE FEATURES,
CHILDREN (4263)*

BONE MARROW, ERYTHROPOIETIN, HUMAN
(4039)

BURKITT LYMPHOMA

DIMETHYLSULFOXIDE KINETICS,
IN VITRO (4254)*

EPSTEIN-BARR VIRUS, CELL LINE
ESTABLISHMENT (4032)

CANDIDIASIS IMMUNOLOGY, HUMAN (4086)*

CELL CHARACTERIZATION, ACIDIC NUCLEAR
PROTEIN PROFILE, HUMAN (3999)

CELL CULTURE, GROWTH STIMULATING
FACTOR, HUMAN (4041)

CELL CYCLE KINETICS, MOUSE (4031)

CHROMOSOMAL ABERRATIONS, MULTIPLE
MYELOMA, LYMPHOPROLIFERATIVE DISEASE
REVIEW (3627)*

CHRONIC GRANULOCYTIC

ACID PHOSPHATASE LEUKOCYTE, HUMAN

(4158)*
 BLASTIC TRANSFORMATION REMISSION,
 HEMATOLOGIC AND CYTOGENETIC
 STUDIES (4021)
 CHRONIC HYPERIMMUNIZATION, ASSOCIATED
 PERTUSSIS-DIPHTHERIA-TETANUS VACCINE
 MOUSE (3916)*
 CHRONIC LYMPHOCYTIC
 HODGKIN'S DISEASE PERIPHERAL
 LYMPHOCYTES, ZINC STIMULATION
 IN VITRO (3917)*
 LYMPHOSARCOMA, MORPHOLOGY, CASE
 REPORT (4282)*
 MEMBRANE-BOUND MONOCLONAL IMMUNO-
 GLOBULIN (3900)
 CHRONIC LYMPHOID, PRIMARY CANCER,
 LUNG, CASE REPORT (4105)*
 CHRONIC MYELOCYTIC
 GENETIC MARKERS, HUMAN (4243)*
 GRANULOCYTE KINETICS, PERIPHERAL
 BLOOD, HUMAN (4197)*
 CHRONIC MYELOID
 ANEUPLOID CELL LINES, CASE REPORT
 (4152)*
 BONE MARROW LEUKOCYTE, METABOLISM,
 HUMAN (4101)*
 HEMATOLOGY, CASE REPORTS (4130)*
 CLASSIFICATION, CYTOCHEMISTRY, ULTRA-
 STRUCTURE (4153)*
 CYTOMEGALOVIRUS INFECTION, IMMUNOLOGY,
 CHILDREN (4063)*
 EXOCRINE PANCREAS FUNCTION, HUMAN
 (4107)*
 FRIEND VIRUS, SPLEEN CELL CHROMOSOMES,
 SEQUENTIAL CHANGES, MOUSE (3791)
 GRANULOCYTE, PROLIFERATION, HUMAN
 (4033)
 GROSS VIRUS, RAUSCHER VIRUS, CELL
 SURFACE ANTIGENS, MOUSE, RAT (3880)
 HERPES VIRUS ANTIBODY, INCIDENCE,
 HUMAN (3747)
 HODGKIN'S DISEASE, ASSOCIATION, CASE
 REPORTS (4213)*
 ISOTRANSPLANT SYSTEM, IMMUNOGENICITY,
 CELLULAR AND CELL-FREE PREPARATIONS,
 MOUSE (3923)*
 KARYOTYPE, MULTIPLE HEMOPATHIES, CASE
 REPORT (4275)*
 L1210 AND L5178Y, COLLATERAL
 SENSITIVITY, MOUSE (4006)
 LEUKOCYTIC RNA METABOLISM, HUMAN
 (4198)*
 LYMPHATIC, IMMUNITY, LEUKOCYTES, MOUSE
 PIG (3906)
 LYMPHOCYTE TRANSFORMATION, IMMUNE

REACTION, ANTILYMPHOCYTE SERA EFFECT
 ANTIPARABLAST SERA EFFECT, CHILDREN
 (3847)
 MONOCYTIC, MURAMIDASE, SERUM, URINE,
 HUMAN (4274)*
 MORBIDITY, ENVIRONMENTAL FACTORS,
 POLAND (3977)*
 MYELOBLAST, GENERATION TIME, HUMAN
 (4013)
 MYELOID
 FETAL ERYTHROPOIESIS, HEMOGLOBIN
 LEVELS, CHILD (4098)*
 RABBIT, CASE REPORT, GENETICS
 (4067)*
 MYELOID MONOCYTIC
 KARYOTYPE, CHROMOSOMAL ABERRATIONS
 CHILDREN (4177)*
 SPLENOMEGALY, CHILDREN, CASE
 REPORT (4176)*
 MURINE MYELOID, COLONY, SPLFEN, MOUSE
 (4201)*
 NUCLEIC ACID CONTENT, LIVER, SPLEEN,
 HUMAN (3987)
 PREGNANCY, SERUM PROTEIN RESPONSE,
 MOUSE (4046)
 RISK, DIAGNOSTIC IRRADIATION, HUMAN
 (3968)
 RNA METABOLISM, LEUKOCYTES, HUMAN
 (4194)*
 SERUM INTERFERON PRODUCTION,
 DEPRESSION, MOUSE (3834)*
 SERUM PROTEIN FRACTIONS, HUMAN (3918)*
 SPONTANEOUS STEM CELL, RAT (3947)
 7,8,12-TRIMETHYLBENZ(A)ANTHRACENE-
 INDUCED, BONE MARROW CHANGES, RAT
 (3691)
 VIRUSES, H-2 ANTIGENS, MOUSE (3870)
 X-RAY INDUCED, INCIDENCE REDUCTION,
 ANTI-LYMPHOCYTE SERUM, MOUSE (3727)
 LEUKOCYTE
 CYTOPLASMIC IMMUNOFLOUORESCENCE,
 LYMPHOSARCOMA, MULTIPLE MYELOMA,
 HODGKIN'S DISEASE, HUMAN (3856)
 IMMUNITY, LYMPHATIC LEUKEMIA, MOUSE,
 PIG (3906)
 REACTION, BURKITT LYMPHOMA TUMOR CELL,
 CELL STIMULATION, HUMAN (3888)
 TRANSFORMATION, PROLIFERATION, HUMAN
 (3843)
 LIPID
 CARCINOGENESIS, ESR SIGNAL OF FERRUM-
 COMPLEXES, FREE RADICAL PROCESSES
 (3721)*
 LIPOPROTEIN
 SERUM, CANCER PATIENTS (4069)*

LIPOSARCOMA

HUMAN, REVIEW (3637)*

LIVER

ACID PHOSPHATASE CHANGE, AZO DYE
CARCINOGENESIS, RAT (3714)
ADENOSINE 3',5'-MONOPHOSPHATE ADENYL
CYCLASE, RAT (4161)*
ALCOHOL DEHYDROGENASE, HEPATOMA CELL
HYBRIDS, RAT (4190)*
AMP DEAMINASE, 3'-METHYL-4-DIMETHYL-
AMINOAZOBENZENE, BINDING, RAT (3710)
BIOPSY, HODGKIN'S DISEASE, HUMAN
(3994)
BLOOD, CATALASE ACTIVITY, TUMOR-
BEARING MOUSE (4187)*

CANCER

ALPHA-1-FETOPROTEIN, HUMAN (3993)
ETIOLOGY, REVIEW (3631)*
SERUM ALPHA-FETOGLOBULIN, HUMAN
(3926)*
CARCINOGENESIS, ETHIONINE, ULTRA-
STRUCTURE, RAT (3717)*
CARCINOMA, ULTRASTRUCTURE, RAT (3695)
CELL FOCI ALTERATIONS, DIETHYL-
NITROSAMINE, QUANTITATIVE STUDY, RAT
(3715)*
CIRRHOSIS, LYMPHOPROLIFERATIVE
DISEASES, ETIOLOGICAL RELATIONSHIP,
CASE REPORTS (4117)*
CYCLOPHOSPHAMIDE METABOLISM, ENZYME,
TOXIC METABOLITE, MOUSE (3660)
N,N-DIMETHYLAMINOAZOBENZENE,
METABOLISM, RAT (3688)
ENERGY METABOLISM, 1,4-DIHYDROPYRIDINE
1,6-DIHYDROPYRIMIDINE, TUMOR CELLS
(3723)*
EXTRACT, MAMMARY TUMOR, GROWTH INHIBI-
TION, MOUSE (4047)
HEMANGIOENDOTHELIAL SARCOMA, HISTOLOGY
DIETHYLNITROSAMINE, RAT (3711)
HEMANGIOENDOTHELIOMA, PATHOLOGY, HUMAN
(4244)*
HEPATOCELLULAR CARCINOMA, PORPHYRIA
CUTANEA TARDA, FREQUENCY, HUMAN
(4042)
MEMBRANE-SPECIFIC ANTIGEN, RAT CELL
(3899)
METASTASES, ANGIOGRAPHY, HISTOLOGY
(4256)*
NEOPLASMS
GLYCOGEN METABOLISM, RAT, MOUSE
(3996)
GRANULOCYTIC ALKALINE PHOSPHATASE,
HUMAN (4266)*
POLADENYLIC ACID HYDROLASE, CARCINO-

GENESIS, DIMETHYLAMINOAZOBENZENE,
RAT (3654)

PRIMARY CANCER

AUSTRALIAN ANTIGEN, HUMAN (3842)
HEPATITIS, CIRRHOSIS, ETIOLOGIC
RELATIONSHIP (4018)
PRIMARY CARCINOMA, PATHOLOGY (4257)*
PRIMARY LIVER CELL CARCINOMA, ULTRA-
STRUCTURE, AFRICAN (3865)
PRIMARY TUMOR, CASE REPORT (4159)*
PYRUVATE KINASE ISOZYMES, SARCOMA
CHROMATINS, RAT (4223)*
TUMORIGENESIS, MUTATION, NEUTRON
IRRADIATION, MOUSE (3732)
TUMORS

INDUCTION, 2-ACETYLAMINOFLUORENE,
RAT (3716)*

TOBACCO, HAMSTER (3722)*

LUCKE RENAL ADENOCARCINOMA

VERTICAL TRANSMISSION, FROG (3759)

LUNG

ADENOCARCINOMA, ULTRASTRUCTURE, HUMAN
(4218)*
ALVEOLAR CELL CARCINOMA, CALCIFIED
BODIES, CYTOPATHOLOGY, CASE REPORTS
(4273)*

BRONCHIOLO-ALVEOLAR CARCINOMA,
TREATMENT, HUMAN, REVIEW (3607)

CANCER

CARDIAC METASTASIS, CASE REPORT
(4184)*
IMMUNOREACTIVE GROWTH HORMONE,
HUMAN (3927)*
SMOKING, SURVIVAL, HUMAN (3693)
TOBACCO, SUGAR CONTENT, PH OF
SMOKE (3645)
CANCER CAVERNS, NEOPLASTIC AUTOPHAGY,
ENZYMES, HUMAN (4106)*
CARCINOGENESIS, 3-METHYLCHOLANTHRENE,
4-NITROQUINOLINE 1-OXIDE, RABBIT
(3696)
CARCINOMA, BENZO(A)PYRENE, DUST, RAT
(3617)
CELLS, DIFFERENTIATION, GROWTH IN
VITRO, NEOPLASIA, ULTRASTRUCTURE,
HUMAN EMBRYO (4009)
LYMPHOSARCOMA, PATHOLOGY, CASE REPORTS
(4196)*
METASTASIS VOLUME, IRRADIATION DAMAGE,
REPAIR, HUMAN (3725)
PAPILLARY ADENOCARCINOMA, PSALMOMA
BODIES, HUMAN (4231)*
PRIMARY EPITHELIAL CANCER, LEUKEMIA,
CHRONIC LYMPHOID, CASE REPORT
(4105)*

- SCLEROSING HEMANGIOMA, ULTRASTRUCTURE,
 CASE REPORT (3960)*
 TUMOR, SCINTISCANNING, HUMAN (4255)*
 TUMORIGENESIS, HYDRAZINE, METHYL-
 HYDRAZINE, METHYLHYDRAZINE SULFATE,
 AMMONIUM HYDROXIDE, MOUSE (3692)
- LYMPH NODE
 METASTASIS DISTRIBUTION, CARCINOMA,
 DIGESTIVE TRACT, RESPIRATORY TRACT,
 HUMAN (4029)
 PRIMARY MALIGNANT NEOPLASM, PATHOLOGY,
 CASE REPORT (4203)*
- LYMPHATICS
 DISSEMINATION OF CANCER CELLS,
 METASTASIS, REVIEW (4081)*
- LYMPHOCYTE
 B, PLASMACYTOMA CELL, IMMUNOGLOBULIN
 RECEPTOR, MOUSE (3853)
 BLASTIC TRANSFORMATION IN VITRO,
 IMMUNOLOGY, CANCER, HUMANS (3925)*
 BLASTOGENESIS RESPONSE, MALIGNANT
 TISSUE, BENIGN TISSUE, NORMAL TISSUE
 HUMAN (3878)
 DEPLETION, TUMOR CELL INOCULATION,
 MOUSE (3859)
 IMMUNE, CYTOTOXICITY, ANTISERUM
 CONCENTRATION, MOLONEY SARCOMA VIRUS
 MOUSE (3869)
 INFECTED, HERPESVIRUS SAIMIRI, ANTIGEN
 MARROSET (3806)
 MITOTIC POTENTIAL, ELECTROMAGNETIC
 RADIATION, MONKEY (3726)
 PERIPHERAL, ZINC STIMULATION IN VITRO,
 HODGKIN'S DISEASE, CHRONIC
 LYMPHOCYTIC LEUKEMIA (3917)*
 PERIPHERAL BLOOD, HYPOGAMMA-
 GLOBULINEMIA, LYMPHOCYTIC LEUKEMIA,
 HUMAN (3837)
 TRANSFORMATION
 L-ASPARAGINASE, ACUTE LEUKEMIA,
 HUMAN (4049)*
 LEUKEMIA, ANTILYMPHOCYTE SERA
 EFFECT, ANTIPARABLAST SERA
 EFFECT, CHILDREN (3847)
- LYMPHOGRANULOMA
 MALIGNANT, HISTOPATHOLOGY, CASE REPORT
 (4114)*
- LYMPHOID CELLS
 LYSIS IN VITRO, MOUSE SARCOMA CELLS,
 GUINEA PIG (3922)*
- LYMPHOMA
 ALLOGRAFT IMMUNITY, THYMOCYTE, BONE
 MARROW CELL, CYTOTOXICITY, MOUSE
 (3873)
 BREAST, HISTOLOGY, PATHOLOGY, HUMAN
 (4235)*
 CELL MIGRATION, INHIBITION, ANTISERA,
 MOUSE (3897)
 DELTA-AMINOLEVULINIC ACID EXCRETION,
 HUMAN (4202)*
 GROSS VIRUS, SURFACE ANTIGEN, ANTIBODY
 BINDING, RAT (3903)
 GROWTH, LUCITE CYLINDER IMPLANTATION,
 ALLOGENEIC MICE (3733)*
 IMMUNOLOGICALLY INDUCED, MORPHOGENESIS
 MOUSE (4007)
 INDUCTION BY SILICA, RAT (3651)
 LYMPHOCYTIC, EPSTEIN-BARR VIRUS,
 SERUM ANTIBODY, HUMAN (3814)
 MALIGNANT
 HISTIOCYTIC TYPE, MORPHOLOGY,
 CLINICAL BEHAVIOR (4052)*
 SPINAL CORD INVOLVEMENT, SYSTEMIC
 SPREAD, CASE REPORT (4056)*
 MEDIASTINUM, MORPHOLOGY, HUMAN (4165)*
 PLASMA MEMBRANE, GLYCOPROTEIN,
 L-ASPARAGINASE (4040)
 SPLENIC, STEMLINE EVOLUTION, A TYPE
 PARTICLE, MOUSE (3941)
 SYSTEMIC MAST CELL DISEASE, IGG PARA-
 PROTEIN, CASE REPORT (4239)*
 TYPE C VIRUS, MOUSE (3789)
- LYMPHOPROLIFERATIVE DISEASE
 CIRRHOSIS, ETIOLOGICAL RELATIONSHIP,
 CASE REPORTS (4117)*
- LYMPHOSARCOMA
 BONE MARROW, KARYOTYPE, COW (3937)
 FELINE LEUKEMIA VIRUS, CAT (3805)
 HERPES-LIKE VIRUS, ISOLATION, COW
 (3737)
 LEUKOCYTE, CYTOPLASMIC IMMUNO-
 FLUORESCENCE, HUMAN (3856)
 LUNG, PATHOLOGY, CASE REPORTS (4196)*
- MACROMOLECULE
 BINDING, BENZ(A)ANTHRACENE,
 DIBENZ(A,H)ANTHRACENE, K-REGION
 EPOXIDE, HAMSTER CELL (3709)
- MACROPHAGE
 MIGRATION INHIBITION, PLASMACYTOMA,
 CELL-MEDIATED IMMUNITY, MOUSE (3893)
- MALIGNANT DISEASE
 SMOOTH MUSCLE ANTIBODY, HUMAN (3860)
- MALIGNANT LYMPHOMA
 HL-A ANTIGEN FREQUENCY, HUMAN (3891)
- MALIGNANT MELANOMA
 RNA SYNTHESIS INHIBITION, CYTOTOXICITY
 SERUM, HUMAN (3883)
 VULVA, CHROMOSOME, HUMAN (3940)
- MAMMARY CARCINOMA
 MALE, INCIDENCE, HUMAN (3966)

REGRESSION, DIMETHYLBENZANTHRACENE,
 NURSING PERIOD, RAT (3655)
 MAMMARY GLAND
 ADENOCARCINOMA, GROWTH INHIBITION,
 LIVER EXTRACT, MOUSE (4047)
 CANCER, IMMUNOLOGY, MOUSE, REVIEW
 (3606)
 CARCINOMA
 CELLULAR RESPIRATION, MOUSE
 (4188)*
 ESTROGENS, VAGINAL CYTOLOGY, HUMAN
 (4145)*
 MODAL DNA, SURVIVAL RATE, HUMAN
 (4270)*
 RNA-DIRECTED DNA POLYMERASE,
 MOUSE (3803)
 CARCINOMA CELL SURVIVAL, IMMUNO-
 SUSCEPTIBILITY, TRANSPLANTABILITY,
 MORPHOLOGY, KARYOTYPE, MOUSE (3851)
 CARCINOMA CELLS, SURFACE PROPERTIES OF
 NON-TUMORIGENIC VARIANTS, MOUSE
 (3840)
 CARCINOMA LOBULAR IN SITU, PATHO-
 GENESIS, HUMAN (3956)*
 9,10-DIMETHYL-1,2-BENZANTHRACENE,
 VITAMIN B15, RAT (3667)
 FIBROADENOMA, SEX CHROMATIN, HUMAN
 (4122)*
 NEOPLASM, PROGESTOGENS, DOG (4193)*
 SARCOMA, MORPHOLOGY, HISTOGENESIS, DOG
 (4268)*
 TA3 CARCINOMA SUBLINES, ANTIBODY
 BINDING, IMMUNOSENSITIVITY, MOUSE
 (3874)
 TISSUE GROWTH, HORMONE REQUIREMENT,
 IN VITRO, HUMAN (4173)*
 TUMOR
 ASCITES TUMOR, ANTIGEN CROSS-
 REACTIVITY, MOUSE (3930)*
 CELLULAR IMMUNITY, BLOCKING
 ACTIVITY, MOUSE (3879)
 MURINE LEUKEMIA VIRUS, MAMMARY
 TUMOR VIRUS, ANTIGENS, MOUSE
 (3784)
 ULTRASTRUCTURE, HUMAN (4146)*
 TUMOR DEVELOPMENT, THYMUS, MOUSE
 (4037)
 TUMORIGENESIS INHIBITION, ANTIOXIDANT,
 7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT
 (3689)
 INDIBLE
 AMEIOBLASTOMA, LUNG METASTASIS, CASE
 REPORT (4051)*
 EPITHELIAL ODONTOGENIC TUMOR, ULTRA-
 STRUCTURE, CASE REPORT (4100)*
 MAREK'S DISEASE
 HERPES VIRUS, AVIAN LEUCOSIS VIRUS,
 INTERACTIONS, TISSUE CULTURE (3762)
 MEDIASTINUM
 PRIMARY LYMPHATIC TUMORS, MORPHOLOGY,
 HUMAN (4165)*
 TUMOR, PATHOLOGICAL ANATOMY, HUMAN
 (4284)*
 MELANOMA
 AMELANOTIC, MORPHOLOGY, 5-BROMODEOXY-
 URIDINE, IN VITRO (4088)*
 MALIGNANT
 CHOROID, ULTRASTRUCTURE, CASE
 REPORT (4154)*
 PENIS, CASE REPORT (4144)*
 METASTASES, PATHOLOGICAL ANATOMY,
 HUMAN (4163)*
 SKIN, METASTASES TO THE STOMACH, CASE
 REPORT (4265)*
 UVEAL, AUTOIMMUNE SERUM, HUMAN (3889)
 MEMBRANE
 GLYCOPROTEIN, LYMPHOMA, L-ASPARAGINASE
 (4040)
 SURFACE, STRUCTURAL CHANGES, MALIGNANT
 CELL TRANSFORMATION, HAMSTER (3938)
 SURFACE CHANGE, ADENOVIRUS INFECTION,
 HUMAN (3748)
 MENOPAUSE
 BREAST CANCER RISK, UNITED STATES
 (3971)
 MESOPHARYNX
 MALIGNANT TUMORS, INCIDENCE, HUMAN
 (3955)*
 MESOTHELIOMA
 ATRIOVENTRICULAR NODE, HEART BLOCK,
 CASE REPORT (4075)*
 GENITAL TRACT, ADENOMATOID TUMOR,
 ULTRASTRUCTURE, CASE REPORTS (3962)*
 INDUCTION, PLEURA, ASBESTOS, FIBROUS
 GLASS, RAT (3676)
 METABOLISM
 ASCITES TUMOR, CATALASE, MOUSE (4289)*
 BONE MARROW LEUKOCYTES, CHRONIC
 MYELOID LEUKEMIA, HUMAN (4101)*
 1-CARBON GROUP, HEPATOMA, WALKER'S
 CARCINOMA, RAT (4210)*
 CHOLESTEROL, PREPUTIAL GLAND TUMOR,
 MOUSE (4237)*
 N,N-DIMETHYLAMINOAZOBENZENE, LIVER,
 RAT (3688)
 EHRLICH ASCITES TUMOR CELL,
 RIBONUCLEOTIDE REDUCTASE, DNA
 SYNTHESIS, MOUSE (4212)*
 GLYCOGEN, REGENERATING LIVER, LIVER
 NEOPLASMS, RAT, MOUSE (3996)

- GLYCOLYSIS, EHRLICH ASCITES TUMOR, IN VITRO (4082)*
 INTRACRANIAL TUMOR CELL, HISTOENZYMOL-
 OBY, HUMAN (4264)*
 MICROELEMENTS, BLOOD AND URINE LEVELS, HUMAN (4109)*
 RNA AND DNA, MURINE CARCINOMA, GROWTH STAGES, MOUSE (4068)*
 SARCOMA, GLYCOLYSIS, RESPIRATION, CARTESIAN DIVER METHOD (4073)*
- METAL
 IONS, SUBCELLULAR BINDING, RHABDOMYO-SARCOMA, RAT (3702)
 NI+2 COMPLEX, BINDING CAPACITY, SUBCELLULAR FRACTION (3706)
- METASTASIS
 BONE, BREAST CANCER, HUMAN (4236)*
 BREAST, HISTOLOGY, HUMAN (4224)*
 CARCINOMA, UTERINE CERVIX, HUMAN (4127)*
 CARDIA, PULMONARY CANCER, CASE REPORT (4124)*
 CHOROID, BREAST CANCER, LUNG CANCER (4137)*
 DISTRIBUTION, LYMPH NODE, CARCINOMA, DIGESTIVE TRACT, RESPIRATORY TRACT, HUMAN (4029)
 EYE, GASTRIC RETICULUM CELL SARCOMA, CASE REPORT (4157)*
 HAND FINGER, GRAVITZ TUMOR, CASE REPORT (4252)*
 LARYNX TUMOR, PATHOLOGY, HUMAN (4296)*
 LIVER, ANGIOGRAPHY, HISTOLOGY (4256)*
 LUNG, VOLUME, IRRADIATION DAMAGE, REPAIR, HUMAN (3725)
 LYMPHATIC SPREAD OF CANCER CELLS, REVIEW (4081)*
 MELANOMA, PATHOLOGICAL ANATOMY, HUMAN (4163)*
 OSTEOLYTIC, PRIMARY CANCER OF THE PROSTATE, HUMAN (4136)*
 OTORHINOLARYNGOLOGY, INCIDENCE, HUMAN (4135)*
 SARCOMA, ITERATED PASSAGING, RAT (4293)*
 SOFT TISSUE, BREAST CANCER, GROWTH RATE (3980)*
 STIMULATION, SUPPRESSION, SYNGENEIC TUMOR CELLS, MOUSE (4074)*
 VASCULAR SYSTEM, NEOPLASTIC CELLS, MASTOMYS STOMACH (3985)
- METHOTREXATE
 CARCINOGENIC ACTIVITY, MOUSE (3662)
 L5178Y MOUSE LEUKEMIA, RESISTANCE (4168)*
- METHYLATION
 DNA, CHRONIC GRANULOCYTIC LEUKEMIA, HUMAN (4036)
 TRANSFER RNA
 ASCITES HEPATOMAS, MOUSE (4003)
 KIDNEY TUMOR, RAT (4002)
- METHYLCHOLANTHRENE
 INDUCED STOMACH TUMORS, FACTORS DETERMINING TUMOR SITES, RAT (3661)
 INDUCED TUMOR, CELL-MEDIATED IMMUNE RESISTANCE, RAT (3868)
 LIPOSARCOMA INDUCTION, TUMOR-SPECIFIC ANTIGEN, GUINEA PIG (3838)
 TUMOR GROWTH, IMMUNE RESPONSE, SPLEEN SIZE, RAT (3911)*
- 3-METHYLCHOLANTHRENE
 BIOCHEMICAL STUDY, PASSAGE THROUGH PLACENTA, MOUSE (3658)
 LUNG CANCER, RABBIT (3696)
 RAUSCHER MURINE LEUKEMIA VIRUS, TRANSFORMATION, RAT (3713)
 TUMOR INDUCTION, PRESENCE OF C-TYPE GROUP-SPECIFIC ANTIGEN, MOUSE (3848)
- 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE
 AMP DEAMINASE, BINDING, LIVER, RAT (3710)
 CARCINOGENESIS, ACID PHOSPHATASE CHANGE, LIVER, RAT (3714)
 LIVER CARCINOMA, ULTRASTRUCTURE, RAT (3695)
- METHYLHYDRAZINE
 LUNG TUMORIGENESIS, MOUSE (3692)
- METHYLHYDRAZINE SULFATE
 LUNG TUMORIGENESIS, MOUSE (3692)
- N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
 TRANSFORMATION, CHROMOSOME ABERRATION, HAMSTER, CELL (3677)
- N-METHYL-N-NITROSOUREA
 DNA, ALKYLATION SITE, 3-METHYLGUANINE (3674)
- METHYLTHIOURACIL
 THYROID CARCINOGENESIS, HAMSTER (3735)*
- MIGRATION
 INHIBITION, MACROPHAGE, PLASMACYTOMA, CELL-MEDIATED IMMUNITY, MOUSE (3893)
- MILK
 RNA DETECTION, HIGH-MOLECULAR-WT, HUMAN (3804)
- MITOCHONDRIA
 N-ACETYL-4-AMINOBIIPHENYL INTERACTION, RAT LIVER (3675)
 DNA SYNTHESIS, STIMULATION CYTOPLASMIC FACTOR, TUMOR, RAT (4022)
 FUNCTION INHIBITORS, ROUS SARCOMA

VIRUS REPLICATION, MALIGNANT TRANS-
 FORMATION, CHICK EMBRYO CULTURE
 (3771)*
 VOLUME CHANGE, ATP, DIBENA(A,H)-
 ANTHRACENE METABOLITE, LIVER, RAT
 (3697)*
MITOSIS
 CELL CYCLE TIME, TUMOR GROWTH,
 RETARDATION (3887)
 KINETICS, LEUKEMIA, MOUSE (4031)
 YOSHIDA ASCITES HEPATOMA, RAT (4120)*
MORBIDITY
 CANCER, ISRAEL (3970)
 LEUKEMIA, ENVIRONMENTAL FACTORS,
 POLAND (3977)*
MORPHOLOGY
 AMELANOTIC MELANOMA, 5-BROMODEOXY-
 URIDINE, IN VITRO (4088)*
 BRONCHIAL CARCINOMA, HUMAN (4285)*
 CARCINOMA, RENAL PARENCHYMA, HUMAN
 (4143)*
 CONGENITAL MESOTHELIOMA, ATRIOVENTRI-
 CULAR NODE, CASE REPORT (4075)*
 GLIOMA, HISTOCHEMISTRY, MOUSE, IN
 VITRO (4055)*
 HEPATOMA TRANSPLANT, CELL LINES, MODEL
 (4205)*
 KROMPECHER'S CARCINOMA, INVOLUTIONAL
 ELASTOSIS, HUMAN (4278)*
 LYMPHOSARCOMA, CHRONIC LYMPHOCYTIC
 LEUKEMIA, CASE REPORT (4282)*
 MALIGNANT LYMPHOMA, HISTIOCYTIC TYPE,
 CASE HISTORIES (4052)*
 MALIGNANT MELANOMA, PIGMENTED NEVUS,
 CASE REPORTS (4283)*
 MAMMARY CARCINOMA CELL, SUBLINE,
 IMMUNOSUSCEPTIBILITY, MOUSE (3851)
 MAMMARY GLAND SARCOMA, HISTOGENESIS,
 DOG (4268)*
 MYELOID LEUKEMIA, RABBIT, CASE REPORT
 (4067)*
 NEURINOMA, RETROPERITONEUM, CASE
 REPORT (4261)*
 ODONTOGENIC TUMORS, FISH, MAMMALS
 (4291)*
 POLYNUCLEAR GIANT CELL ENDOTHELIUM,
 VEIN, MALIGNANT TUMORS, HUMAN, RAT
 (4279)*
 SALIVARY GLAND TUMOR, INCIDENCE,
 CHILDREN (4096)*
 SARCOMA, BRAIN, CASE REPORTS (4250)*
 UVEAL TRACT MELANOMA, HUMAN (4134)*
MORTALITY
 CANCER, ISRAEL (3969)
 MALIGNANT TUMORS, KAZAN (3976)*
 REPORTING PROCEDURES, ISRAEL (3967)
 STOMACH CARCINOMA AND PANCREATIC
 CARCINOMA, UNITED STATES (3984)*
MUCOSUBSTANCE
 ABNORMAL MUCIN, WILM'S TUMOR,
 PATHOLOGY, CHILDREN (4228)*
MULTIPLE MYELOMA
 LEUKOCYTE, CYTOPLASMIC IMMUNO-
 FLUORESCENCE, HUMAN (3856)
 PROSTATE CARCINOMA, 9S IGG PARAPROTEIN
 HUMAN (3928)*
MURINE LYMPHOMA
 DNA, REPLICATING UNIT (4035)
MUTANT
 ADENOVIRUS, RECOMBINATION, HAMSTER
 CELL (3820)
MUTATION
 LIVER TUMORIGENESIS, NEUTRON IRRADIA-
 TION, MOUSE (3732)
 MAMMALIAN CELLS, N-ACETOXY-N-2-
 FLUORENYLACETAMIDE (3646)
 NITROSOGUANIDINE-INDUCED, TRANSFORMA-
 TION, HAEMOPHILUS INFLUENZAE (3657)
MYCOBACTERIUM BOVIS
 BACILLUS CALMETTE-GUERIN, CELL WALL,
 OIL DROPLET, TUMOR SUPPRESSION,
 HEPATOMA, GUINEA PIG (3877)
MYCOBACTERIUM BUTYRICUM
 TRANSPLANTATION IMMUNITY, ENHANCEMENT,
 MOUSE (3904)
MYELOMA
 IMMUNOGLOBULIN-PRODUCING, CYTOPLASMIC
 RNA (4247)*
 LIGHT CHAIN SYNTHESIS, MRNA,
 PROPERTIES (3845)
 POLYRIBOSOME DISAGGREGATION, PROTEIN
 SYNTHESIS, MOUSE (4238)*
MYELOPROLIFERATIVE DISEASE
 CYTOGENETICS, BONE MARROW, SIDEROBLAS-
 TIC ANEMIA, CASE REPORT (4241)*
 MONOCYTIC LEUKEMIA, MYELOID LEUKEMIA,
 CHILDREN, CASE REPORT (4176)*
 PLATELET AGGREGATION, PLASMA, HUMAN
 (4242)*
NASOPHARYNGEAL CARCINOMA
 CHINESE, SOUTH EAST ASIA, AFRICA
 (3619)
 HERPES VIRUS ANTIBODY, INCIDENCE,
 HUMAN (3747)
 IMMUNOLOGICAL ASPECTS, HUMAN, REVIEW
 (3609)
NEOPLASIA
 EPITHELIUM, RIBOFLAVIN DEFICIENCY,
 ARYL HYDROCARBON HYDROXYLASE, MOUSE
 (3668)

GROWTH, INHIBITION, TRACE ELEMENTS, REVIEW (3648)
 INHIBITION, ANTIGENIC CARCINOGEN, PROTEIN CONJUGATE, RAT (3981)*
 MULTIPLE PRIMARY MALIGNANT, EPIDEMIOLOGY, ITALY (3978)*
 NEOPLASM
 ANTIGEN, HAPTEN ISOLATION, RABBIT (3850)
 BONE, URINARY HYDROXYPROLINE, SERUM ALKALINE PHOSPHATASE, CALCIUM, PHOSPHORUS, HUMAN (4251)*
 COLLAGENOLYTIC ENZYMES, HUMAN (3990)
 LIVER, GLYCOGEN METABOLISM, RAT, MOUSE (3996)
 MAMMARY GLAND, PROGESTOGENS, DOG (4193)*
 PRIMARY MALIGNANT, LYMPH NODE, PATHOLOGY, CASE REPORT (4203)*
 URICHELUM, PATHOLOGY, HUMAN (4269)*
 VIRAL AND IMMUNOLOGIC STUDIES, HUMAN (3797)
 NEPHROBLASTOMA
 HISTOCHEMISTRY, ULTRASTRUCTURE, AUTORADIOGRAPHICAL INVESTIGATIONS (3724)*
 NERVE
 TRANSPLANTED TUMOR, ENZYMES, RAT (4141)*
 TUMOR TRANSPLANTATION, ENZYME HISTOCHEMISTRY, RAT (4102)*
 NERVOUS SYSTEM
 NEUROEPITHELIAL TUMORS, CYTOGENESIS, DIFFERENTIATION, REVIEW (3603)
 NEURINOMA
 ETHYLNITROSOUREA, TISSUE CULTURE, RAT (3700)
 NEUROSARCOMA, CHROMOSOMES, HUMAN (4214)*
 RETROPERITONEUM, MORPHOLOGY, CASE REPORT (4261)*
 NEUROBLASTOMA
 DOPAMINE- β -HYDROXYLASE, MOUSE (4023)
 NEURITE OUTGROWTH INHIBITION, COLLAGEN (4066)*
 NEVUS
 PIGMENTED, MALIGNANT MELANOMA, MORPHOLOGY, CASE REPORTS (4233)*
 NICOTINE
 ENZYME METABOLISM, LIVER, MOUSE (3660)
 4-NITROQUINOLINE-1-OXIDE
 IMMUNE RESPONSE DEPRESSION, SPLEEN CELL, MOUSE (3679)
 LUNG CANCER RABBIT (3696)
 NITROSAMINE
 DIMETHYLNITROSAMINE, IN VIVO PRODUCTION, AMINOPYRINE, NITRITE, RAT (3653)
 FORMATION, DRUG/NITRITE INTERACTION, (3704)
 NITROSO COMPOUNDS
 TRANSPLACENTAL PLASTOMOGENESIS, RAT (3618)
 N-NITROSO COMPOUNDS
 FORMATION, NITROSATION INHIBITION, ASCORBATE (3690)
 NITROSOETHYLUREA
 CARCINOGENESIS, ALKYLATION, NUCLEIC ACIDS, LIVER, RAT (3708)
 NITROSOMETHYLUREA
 CARCINOGENESIS, ALKYLATION, NUCLEIC ACIDS, LIVER, RAT (3708)
 NUCLEIC ACID
 HUMAN TUMOR CELL, CARCINOGENICITY, MOUSE (3829)*
 METABOLISM, MURINE CARCINOMA, GROWTH STAGES, MOUSE (4068)*
 SYNTHESIS, ACUTE LYMPHOBLASTIC LEUKEMIA, L-ASPARAGINASE, HUMAN (4026)
 NUCLEOLUS
 PROTEIN SYNTHESIS, NOVIKOFF ASCITES TUMOR (4028)
 NUCLEOTIDE
 AVIAN TUMOR VIRUS SPECIFIC SEQUENCES, DETECTION, AVIAN CELL DNA (3778)
 OCCUPATIONAL HAZARD
 AMOSITE ASBESTOS, CARCINOGENICITY, REVIEW (3601)
 ASBESTOS, REVIEW (3616)
 HERPES-LIKE SIMIAN VIRUS, REVIEW (3605)
 ONCOGENESIS
 IMMUNOLOGIC MECHANISMS, HUMAN, REVIEW (3608)
 VIRUS THEORIES, REVIEW (3615)
 ONCOLOGY
 PROGESTINS, REVIEW (3635)*
 ORAL CONTRACEPTIVE
 ADENOCARCINOMA, MAMMARY GLAND, MONKEY (3669)
 OSTEOSARCOMA
 CELL LINE DERIVATION, CHROMOSOMAL ABERRATIONS, HUMAN (4151)*
 INDUCTION, MOUSE (3765)
 RADIATION, IMMUNOGENICITY, MOUSE (3896)
 OVARY
 CLEAR CELL CARCINOMA, ENDOMETRIOSIS, HUMAN (4226)*

CYSTOADENOFIBROMA, HISTOLOGY, CASE REPORT (4287)*
 HYPERPLASIA, ADENOMA, DEVELOPMENT, MOUSE (3943)
 MURINE OVARIAN CARCINOMA, LYMPHATIC OBSTRUCTION, ASCITES FORMATION, MOUSE (3963)*
 TUMORS
 HISTOLOGY, HUMAN (4121)*
 INCIDENCE, PATHOLOGY, CALCUTTA (4267)*
 PEUTZ-JEGHERS SYNDROME, CASE REPORT (4044)
 GET'S DISEASE
 VULVA, CHROMOSOME, HUMAN (3940)
 INCREAS
 EXOCRINE FUNCTION, LEUKEMIA, HUMAN (4107)*
 TUMOR, AMYLOID STROMA, A CELL ADENOMAS CASE REPORT (4295)*
 PILLOMA
 CUTANEOUS, PAPOVA VIRUS, OPOSSUM (3749)
 OTID GLAND
 ANAPLASTIC CARCINOMA, MORPHOLOGY, INCIDENCE, ALASKA (4232)*
 EPITHELIOMA, PATHOLOGICAL ANATOMY, CASE REPORT (4208)*
 THOGENESIS
 CARCINOMA LOBULARE IN SITU, NOSOLOGY, HUMAN (3956)*
 THOLOGY
 ACUTE LEUKEMIA, STATISTICS, HUMAN (4286)*
 GIANT CELL TUMORS, SKULL, HUMAN (4290)*
 HEPATIC HEMANGIOENDOTHELIOMA, HUMAN (4244)*
 HODGKIN'S DISEASE, IDIOPATHIC THROMBOCYTOPENIC PURPURA, HUMAN (4061)*
 KAPOSI'S SARCOMA, PATHOLOGY, IMMUNOLOGY, CHILDREN (4199)*
 MALIGNANT GIANT CELL TUMOR, SOFT PARTS HUMAN (4219)*
 MIDLINE MALIGNANT RETICULOSIS, CASE REPORTS (4064)*
 MULTIPLE PRIMARY MALIGNANCIES, COLON, CASE REPORT (4192)*
 OCCULT SEMINOMA, CASE REPORTS (4085)*
 OVARIAN TUMORS, INCIDENCE, CALCUTTA (4267)*
 PLASMACYTOMA, UPPER RESPIRATORY AND DIGESTIVE TRACT, HUMAN (4094)*
 PNEUMATOSIS CYSTOIDES INTESTINALIS, ACUTE LEUKEMIA, CASE REPORTS (4060)*
 UROTHELIAL NEOPLASM, MORPHOLOGY, HUMAN (4269)*
 PENIS
 MALIGNANT MELANOMA, CASE REPORT (4144)*
 PHENOBARBITAL
 GROWTH, ALLOGENEIC SARCOMA, RAT (4167)*
 PHORBOL ESTER
 TUMOR PROMOTION, SKIN, MOUSE (3680)
 PHYTOHEMAGGLUTININ
 IMMUNE RESPONSE SUPPRESSION, GUINEA PIG (3907)
 PINEAL GLAND
 DEGENERATION, CANCER PATIENTS (4006)
 PLANT
 EDIBLE, CARCINOGENICITY, RAT (3707)
 PLASMA
 PLATELET AGGREGATION, MYELOPROLIFERATIVE DISEASE, HUMAN (4242)*
 PLASMACYTOMA
 B LYMPHOCYTE, IMMUNOGLOBULIN RECEPTOR, MOUSE (3853)
 CELL-FREE TRANSMISSION, MOUSE (3780)
 CELL-MEDIATED IMMUNITY, MACROPHAGE MIGRATION INHIBITION, MOUSE (3893)
 COLON, MORPHOLOGY, CASE REPORT (4059)*
 GROWTH, PERITONEUM, MINERAL-OIL CONDITIONING, MOUSE (3946)
 UPPER RESPIRATORY AND DIGESTIVE TRACT, PATHOLOGY, HUMAN (4094)*
 PLEURA
 MESOTHELIOMA, ASBESTOS, FIBROUS GLASS, RAT (3676)
 POLYCYCLIC HYDROCARBON
 AROMATIC, BINDING, DNA, RIA AND PROTEIN, TRANSFORMED CELLS, HAMSTER (3672)
 POLYCYTHEMIA VERA
 ACUTE ERYTHROCYTIC LEUKEMIA, CASE REPORT (4148)*
 BONE MARROW, ERYTHROPOIETIN, HUMAN (4039)
 POLYMER
 ORGANIC, BIOCOMPATIBILITY, TOXICOLOGY, REVIEW (3642)*
 POLYNUCLEOTIDE LIGASE
 DNA SYNTHESIS, ASCITES HEPATOMA, RAT (4043)
 POLYRIBOADENYLIC ACID
 RNA TUMOR VIRUSES (3862)
 POLYRIBOINOSINIC-POLYRIBOCYTIDYLIC ACID
 MURINE SARCOMA VIRUS, TUMOR INDUCTION, MOUSE (3764)

PREGNANCY
 LEUKEMIA, SERUM PROTEIN RESPONSE,
 MOUSE (4040)
 PROGESTINS
 ONCOLOGY, REVILW (3635)*
 PROLIFERATION
 CELLULAR, ACUTE LEUKEMIA,
 PRELEUKEMIC STATE, CYTOPHOTOMETRY,
 AUTORADIOGRAPHY, CASE REPORT (3964)*
 GRANULOCYTE, LEUKEMIA, HUMAN (4033)
 LEUKOCYTES, HUMAN (3843)
 PROSTAGLANDIN
 PRODUCTION, TUMOR, MOUSE (4024)
 PROSTATAS
 ADENOMA, EPITHELIAL GROWTH IN VITRO,
 HUMAN (4155)*
 CANCER, OSTEOLYTIC METASTASES, HUMAN
 (4136)*
 PROSTATE
 CANCER, GLYCOLYSIS, HUMAN (4298)*
 TRANSFORMED CELL, ANTIGEN, MOUSE
 (3601)
 PROTEIN
 ALBUMIN SYNTHESIS, RAT HEPATOMA-MOUSE
 FIBROBLAST, HYBRID CELLS (4259)*
 ANTIGEN, DETECTION IN URINE, IMMUNO-
 DIFFUSION, HUMAN (3912)*
 BRAIN SPECIFIC, TUMOR, N-METHYLNITRO-
 SCUREA, RAT (4258)*
 CEREBROSPINAL FLUID, BRAIN TUMORS,
 HUMAN (4110)*
 FETAL ALPHA-GLOBULIN, ISOLATION,
 CHARACTERIZATION, HUMAN (3849)
 HERPES SIMPLEX VIRUS-SPECIFIC, PLASMA
 MEMBRANE (3621)
 METHYLASE, HEPATOMAS, RAT (3988)
 9S IGG PARAPROTEIN, MULTIPLE MYELOMA,
 CARCINOMA, PROSTATE, HUMAN (3928)*
 ROUS SARCOMA VIRUS, BRYAN STRAIN
 (3743)
 SERUM
 EHRlich TUMOR, MOUSE (3915)*
 IMMUNOELECTROPHORESIS, EHRlich
 ASCITES TUMOR, MOUSE (4119)*
 LEUKEMIA, HUMAN (3918)*
 MALIGNANT LYMPHOMA, SYSTEMIC MAST
 CELL DISEASE, CASE REPORT
 (4239)*
 SERUM ALPHA-FETOGLOBULIN, CANCER,
 HUMAN (3926)*
 SH-GROUPS, LARYNGEAL EPITHELIUM,
 HYPERPLASIA, TUMOR (4108)*
 SV40-SPECIFIC, SYNTHESIS AND VIRAL
 INCORPORATION (3768)
 SYNTHESIS
 NUCLEOLUS, NOVIKOFF ASCITES TUMOR
 (4028)
 SUBCELLULAR FRACTIONS, UTERINE
 CERVIX, MALIGNANT NEOPLASM,
 HUMAN (4229)*
 PYRAN COPOLYMER
 TUMORIGENESIS INHIBITION, POLYOMA
 VIRUS, RAUSCHER LEUKEMIA VIRUS,
 IMMUNOSUPPRESSION, MOUSE (3686)
 RADIATION
 BONE MARROW STEM CELLS, CELL CYCLE,
 MOUSE (3734)*
 CORAL, LUNG METASTASIS VOLUME, DAMAGE
 REPAIR, HUMAN (3725)
 DIAGNOSTIC LEUKEMIA RISK, HUMAN (3968)
 ELECTROMAGNETIC, LYMPHOCYTE, MITOTIC
 POTENTIAL, MONKEY (3726)
 IMMUNITY TRANSFER, BESNOITIA JELLISONI
 HAMSTER (3729)
 IMMUNOGENICITY, TUMOR GROWTH RATE,
 H-2 ANTIGEN, MOUSE (3894)
 NEUTRON, LIVER TUMOR, MUTATION, MOUSE
 (3732)
 OSTEOGENIC SARCOMA, HEAD AND NECK,
 CASE REPORTS (3736)*
 RESPONSE, FIBROSARCOMA, IMMUNE
 RESPONSE, VITAMIN A, MOUSE (3730)
 STRONTIUM 90, OSTEOSARCOMA, IMMUNO-
 GENICITY, MOUSE (3896)
 THERAPY, THROAT CARCINOMAS, CASE
 REPORTS (3728)
 UV, 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 SKIN, MOUSE (3719)*
 REPLICATION
 DNA, MURINE LYMPHOMA (4035)
 ROUS SARCOMA VIRUS, INHIBITORS OF
 MITOCHONDRIAL FUNCTION, CHICK
 EMBRYO CULTURE (3771)
 RESISTANCE
 AUTOCHTHONOUS TUMORS, METHYL-
 CHOLANTHRENE-INDUCED, CELL-MEDIATED,
 RAT (3868)
 LS178Y MOUSE LEUKEMIA, METHOTREXATE
 (4168)*
 TUMOR DEVELOPMENT, FREUND'S ADJUVANT
 PRETREATMENT, NEOPLASM, MOUSE (3839)
 RESPIRATION
 BURKITT LYMPHOMA CELLS, MICRO-
 CARTESIAN DIVER TECHNIQUE (4133)*
 RESPIRATORY TRACT
 CARCINOMA, LYMPH NODE, METASTASIS
 DISTRIBUTION, HUMAN (4029)
 RETICULOSARCOMA
 AMYLOIDOSIS, SYNGENEIC CELL INOCULA-
 TION, MOUSE (4048)

STOMACH, EYE METASTASIS, CASE REPORT (4157)*
 TINORLASTOMA
 INCIDENCE, AFRICA (3983)*
 VERSION
 TRANSFORMED CELL, CHROMOSOMAL MECHANISM, HAMSTER CELL (4038)
 ABDOMYOSARCOMA
 HEART, CASE REPORT (4050)*
 HUMAN, REVIEW (3657)*
 METAL ION, SUBCELLULAR BINDING, RAT (3702)
 OF FLAVIN
 DEFICIENCY, EPITHELIAL NEOPLASIA, ARYL HYDROCARBON HYDROXYLASE, MOUSE (3668)
 OSOME
 BINDING, RNA, RAUSCHER LEUKEMIA VIRUS (3738)
 MEMBRANE-BOUND, PROTEIN SYNTHESIS, MYELOMA CELLS, MOUSE (4238)*
 AMYCIN
 MURINE LEUKEMIA VIRUS, RAUSCHER LEUKEMIA VIRUS, FOCUS-FORMATION, REVERSE TRANSCRIPTASE (3742)
 MURINE SARCOMA VIRUS, REVERSE TRANSCRIPTASE INHIBITION, LEUKEMIA (3782)
 RAUSCHER MURINE LEUKEMIA VIRUS, REVERSE TRANSCRIPTASE, DNA POLYMERASE, LEUKEMIA (3790)
 ADENOVIRUS TYPE 12 SPECIFIC, SYNTHESIS (3798)
 DETECTION IN MILK PARTICLES, HUMAN (3804)
 EHRICH ASCITES TUMOR, INHIBITION, MOUSE (4099)*
 HOMOLOGOUS, HUMAN BREAST CANCER, MOUSE MAMMARY TUMOR VIRUS (3774)
 MESSENGER
 CYTOPLASM, IMMUNOGLOBULIN SECRETING MYELOMA (4247)*
 INCREASED TRANSLATION EFFICIENCY, KREBS ASCITES CELL LYSATE, MOUSE RABBIT, HUMAN (4025)
 MYELOMA LIGHT CHAIN, PROPERTIES (3845)
 TRANSLATION, IMMUNOGLOBULIN, CELL-FREE SYSTEM, KREBS II ASCITES (4189)*
 METABOLISM, LEUKEMIC LEUKOCYTES, HUMAN (4194)*, (4198)*
 OLIGONUCLEOTIDE MODIFICATION, CIRCULAR DICHROISM, PROTON MAGNETIC
 RESONANCE, N-2-ACETYLAMINOFLUORENE (3705)
 RAUSCHER LEUKEMIA VIRUS, RIBOSOME BINDING (3738)
 RIBOSOMAL, MATURATION PATHWAY, FINGER-PRINTING, HELA CELL (4015)
 SYNTHESIS, HEMOCYTOBLASTOSIS, HUMAN DIPLOID CELLS (3760)
 SYNTHESIS OF DNA COMPLEMENTS, GENERAL APPROACH (3769)
 SYNTHESIS INHIBITION, CYTOTOXICITY, MALIGNANT MELANOMA, SERUM, HUMAN (3883)
 3'-TERMINAL NUCLEOSIDES, AVIAN MYELOBLASTOSIS VIRUS (3788)
 TRANSFER
 HYDROLASE ACTIVITY, HUMAN TUMORS, RAT TISSUES (3986)
 METHYLATION, KIDNEY TUMOR, RAT (4002)
 METHYLATION PATTERNS, ASCITES HEPATOMAS, MOUSE (4003)
 NOVIKOFF ASCITES HEPATOMA, SV40 TUMOR, HAMSTER (4083)*
 TRANSFER RNA METHYLASES, NOVIKOFF ASCITES HEPATOMA CELLS, RAT (4005)
 UPTAKE, NOVIKOFF HEPATOMA CELLS, IN VITRO (4070)*
 VIRAL SUBUNITS, MURINE SARCOMA VIRUS-SPECIFIC, TRANSFORMED CELLS, RAT, MOUSE, HAMSTER (3745)
 SALIVARY GLAND
 ADENOMA, MORPHOLOGY, HUMAN (4062)*
 TUMOR, INCIDENCE, MORPHOLOGY, CHILDREN (4096)*
 SARCOMA
 ALLOGENEIC, GROWTH, PHENOBARBITAL, RAT (4167)*
 ALVEOLAR SOFT PART, HISTOGENESIS, ULTRASTRUCTURE, HUMAN (3948)
 ANTIGENICITY ALTERATIONS, SPONTANEOUS PULMONARY METASTASES, MOUSE (3935)*
 CHROMATINS, LIVER PYRUVATE KINASE ISOENZYMES, RAT (4223)*
 EPITHELIOID, ULTRASTRUCTURE, HUMAN (3958)*
 FIBROSARCOMA, HUMAN, REVIEW (3637)*
 KAPOSI'S, EPIDEMIOLOGY, BANTU OF MOFAMBIQUE (3982)*
 LEIOMYOSARCOMA, HUMAN, REVIEW (3637)*
 LIPOSARCOMA, HUMAN, REVIEW (3637)*
 MALIGNANT FIBROUS HISTIOCYTOMA, SOFT TISSUES, HUMAN (4053)*
 METASTASES, ITERATED PASSAGING, RAT (4293)*

- OSTEOGENIC, HEAD AND NECK, RADIATION
THERAPY-INDUCED, CASE REPORTS
(3736)*
- RESPIRATION, GLYCOLYSIS, CARTESIAN,
DIVER TECHNIQUE (4073)*
- RHABDOMYOSARCOMA, HUMAN, REVIEW
(3657)*
- SPERMATIC CORD, HUMAN (4014)
- SPONTANEOUS OSTEOGENIC, MONKEY (4169)*
- SCALP
RETICULUM CELL SARCOMA, CELL KINETICS,
CASE REPORT (4234)*
- SCAR
CHRONIC ULCERATION, CANCER, HUMAN
(3953)*
- SCHISTOSOMA HEMATOBIIUM
INFECTION, BLADDER, EPITHELIAL
NEOPLASMS, MONKEY (3944)
- SCIRRHOMA
STOMACH, EXOGASTRIC DEVELOPMENT, HUMAN
(4160)*
- SENSITIVITY
BALB/3T3 CELLS, MURINE SARCOMA VIRUS,
MURINE LEUKEMIA VIRUS, INFECTION,
POLYCATIONS (3770)
- SERUM
ANTIBODY, EPSTEIN-BARR VIRUS, CANCER
PATIENT (3876)
- ANTI-THYMOCYTE, NORMAL, FRIEND DISEASE
VIRUS, MOUSE (3817)
- ASCITES TUMOR-INDUCED CHANGE, HAMSTER
(4016)
- CYTOTOXICITY, RNA SYNTHESIS INHIBITION
MALIGNANT MELANOMA, HUMAN (3883)
- LIPOPROTEINS, CANCER PATIENTS (4069)*
- PROTEIN FRACTIONS, LEUKEMIA, HUMAN
(3918)*
- PROTEIN RESPONSE, PREGNANCY, LEUKEMIA,
MOUSE (4046)
- PROTEINS, EHRlich ASCITES TUMOR, MOUSE
(4119)*
- SEX CHROMATIN
BREAST CANCER, AGE FACTOR, HUMAN
(4281)*
- CAROTID BODY TUMOR, CASE REPORT
(4230)*
- SHAY CHLORO-LEUKEMIC TUMOR
CELL ELECTRICAL POTENTIAL DIFFERENCE,
ION DISTRIBUTION (4186)*
- SILICA
LYMPHOMA INDUCTION, RAT (3651)
- SKIN
CANCER, ETIOLOGY, HUMAN (3952)*
- CHRONIC CICATRICAL ULCERATION, CANCER
POTENTIAL, HUMAN (3953)*
- CUTANEOUS CARCINOMA, YOUNG MEN, CASE
REPORT (4185)*
- CUTANEOUS PAPILLOMA, PAPOVA VIRUS,
OPOSSUM (3749)
- CUTANEOUS PRECANCER, CANCER, HUMAN,
REVIEW (3641)*
- 7,12-DIMETHYLBENZ(A)ANTHRACENE,
UV RADIATION, MOUSE (3719)*
- DNA SYNTHESIS, DIMETHYLBENZANTHRACENE,
TUMOR PROMOTER, MOUSE (3644)
- EPIDERMODYSPLASIA VERRUCIFORMIS,
PAPOVAVIRUSES, ONCOGENESIS (3793)
- MELANOMA, METASTASES TO THE STOMACH,
CASE REPORT (4265)*
- MULTIPLE LEIOMYOMA, MULTIPLE GLOMUS
TUMORS, BLUE RUBER-BLEB NEVUS
SYNDROME, GENETICS (4175)*
- MULTIPLE TUMOR, GENETICS, HUMAN
(4140)*
- TUMOR PROMOTION, PHOROL ESTER, MOUSE
(3680)
- TUMORIGENESIS
ARYL HYDROCARBON HYDROXYLASE,
INHIBITION, 7,8-BENZOFLAVONE
7,12-DIMETHYLBENZ(A)ANTHRACENE,
MOUSE (3678)
- RECONSTITUTED TOBACCO, TAR, MOUSE
(3684)
- TUMORIGENESIS INHIBITION, ANTIOXIDANT,
7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT
(3689)
- SKULL
GIANT CELL TUMORS, PATHOLOGY, HUMAN
(4290)*
- SPERMATIC CORD
SARCOMAS, HUMAN (4014)
- SPLEEN
CELL GRAFT, GRAFT-VERSUS-HOST REACTION
IMPAIRMENT, TUMOR, RAT (3855)
- CELL PROLIFERATION, ANTIBODY, EHRlich
TUMOR, MOUSE (3913)*
- IMMUNE RESPONSE DEPRESSION, 4-NITRO-
QUINOLINE 1-OXIDE, MOUSE (3679)
- LYMPHOMA, STEMLINE, EVOLUTION, A TYPE
PARTICLE, MOUSE (3941)
- MURINE MYELOID LEUKEMIA, COLONY, MOUSE
(4201)*
- STILBESTROL
ADENOCARCINOMA, VAGINA, HUMAN, REVIEW
(3610)
- STOMACH
CANCER
CHRONIC GASTRITIS, HUMAN (3949)
- IMMUNOREACTIVE GROWTH HORMONE,
HUMAN (3927)*

CARCINOMA, PATHOLOGY, HUMAN (4065)*
 GASTRIC CARCINOMA, INCIDENCE COAL
 MINING REGION (3974)
 GASTRIC MUCOSA, EPITHELIAL CELL DNA,
 ULCER, CANCER, HUMAN (3954)*
 MALIGNANT SCHWANNOMA, EXOGASTRIC
 DEVELOPMENT, HUMAN (4160)*
 MYOID TUMOR, CASE REPORT (4162)*
 TUMOR, METHYLCHOLANTHRENE-INDUCED,
 FACTORS DETERMINING TUMOR SITES, RAT
 (3661)
 TUMORIGENESIS INHIBITION, ANTIOXIDANT,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 MOUSE (3689)

STIS
 OCCULT SEMINOMA, CASE REPORTS (4085)*

ROAT
 CARCINOMA, THERAPEUTIC RADIATION, CASE
 REPORTS (3728)

YOMA
 SPINDLE-CELL, EPITHELIAL NATURE,
 ULTRASTRUCTURE, CASE REPORT (3959)*

YMS
 BONE MARROW CELL, CYTOTOXICITY,
 ALLOGRAFT IMMUNITY, LYMPHOMA, MOUSE
 (3873)
 DERIVED CELL, HELPER ACTIVITY
 SUPPRESSION, EHRlich ASCITES TUMOR,
 MOUSE (3863)
 MAMMARY TUMOR, DEVELOPMENT, MOUSE
 (4037)
 THYMIC GRAFTS, LYMPHOMAGENIC VIRUS,
 MORPHOLOGY, MOUSE (3751)

ROID
 ADENOMA, METASTASIS TO THE LUNG, CASE
 REPORT (4288)*
 CARCINOGENESIS, 131-IODINE, METHYL-
 THIOURACIL, HAMSTER (3735)*
 CARCINOMA, ETIOLOGY, CHILDREN (4045)
 MEDULLARY CARCINOMA, HISTOLOGY, CASE
 REPORT (4142)*
 SCLEROSING CARCINOMA, ULTRASTRUCTURE,
 CASE REPORTS (4227)*

SUE
 INTERACTIONS, MORPHOGENESIS, MORPHO-
 STASIS, CARCINOGENESIS (3945)

ACCO
 FRACTIONS, TUMOR PROMOTION, MOUSE SKIN
 (3687)
 LIVER TUMORS, HAMSTER (3722)*
 SMOKE, TUMOR ACCELERATOR, TUMOR
 PROMOTER, CARCINOGEN, REVIEW (3604)
 SMOKING, LUNG CANCER, SURVIVAL, HUMAN
 (3693)
 SUGAR CONTENT, PH OF SMOKE, LUNG

CANCER (3645)
 TAR, TUMORIGENICITY, RECONSTITUTED
 TOBACCO SHEET, MOUSE SKIN (3684)

TOXICOLOGY
 ORGANIC POLYMER, BIOCOMPATIBILITY,
 REVIEW (3642)*

TRACE ELEMENT
 NEOPLASTIC GROWTH, INHIBITION, REVIEW
 (3648)

TRACHEA
 SQUAMOUS METAPLASIA, BENZO(A)PYRENE,
 VITAMIN A, HAMSTER (3685)

TRANSFORMATION
 ADENOVIRUS TYPE 3, HAMSTER EMBRYO
 (3811)
 CHROMATIN TRANSCRIPTION, DNA
 REPRESSION AND DEREPRESSION,
 WALKER'S CARCINOMA (4090)*
 CHROMOSOMAL ABERRATION, N-METHYL-N'-
 NITRO-N-NITROSOGUANIDINE, HAMSTER,
 CELL (3677)
 DNA, 4-HYDROXYAMINOQUINOLINE-1-OXIDE,
 DIFFERENTIAL INACTIVATION, BACILLUS
 SUBTILIS (3666)
 GLUCOSAMINE TO GLYCOGEN AND LACTATE,
 ASCITES TUMOR CELLS, RAT, MOUSE
 (4012)
 INHIBITORS OF MITOCHONDRIAL FUNCTION,
 CHICK EMBRYO CULTURE (3771)
 KIRSTEN MOUSE SARCOMA VIRUS, GUINEA
 PIG EMBRYO CELLS (3756)
 LEUKEMIA-LIKE VIRUS, HUMAN DIPLOID
 CELLS (3760)
 LEUKOCYTES, HUMAN (3843)
 LYMPHOCYTE, LEUKEMIA, ANTILYMPHOCYTE
 SERA EFFECT, ANTIPARABLAST SERA
 EFFECT, CHILDREN (3847)
 MALIGNANT CELL, SURFACE MEMBRANE
 CHANGES, HAMSTER (3938)
 MAMMALIAN CELLS, N-ACETOXY-N-2-
 FLUORENYLACETAMIDE (3646)
 MURINE SARCOMA VIRUS, RAT (3772)
 NEOPLASTIC, LIVER EPITHELIAL CELLS,
 NUTRITIONAL STRESS, RAT (3936)
 PROSTATE CELL, ANTIGEN, MOUSE (3881)
 REVERSION, CHROMOSOMAL MECHANISM,
 HAMSTER CELL (4038)
 REVERTANT CELL VARIANT, RE-REVERSION,
 CHROMOSOME NUMBER, POLYOMA VIRUS,
 HAMSTER CELL (3683)
 ROUS SARCOMA VIRUS
 DNA SYNTHESIS INHIBITION, ARABINO-
 FURANOSYL ADENINE, RAT (3754)
 GENOME INTEGRATION, CHICKEN CELLS
 (3813)

- VIRUS INDUCTION, HAMSTER (3801)
 SMOG EXTRACT, AKA LEUKEMIA VIRUS,
 MOUSE (3703)
 SPONTANEOUS, VIRUS ANTIGENS, RAT
 (3902)
 TRANSHYDROGENASE
 CELL ACTIVITY, HEPATOMA, RAT (3997)
 TRANSPLACENTAL CARCINOGENESIS
 CHEMICAL, HUMAN, REVIEW (3630)*
 TRANSPLANTABILITY
 MAMMARY CARCINOMA CELL, SUBLINE,
 IMMUNOSUSCEPTIBILITY, MOUSE (3851)
 TRANSPLANTATION
 CANCER TISSUE, XENOPUS LAEVIS (3934)*
 ENHANCEMENT, TUMOR ELUATE,
 IGG2 IMMUNOGLOBULIN, MOUSE (3862)
 IMMUNITY ENHANCEMENT, MYCOBACTERIUM
 TUBERICUM, MOUSE (3904)
 KIDNEY, EPSTEIN-BARR VIRUS ANTIBODY,
 HUMAN (3884)
 MELANOMA, TUMOR GROWTH, HAMSTER
 (4179)*
 MORRIS HEPATOMA, ERYTHROCYTIC
 GLYCOLYSIS, RAT (4126)*
 PHOSPHORUS COMPOUNDS, RAT (4128)*
 NERVE TUMOR, ENZYME HISTOCHEMISTRY,
 RAT (4102)*
 7,12-DIMETHYLBENZ(A)ANTHRACENE
 INDUCED-LEUKEMIA, BONE MARROW CHANGES,
 RAT (3691)
 TROPHOBLASTIC TUMOR
 MALIGNANT, HYDATIDIFORM MOLE,
 EPIDEMIOLOGIC ASPECTS, WOMEN, ISRAEL
 (3972)
 TUMOR
 ASCITES, SERUM CHANGE, HAMSTER (4016)
 BONE, FIBROUS DYSPLASIA, HUMAN (4300)*
 CARCINOID, ORGAN DISTRIBUTION, WIENNA
 (4150)*
 CELL, DIFFERENTIATION, GROWTH, MOUSE
 (4272)*
 CELL MORPHOLOGY, INTERFERENCE FROM
 PLANT CELLS, MISDIAGNOSIS (4240)*
 CHONDROBLASTOMA, PATHOLOGY, HUMAN
 (4093)*
 CYTOPLASMIC FACTOR, MITOCHONDRIAL DNA
 SYNTHESIS, STIMULATION, RAT (4022)
 EHRLICH, SERUM PROTEINS, MOUSE (3915)*
 FIBROUS HISTIOCYTOMA, HISTOLOGY, HUMAN
 (4058)*
 GIANT CELL, EXTRASKELETAL, PATHOLOGY,
 HUMAN (4219)*
 GRAWITZ, METASTASES TO HAND FINGERS
 CASE REPORT (4252)*
 GROWTH, ASCITES CARCINOMA, BONE
 DETRIORATION, MOUSE (4103)*
 GUERIN T8 ASCITES, EXTENDED PASSAGES
 IN VITRO, CYTOGENETICS (4164)*
 HAMSTER CHEEK POUCH, CYTOLOGY (4141)*
 HISTONE ELECTROPHORESIS, CELL
 REPLICATION RATE, PHOSPHORYLATION
 (4087)*
 INTRACRANIAL, FIBRINOLYSIS, HUMAN
 (4113)*
 KARYOTYPE, 7,12-DIMETHYLBENZ(A)ANTHRA-
 CENE, ROUS SARCOMA, HAMSTER (4191)*
 KIDNEY, ANTIGENS, HUMANS (3924)*
 LIVER, CASE REPORT (4159)*
 LUNG, SCINTISCANNING, HUMAN (4255)*
 MAMMARY CARCINOMA, REGRESSION,
 DIMETHYLBENZANTHRACENE, NURSING
 PERIOD, RAT (3655)
 MEDIASTINUM, PATHOLOGICAL ANATOMY,
 HUMAN (4284)*
 MORRIS HEPATOMA
 AMINO ACID TRANSPORT, TYROSINE
 AMINOTRANSFERASE, RAT (4271)*
 CYCLIC AMP, RAT (4178)*
 MYOID, STOMACH, CASE REPORT (4162)*
 PREPUTIAL GLAND, MICROSOMAL ENZYMES,
 CHOLESTEROL ACYLATION, MOUSE (4237)*
 SHAY CHLOROBLASTEMIC, CELLULAR ION
 DISTRIBUTION, POTENTIAL DIFFERENCE
 (4186)*
 TISSUE, IMMUNOLOGY, MOUSE (3931)*
 TOOTH BEARING REGIONS, MORPHOLOGY,
 FISH, MAMMALS (4291)*
 TUMOR CELL
 INOCULATION, LYMPHOCYTE DEPLETION,
 MOUSE (3859)
 TUMOR PROMOTION
 SKIN, PHORBOL ESTER, MOUSE (3680)
 TOBACCO, FRACTION, MOUSE SKIN (3687)
 TWEEN-60, CROTON OIL, DIMETHYLBENZ-
 ANTHRACENE, EPITHELIUM, DNA
 SYNTHESIS, MOUSE (3644)
 TUMORIGENICITY
 AGGLUTINABILITY, CONCAVALIN A,
 HAMSTER CELLS, CELL HYBRIDS (3694)
 TWEEN-60
 TUMOR PROMOTION, EPITHELIUM, DNA
 SYNTHESIS, MOUSE (3644)
 ULTRASTRUCTURE
 BURKITT'S LYMPHOMA, CYTOLOGY, CASE
 REPORT (4207)*
 CARCINOMA
 SALIVARY DUCT, HUMAN (4129)*
 VAGINA, PATHOLOGY, HUMAN (4225)*
 CHONDROBLASTOMA, HISTOCHEMISTRY, CASE
 REPORT (4216)*

CYTOCHEMISTRY, IMMATURE CELL
 LEUKEMIAS, CLASSIFICATION (4153)*
 ENDOMETRIUM, ENDOMETRIAL ADENO-
 CARCINOMA, HUMAN (4233)*
 ENDOMETRIUM GLANDULAR CELLS, CARCINOMA
 HUMAN (4245)*
 EPITHELIAL ODONTOGENIC TUMOR, HISTO-
 CHEMISTRY, CASE REPORT (4100)*
 EWING'S SARCOMA, BONE, CASE REPORTS
 (4299)*
 GONADOBLASTOMA, HISTOCHEMISTRY, HUMAN
 (4077)*
 LUNG ADENOCARCINOMA, TRANSMISSION AND
 SCANNING ELECTRON MICROSCOPY, HUMAN
 (4218)*
 MALIGNANT MELANOMA, CHOROID, CASE
 REPORT (4154)*
 MAMMARY GLAND TUMOR, HUMAN (4146)*
 SCLEROSING CARCINOMA, THYROID, CASE
 REPORTS (4227)*
 TUBULAR CARCINOMA, BREAST, HUMAN
 (4054)*
 TUMOR CELL DIFFERENTIATION, GROWTH,
 MOUSE (4272)*
 ER
 CARCINOMA, HISTOLOGY, CASE REPORT
 (4104)*
 HAN
 IMMUNOSUPPRESSION, RAT (3921)*
 HRA
 EXCRETO-URINARY CANCERS, HUMAN, REVIEW
 (3613)
 ARY TRACT
 CARCINOMA
 ANALGESIC ABUSE, HUMAN (3718)*
 BILHARZIASIS, HUMAN (4057)*
 IRE CANCER
 URINARY ESTROGENS, ADRENAL CORTEX AND
 THYROID FUNCTION, LIVER FUNCTION
 TESTS, WOMEN (3663)
 US
 BILATERAL BRENNER TUMOR, HISTOPATH-
 OLOGY, CASE REPORT (4131)*
 CARCINOMA, BLOOD AND URINE MICRO-
 ELEMENTS, HUMAN (4109)*
 CERVIX CARCINOMA, GLYCOGEN HISTO-
 CHEMISTRY, HUMAN (4078)*
 LEIOMYOSARCOMA, HISTOLOGY, PATHOLOGY,
 HUMAN (4220)*
 OVARIAN FUNCTION, PRECANCEROUS
 CONDITIONS, HUMAN (3951)*
 TUMOR, HEXOKINASE ISOZYMES, HUMAN
 (4095)*
 CANCER, ETIOLOGY, REVIEW (3629)*

CANCER IN SITU, EPIDEMIOLOGY, CUBA
 (3979)*
 CARCINOMA
 METASTASIS, HUMAN (4127)*
 STROMAL INVASION, PATHOLOGY
 (4249)*
 MELANOMA, IMMUNOLOGY, CASE REPORT,
 REVIEW (3914)*
 VACCINATION
 YELLOW FEVER, CANCER RISK, AVIAN
 LEUKOSIS VIRUS, HUMAN (3740)
 VAGINA
 CLEAR CELL CARCINOMA, ULTRASTRUCTURE,
 PATHOLOGY, HUMAN (4225)*
 VIROLOGY
 BREAST CANCER VIRUS, MORPHOLOGIC
 DEVELOPMENT, TRANSMISSION MECHANISM,
 REVIEW (3632)*
 VIRUS
 A-TYPE PARTICLE, SPLEMIC LYMPHOMA,
 STEMLINE EVOLUTION, MOUSE (3941)
 ADENO MUTANTS, RECOMBINATION, HAMSTER
 CELL (3820)
 ADENOVIRUS
 CANCER, ETIOLOGY, HUMAN, REVIEW
 (3602)
 INFECTION, SURFACE MEMBRANE CHANGE
 HUMAN (3748)
 TYPE 2, INHIBITION OF FORMATION,
 CAMPTOTHECIN (3739)
 TYPE 2 AND 4
 INTERFERENCE WITH ADENOVIRUS
 TYPE 12, KIDNEY CELLS, GUINEA
 PIG (3826)*
 TYPE 3
 TRANSFORMATION, HAMSTER EMBRYO
 (3811)
 TYPE 7
 HELA CELL LYSOSOME (3828)*
 TYPE 12
 INFECTION, BHK 21 CELLS (3798)
 ULTRASTRUCTURE, SOUTH AMERICAN
 MONKEYS (3832)*
 AKR LEUKEMIA
 SMOG EXTRACT, TRANSFORMATION,
 MOUSE (3703)
 AVIAN
 MURINE, REVERSE TRANSCRIPTASE
 INHIBITION, ANTISERUM (3867)
 AVIAN LEUKOSIS
 MAREK'S DISEASE HERPESVIRUS,
 INTERACTIONS, TISSUE CULTURE
 (3762)
 YELLOW FEVER VACCINATION, CANCER
 RISK, HUMAN (3740)

- AVIAN MYELOBLASTOSIS
DNA SYNTHESIS STIMULATION, CHICKEN
FIBROBLASTS (3777)
RNA, 3'-TERMINAL NUCLEOSIDES
(3788)
- BREAST CANCER
MORPHOLOGIC DEVELOPMENT, TRANS-
MISSION MECHANISMS, REVIEW
(3632)*
- C-TYPE
ANTIGENIC REACTIONS, GROUP-
SPECIFIC, INTERSPECIES SPECIFIC,
IMMUNOGLOBULINS (3875)
BUDDING, ULTRASTRUCTURE (3783)
CYTOPATHOLOGY, RAT EMBRYO, CELLS
(3800)
GROUP-SPECIFIC ANTIGEN, 3-METHYL-
CHOLANTHRENE TUMOR INDUCTION,
MOUSE (3848)
SPONTANEOUS TRANSFORMATION, BRAIN
CELL, HUMAN (3750)
DNA, POLYOMA, REPLICATION, MOUSE
EMBRYO (3827)*
DNA SYNTHESIS, ADENOVIRUS-INFECTED
KB CELLS (3819)
EPSTEIN-BARR
ANTIBODY, KIDNEY TRANSPLANT, HUMAN
(3864)
ANTIBODY LEVELS, INCIDENCE,
CHILDREN, UGANDA (3744)
BURKITT LYMPHOMA, LEUKEMIA, CELL
LINE ESTABLISHMENT (4032)
INFECTION, DNA SYNTHESIS, FRAGMENT-
ATION, RAJI CELLS (3792)
RAUSCHER MURINE LEUKEMIA, DUAL
INFECTION, LYMPHOBLAST, HUMAN
(3773)
SERUM ANTIBODY, CANCER PATIENT
(3876)
SERUM ANTIBODY, LYMPHOCYTIC
LYMPHOMA, HUMAN (3814)
- VIRUS - CONTINUED
FELINE LEUKEMIA
BUDDING, ULTRASTRUCTURE (3763)
HEMATOPOIETIC TUMOR, LYMPHOSARCOMA
CAT (3805)
PSEUDOTYPE, MURINE SARCOMA,
FOCUS-FORMATION, KIDNEY CELL
LINE, CAT (3758)
FRIEND DISEASE
ANTITHYMOCYTE SERUM, NORMAL SERUM,
MOUSE (3817)
GROSS
LEUKEMIA, DNA SYNTHESIS, IMMUNOL-
OGY, MOUSE (3919)*
- LYMPHOMA, SURFACE ANTIGEN, ANTI-
BODY BINDING, RAT (3803)
RAUSCHER, LEUKEMIA CELLS, CELL
SURFACE ANTIGENS, MOUSE, RAT
(3880)
- HERPES
FLUORESCENT ANTIBODY, IDENTIFICA-
TION, PRIMATE (3757)
SPECIES SPECIFICITY, OWL, MONKEY
(3781)
- HERPES HOMINIS
ADENOVIRUS, CERVICAL CARCINOMA,
ANTIBODY, INCIDENCE, HUMAN
(3864)
CERVIX, INFECTED CELL, ULTRA-
STRUCTURE, HUMAN (3815)
- HERPES-LIKE
ISOLATION, LYMPHOSARCOMA, COW
(3737)
STIMIAN, OCCUPATIONAL HAZARD,
REVIEW (3605)
- HERPES SAIMIRI
ANTIGEN, INFECTED LYMPHOCYTE,
MARMOSSET (3806)
- HERPES SIMPLEX
CHROMOSOME, HEMATOPOIETIC CELL,
HUMAN (3812)
GROWTH, LYMPHOID CELLS, HUMAN
(3746)
INFECTIONS, HEMATOLOGIC MALIGNAN-
CIES, HUMAN (3786)
INTERFERON INDUCTION (3753)
VIRAL PROTEINS, PLASMA MEMBRANE
(3821)
- HERPESVIRUS
RECOVERY, CHARACTERIZATION,
INFECTED, SPIDER, MONKEY (3823)*
SEROLOGICAL RELATIONSHIPS, MAREK'S
DISEASE VIRUS, PSEUDORABIES
VIRUS, IMMUNOFLOUORESCENCE
(3761)
SPIDER, MONKEY (3822)*
ULTRASTRUCTURE, SOUTH AMERICAN
MONKEYS (3832)*
- VIRUS - CONTINUED
INDUCED THYMIC LYMPHOMA, ALKALINE
PHOSPHATASE ACTIVITY, MOUSE (3775)
INFECTION, SEROLOGIC EVIDENCE,
SOUTH AMERICAN MONKEYS (3825)*
KIRSTEN MURINE SARCOMA, TRANSFORMATION
GUINEA PIG EMBRYO CELLS (3756)
LEUKEMIA, H-2 ANTIGENS, MOUSE (3870)
LYMPHOMAGENIC, THYMIC GRAFTS,
MORPHOLOGY, MOUSE (3751)
MAMMARY TUMOR

- CIRCULATING ANTIBODY, IMMUNOSUPPRESSION, MOUSE (3857)
 MURINE LEUKEMIA, MAMMARY TUMOR, ANTIGENS, MOUSE (3784)
 MAREK'S DISEASE HERPESVIRUS, AVIAN LEUKOSIS VIRUS, INTERACTIONS, TISSUE CULTURE (3762)
 MOLONEY SARCOMA
 IMMUNE LYMPHOCYTE, CONCENTRATION, CYTOTOXICITY, RAT, ANTISERUM (3869)
 STRESS, IMMUNOLOGY, MOUSE (3920)*
 MOUSE MAMMARY TUMOR, RNA-DIRECTED DNA POLYMERASE, MOUSE (3803)
 MURINE LEUKEMIA
 BUDDING, ULTRASTRUCTURE (3783)
 RAUSCHER LEUKEMIA, RIFAMYCIN, FOCUS-FORMATION, REVERSE TRANSCRIPTASE (3742)
 SPONTANEOUS INFECTION, ANTIBODY RESPONSE, MOUSE (3852)
 MURINE LEUKOSIS, TISSUE CULTURE, HELA CELL, L CELL (3807)
 MURINE SARCOMA
 FOCUS-FORMING INDUCTION, 5-BROMO-DEOXYURIDINE (3665)
 GENOME, TUMOR CELL, CYTOLOGY, HAMSTER (3785)
 HARVEY, TRANSFORMATION, RAT (3772)
 NONPRODUCER TRANSFORMED CELL, TRANSPLANTATION ANTIGEN, MOUSE (3808)
 REVERSE TRANSCRIPTASE INHIBITION, RIFAMYCIN (3782)
 TUMOR INDUCTION, POLYRIBOINOSINIC-POLYRIBOCYTYDYLIC ACID, MOUSE (3764)
 VIRUS-SPECIFIC RNA, TRANSFORMED CELLS, RAT, MOUSE, HAMSTER (3745)
 US - CONTINUED
 ONCOGENIC
 CANCER, HUMAN, REVIEW (3643)*
 ONCOGENIC RIBOVIRUSES, PRESENCE OF DNA, CHICKEN, MOUSE (3794)
 ONCOGENIC THEORIES, REVIEW (3615)
 PAPOVA
 EPIDERMODYSPLASIA VERRUCIFORMIS, ONCOGENESIS (3793)
 TUMOR, FETAL ANTIGEN, MOUSE (3835)
 PAPOVAVIRUS, ULTRASTRUCTURE, SOUTH AMERICAN MONKEYS (3832)*
 PARAMYXOVIRUS, ULTRASTRUCTURE, SOUTH AMERICAN MONKEYS (3832)*
 PLAQUE CHARACTERIZATION, SOUTH AMERICAN NONHUMAN PRIMATES (3824)*
 POLYOMA
 POLYNUCLEOTIDE LIGASE, MOUSE CELL (3818)
 RAUSCHER, PYRAN COPOLYMER, TUMORIGENESIS INHIBITION, IMMUNOSUPPRESSION, MOUSE (3686)
 TUMOR CELL, TUMOR-SPECIFIC ANTIGEN, MOUSE (3871)
 RADIATION LEUKEMIA
 ALKALINE PHOSPHATASE ACTIVITY, MOUSE (3775)
 RAUSCHER LEUKEMIA
 RNA, RIBOSOME BINDING (3738)
 RAUSCHER MURINE LEUKEMIA
 CHEMICAL CARCINOGENESIS, TRANSFORMATION, RAT (3713)
 CHROMOSOME, V-CELL, MOUSE (3779)
 EPSTEIN-BARR, DUAL INFECTION, LYMPHOGLAST, HUMAN (3773)
 FOCUS-FORMATION, REVERSE TRANSCRIPTASE, RIFAMYCIN (3742)
 REVERSE TRANSCRIPTASE, RIFAMYCIN (3790)
 RNA TUMOR, POLY A CONTENT (3802)
 VIRUS - CONTINUED
 ROUS SARCOMA
 BRYAN STRAIN, PROTEINS (3743)
 CARR-ZILBER STRAIN, MOUSE (3833)*
 INDUCED TUMORS, HAMSTER (3831)*
 RNA DEPENDENT DNA POLYMERASE, MITOCHONDRIA, TUMOR, CHICKEN (3810)
 TRANSFORMATION, DNA SYNTHESIS INHIBITION, ARABINOFURANOSYL ADENINE, RAT (3754)
 TRANSFORMATION, GENOME INTEGRATION, CHICKEN CELLS (3813)
 TRANSFORMED CELL, VIRUS INDUCTION, HAMSTER (3801)
 SV40
 CAPSID PROTEIN I SYNTHESIS, REPLICATION (3768)
 DELAYED HYPERSENSITIVITY, MOUSE (3882)
 DEOXYNUCLEOPROTEIN COMPLEX (3609)
 DNA, REPLICATION, INITIATION POINT (3776)
 DNA, STRAIN DIFFERENCE (3741)
 IMMUNIZATION, ROUTE OF INOCULATION, HAMSTER (3886)
 NOVIKOFF ASCITES HEPATOMA, ASPARTYL-TRNA (4083)*
 RELATED PAPOVAVIRUS, INFECTION,

HUMAN, REVIEW (3812)
 RESISTANT CELL LINE (3752)
 TRANSFORMATION, HOST CELL ROLE,
 HAMSTER (3830)*
 TRANSFORMED CELL, SUPERINFECTION,
 MONKEY (3755)
 TYPE C
 LYMPHOMA, MOUSE (3789)
 VIRAL DNA, HOST DNA, HOMOLOGY, MONKEY,
 MONKEY CELL (3816)
 VIRAL DNA GENOMES, MAMMALIAN CELL
 ORGANIZATION, CARCINOGENESIS
 MECHANISMS, REVIEW (3811)
 VITAMIN A
 DEFICIENCY, SQUAMOUS METAPLASIA,
 TRACHEA, HAMSTER (3885)
 FIBROSARCOMA, RADIATION RESPONSE,
 IMMUNE RESPONSE, MOUSE (3730)
 VITAMIN B2
 DEFICIENCY, EPITHELIAL NEOPLASIA, ARYL
 HYDROCARBON HYDROXYLASE, MOUSE
 (3668)
 VITAMIN B12
 9,10-DIMETHYL-1,2-BENZANTHRACENE,
 MAMMARY GLAND TUMOR, RAT (3667)
 VULVA
 CARCINOMA, LEUKOPLAKIA, CLINICAL STUDY
 REVIEW (4170)*
 GRANULAR CELL TUMOR, HISTOGENESIS,
 ULTRASTRUCTURE, REVIEW (3626)*
 MALIGNANCY, CONDYLOMA ACUMINATUM,
 PAGET'S DISEASE, CARCINOMA,
 MALIGNANT MELANOMA, CHROMOSOME,
 HUMAN (3940)
 WALKER'S CARCINOMA
 CHROMATIN TRANSCRIPTION, DNA
 REPRESSION, TRANSFORMATION PROCESS
 (4090)*
 CYTOGENETICS, METASTASES, RAT (4110)*
 HEPATOMA, 1-CARBON GROUP METABOLISM,
 RAT (4210)*
 WART
 CUTANEOUS PAPILLOMAS, POPOVA VIRUS,
 OPSOUM (3749)
 WILM'S TUMOR
 CIRCULATING MUCIN, PATHOLOGY, CHILDREN
 (4228)*
 NEUROBLASTOMA, CELL POPULATION
 KINETICS, HUMAN (4221)*
 RENAL TRANSPLANT, IMMUNOSUPPRESSION,
 HUMAN (4276)*
 WOUND
 CICATRIZATION, CANCER, RAT (4149)*

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Editor

Robert Love, M.D.
Jefferson Medical College, Philadelphia

Associate Editor

George P. Studzinski, M.D.
Jefferson Medical College, Philadelphia

NCI Staff Consultants

Elizabeth Weisburger, Ph.D.

Sidney Siegel, Ph.D.

Louis P. Greenburg, M.S.

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PREFACE

Carcinogenesis Abstracts is a publication of the National Cancer Institute. The journal serves as a vehicle through which current documentation of carcinogenesis research highlights are compiled, condensed, and disseminated on a regular basis. It represents an integral part of the Institute's program of fostering and supporting coordinated research into cancer etiology. Issues of *Carcinogenesis Abstracts* normally contain three-hundred-fifty abstracts and three-hundred-fifty citations (unaccompanied by corresponding abstracts). Abstracts and citations refer to the current scientific literature that describes the most significant carcinogenesis research carried on at the National Cancer Institute, other governmental agencies, and private institutions. *Carcinogenesis Abstracts* is intended to be a highly useful current awareness tool for scientists engaged in carcinogenesis research or related areas. The great number and diversity of publications relevant to carcinogenesis make imperative the availability of this service to investigators whose work requires that they keep abreast with current developments in the field.

Carcinogenesis Abstracts is normally published monthly. Volume X covers the scientific literature published from July 1971 through Dec 1972. A cumulative subject and author index for Volume X will be published shortly after the final regular issue. This journal is available free of charge to libraries and to individuals who have a professional interest in carcinogenesis. Requests for *Carcinogenesis Abstracts* from qualified individuals should include statements of their relationship to carcinogenesis research. All correspondence should be addressed as follows.

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NOTE

Journal names are abbreviated according to the list of abbreviations used by *Index Medicus*. For journals not covered by *Index Medicus*, the abbreviations (with some modifications) found in *World Medical Periodicals*, 3rd Edition, are used.

LANGUAGE ABBREVIATIONS

Afr.	Afrikaans	It.	Italian
Ar.	Arabic	Jap.	Japanese
Bul.	Bulgarian	Kor.	Korean
Ch.	Chinese	Latv.	Latvian
Cz.	Czech	Lith.	Lithuanian
Dan.	Danish	Nor.	Norwegian
Dut.	Dutch	Pol.	Polish
E.	English	Por.	Portuguese
Eston.	Estonian	Rum.	Rumanian
Fin.	Finnish	Rus.	Russian
Fl.	Flemish	Ser.	Serbo-Croatian
Fr.	French	Sl.	Slovak
Ger.	German	Sp.	Spanish
Gr.	Greek	Sw.	Swedish
Heb.	Hebrew	Th.	Thai
Hun.	Hungarian	Turk.	Turkish
Ic.	Icelandic	Uk.	Ukrainian
In.	Indonesian	Viet.	Vietnamese

ABBREVIATIONS USED IN ABSTRACTS

adrenocorticotrophic hormone	mg	milligram(s)
adenosine diphosphate	min	minute(s)
adenosine monophosphate	ml	milliliter(s)
adenosine triphosphate	mm	millimeter(s)
degrees centigrade	MTD	maximum tolerated dose
centimeter(s)	ng	nanogram (10^{-9})
central nervous system	pg	picogram (10^{-12})
counts per minute	p.o.	orally
deoxyribonucleic acid	ppm	parts per million
for example	r	Roentgen
gram(s)	RBC	red blood cells (erythrocytes), red blood count
microgram(s)	resp.	respectively
hour(s)	Rev.	review (only in citations)
intramuscular	RNA	ribonucleic acid
intraperitoneal	s.c.	subcutaneous
international unit(s)	sec	second(s)
intravenous	U	unit(s)
kilogram(s)	UV	ultraviolet
median lethal dose(s)	WBC	white blood cells (leukocytes), white blood count
meter(s)	wk	week(s)
molar	wt	weight
milliequivalent(s)	yr	year(s)
millimolar		
micromolar		
milli-,microcurie(s)		

CONTENTS

	Cross Reference Abbreviations	Abstracts Citations	Page
REVIEW.....	(Rev).....	4301-4360	695
CHEMICAL CARCINOGENESIS.....	(Chem).....	4361-4488	702
PHYSICAL CARCINOGENESIS.....	(Phys).....	4489-4501	726
VIRAL CARCINOGENESIS.....	(Viral).....	4502-4610	728
IMMUNOLOGY.....	(Immun).....	4611-4779	748
PATHOGENESIS.....	(Path).....	4780-4806	775
EPIDEMIOLOGY AND BIOMETRY.....	(Epid-Biom).....	4807-4839	779
MISCELLANEOUS.....	(Misc).....	4840-5000	784
AUTHOR INDEX.....			1
SUBJECT INDEX.....			xx



001 TRENDS IN LUNG CANCER: MORTALITY, INCIDENCE, DIAGNOSIS, TREATMENT, SMOKING, AND URBANIZATION. (E.) Schneiderman, M. A. (Nat'l. Cancer Inst., Bethesda, Md.) and D. L. Levin. *Cancer* 30(5):1320-1325, 1972.

International trends in male lung cancer mortality rates have been rising but are beginning to level off. In the U.S., rates for men follow international trends; rates for women are increasing at a greater than exponential pace and far more rapidly than for men. Rates for nonwhites are rising faster than for whites. The trends in smoking (as a measure of personal air pollution)-increasing for women, decreasing for men- and urbanization (as an indirect measure of nonpersonal air pollution)-higher for non-whites than for whites-are correlated with cancer trends. There is evidence that several lung cancer hazards operating together multiply the risks. Patterns in diagnosis and survival are discussed, and recommendations are made for future study and action to reduce lung cancer mortality. (14 references)

002 THE ENDOGENOUS FORMATION OF CARCINOGENIC N-NITROSO COMPOUNDS: IS THIS A POSSIBLE CAUSE OF HUMAN TUMORS? (Ger.) Osske, G. (Med. Acad. Erfurt, East Germany). *Arch Geschwulstforsch* 18(1):62-69, 1972.

in vitro and *in vivo* investigations of the endogenous formation of cancerogenic N-nitroso derivatives are summarized. The formation of these compounds is easily obtained from secondary amines, N-alkyl-N-arylamides in an acid medium following the addition of nitrogenated substances. It is suggested that such compounds may be formed in the intragastric medium. Among the nitrogenated substances, nitrates are the most important. In many countries these are found in food additives. Secondary amines may be present in human food, fermentation, alcohol and in tobacco. The experimental induction of malignant tumors in animals is reviewed. For prophylactic measures with respect to tumor formation in the intragastric region, it is recommended that the nitrogenated substances or the secondary amines be deleted from the diet. (36 references)

003 CURRENT OPINIONS ON THE ASBESTOS CANCER PROBLEM. (E.) Wagner, J. C. (Llandough Hosp., Penarth, Wales). *Ann Occup Hyg* 15:61-64, 1972.

Epidemiological data on the association of asbestos and cancer are reviewed. Excessive lung cancer incidence has been reported among asbestos miners in Australia, Rhodesia, Italy, Finland, and the Soviet Union. Excess lung cancer incidence has also been reported among asbestos-exposed insulation workers in New York and shipyard workers in Britain, Germany and Holland. Studies of the aerodynamics of various types of asbestos particles indicate that chrysotile fibers are unlikely to reach the pleura when inhaled;

this may explain the small mesothelioma risk attending chrysotile exposure. The different structure of crocidolite, the fiber which is associated with excess mesothelioma incidence, makes it more likely that these particles will be deposited in the pleura after inhalation. (22 references)

4304 EXTRAPOLATION OF EXPERIMENTAL CARCINOGENICITY TO THE REALITY OF INDUSTRIAL EXPOSURE.

(E.) Munn, A. (Imp. Chem. Ind. Ltd., Manchester, England). *Ann Occup Hyg* 15:75-79, 1972.

The relevance of experimental animal studies of chemical carcinogens for occupational safety is discussed. It is stressed that animal studies, in which large doses of chemicals are deliberately introduced by artificial routes, do not duplicate human industrial chemical exposures. At certain small dose levels, even potent carcinogens may not produce tumors; consequently, the finding that an agent is carcinogenic for animals at large doses does not mean it presents a danger for exposed humans. Moreover, a chemical compound (excluding skin carcinogen) cannot exert a carcinogenic effect until it is absorbed into the body. Thus, in assessing the supposed carcinogenic hazard of a chemical compound, as opposed to its actual carcinogenicity, factors influencing ease of absorption into the body must be considered. For example, chemicals which are carcinogenic by injection do not necessarily present a hazard for workers who are not exposed to them in that way. (13 references)

4305 ONCORNAVIRUSES AND THEIR PROVIRUSES. (E.) Bentvelzen, P. (Netherlands Cancer Inst., Amsterdam) and J. H. Daams. *Rev Europ Etud Clin Biol* 17(3):245-248, 1972.

The two prevailing theories of the "provirus", or viral agent supposed to give rise to neoplastic development in cells, are reviewed and a new hypothesis which reconciles the prevailing theories is presented. According to the "somatic provirus" theory, a virus infects a cell and proceeds to produce viral DNA by means of an RNA-dependent DNA polymerase. The viral DNA is integrated with host cell DNA which it alters to code for neoplastic conversion. According to the "germinal provirus" theory, the provirus genetic information is present in a host chromosome from the outset (no infection event is postulated) and is transmitted genetically to the offspring. No RNA-dependent DNA polymerase is required for virus continuity. Mutation, aging or carcinogenic stimuli cause the germinal provirus genetic information to be expressed, leading to cancer. In noncancerous cells, the germinal provirus is ordinarily repressed, possibly by some form of the classical repressor molecule. A new concept postulates that carcinogenic stimuli temporarily derepress a germinal provirus, which produces some viral RNA. This RNA produces a viral DNA by means of a reverse transcriptase (as in the somatic provirus) and this DNA becomes integrated into host cell DNA, but at a locus which is not affected by repressor molecules. Unsuppressed, the viral DNA

produces RNA which codes for neoplastic change. (26 references)

- 4306 ARE SOME HUMAN LYMPHOBLASTOID CELL LINES ESTABLISHED FROM LEUKEMIC TISSUES ACTUALLY DERIVED FROM NORMAL LEUKOCYTES? (E.) Belpomme, D. (Roswell Park Mem. Inst., Buffalo, N.Y.), J. Minowada and G. E. Moore. *Cancer* 30(1):282-287, 1972.

Data on properties of human lymphoid cell lines derived from leukemic tissues are reviewed and interpreted. In most cases it has been impossible to distinguish cell lines from leukemic donors from normal cell lines on the basis of cell morphology. The presence of herpes-like viruses does not provide a criterion of malignancy for cell lines, either, since these viruses have been reported in lines derived from normals. Cinematographic studies show that Burkitt lymphoma cells are relatively nonmotile, but do not allow the distinction of leukemic from normal cells. Among properties of malignant cells which approach the status of criteria for malignancy are abnormal chromosome constitution, high cloning efficiency in agar, successful heterotransplantability in immunosuppressed hosts and production of abnormal immunoglobulin. Nevertheless, similarities between normal and leukemic cell lines raise the question of whether supposedly malignant leukemic cell lines derived from leukemic blood are truly either malignant or leukemic. (67 references)

- 4307 AN ORIENTATION TO THE CONCEPT OF MINIMAL BREAST CANCER. (E.) Gallager, H. S. (U. Texas, M.D. Anderson Hosp. Tumor Inst., Houston) and J. E. Martin. *Cancer* 28(6):1505-1507, 1971.

The term "minimal breast cancer" is introduced to designate certain highly curable forms of mammary cancer. By definition it encompasses lobular carcinoma *in situ*, noninvasive intraductal carcinoma and invasive carcinoma, either lobular or ductal, forming a mass no greater than 0.5 cm in diameter. This formulation is a product of a study of breast carcinoma by subserial whole organ sectioning and mammography which led to the conclusion that breast carcinoma is not a focal process but a diffuse disease. Minimal breast cancer and early breast cancer are not coterminous designations. A lesion considered early breast cancer does not have the extremely favorable prognosis of noninvasive or microinvasive carcinoma. Similarly, minimal breast cancer must be distinguished from occult breast cancer as the occult category includes fully invasive, mass-forming lesions which are nonpalpable. The segregation of minimal breast cancer to a special category similar to that used for carcinoma *in situ* of the cervix would clarify end-result reporting and would lay the groundwork for therapeutic trials in this defined stage of carcinoma. The widespread use of mammography as a diagnostic tool has led to more frequent biopsy of small, suspicious lesions, and minimal breast cancer is thus being encountered more often. The need for accurate and simple

screening methods is discussed and techniques presently under development are mentioned with regard to their applicability. It is suggested that radical mastectomy is a more formidable procedure than that required for cure of minimal breast cancer. (8 references)

- 4308 OCCUPATIONAL MORTALITY: CANCER. (E.) Adelstein, A. M. (Office Population Census Survey, London, England). *Ann Occup Hyg* 15:53-57, 1972.

Cancer mortality in 27 occupations and in the occupations grouped according to social class is reviewed on the basis of data gathered by the British Census for 1961. Well-known occupational hazards, including skin, scrotal, bladder and nasal sinus cancers, are reconfirmed. Other findings include high rates of lip cancer in outdoor workers, high rates of stomach cancer in urban males, and high leukemia rates in farmers, fishermen, managers, artists and soldiers. Marked gradients of mortality are noted between social classes for cervix, lung and stomach cancer; these gradients are thought to reflect class-related differences in smoking, drinking and sexual behavior. (4 references)

- 4309 INTERNATIONAL CONFERENCE ON RNA VIRUSES AND HOST GENOME IN ONCOGENESIS. (E.) Bentvelzen, P. (Amsterdam, Holland). *Union Int Contre Cancer Bull* 9(2):2, 1972.

At the International Conference on RNA Viruses and Host Genome in Oncogenesis, held in Amsterdam from May 12-15, 1972, scientists from 19 countries presented their views on how interactions between viruses and host genes may lead to cancer. Several speakers indicated that susceptibility to an oncogenic virus is associated with membrane configuration which in turn might influence virus penetration or the chance for a membrane change leading to neoplasia. With regard to genetic transmission of oncornavirus, evidence was presented that all mice carry information for a mammary tumor virus. One speaker postulated that a genetically transmitted oncornavirus is switched on during embryogenesis, switched off during normal adult life and switched on during carcinogenesis. Another theory advanced holds that only a partial provirus is present initially in the germline; new tumor viruses may originate due to duplication of polymerase, somatic mutation and recombination. Results of a panel discussion suggested that no RNA-instructed DNA polymerase is needed for continuity of germinal proviruses. The enzyme is apparently necessary only for the establishment of a new somatic provirus at a site where no repression of transcription takes place. (No references)

- 4310 INTERCELLULAR JUNCTIONS IN NORMAL AND IN MALIGNANT CELLS. (E.) Martinez-Palomo, A. (No affiliation). *Pathol Annu* 1(1):261-279, 1971.

studies pertaining to altered contact properties in malignant cells are reviewed. Electrophysiologic techniques have shown that epithelial and mesenchymal tissues have a form of intercellular communication determined by the free passage of ions from cell to cell through contact regions of low resistance. Under normal conditions, gap junctions and, probably, tight junctions represent the structural basis for this form of electrical communication. Gap junctions appear to function as highly permeable regions of intimate membrane apposition. Tight junctions may contribute to electrical coupling, acting as high resistance barriers that isolate the extracellular space and thus facilitating the flow of ions through the more permeable membrane regions. Most malignant epithelial cells lack electrical coupling. In differentiated carcinomas, desmosomes and gap junctions are decreased in number, while tight junctions become permeable to electron-dense tracers. No intercellular junctions are present in highly anaplastic tumors of epithelial origin. Mesenchymal tumor cells show normal electrical communication but lack tight and gap junctions. It is likely that the abnormal surface connections of malignant cells revealed by electrophysiologic and ultrastructural methods have considerable significance in relation to the establishment of malignant growth. (67 references)

311 MOLECULAR HYBRIDIZATION: A POWERFUL APPROACH TO THE DETECTION OF VIRAL NUCLEIC ACID SEQUENCES IN HUMAN CANCER. (E.) Green, M. (Saint Louis U. Sch. Med., Missouri) and H. J. Raskas. *J Nat Cancer Inst* 48(6):1559-1565, 1972.

The applications of molecular hybridization to the detection and quantitation of viral nucleic acids in productively infected and transformed cells are reviewed. Detection of DNA tumor virus genetic information in human cancers by molecular hybridization has been attempted by three methods. Virus-specific RNA in DNA tumor virus-transformed cells can be detected by DNA-RNA hybridization; the precision of this method is stressed. In addition, RNA polymerase from *E. coli* can be used to synthesize highly radioactive and virus-specific RNA which can be annealed with DNA from cells. A third method is molecular hybridization competition analysis, which is based on the premise that viral RNA sequences, present in RNA from human cancers, will block the annealing of virus-specific RNA to viral DNA. Data from molecular hybridization analyses of human cancers for RNA tumor-virus genetic information are reviewed. Examples of positive hybridization of human ovarian cancers and murine sarcoma virus DNA are discussed. (27 references)

312 CLINICAL, EPIDEMIOLOGIC, AND PATHOLOGIC FEATURES OF CYTOTOXIC AND ONCOGENIC HERPESVIRUS IN SOUTH AMERICAN MONKEYS. (E.)

Hunt, R. D. (Harvard Med. Sch., Southboro, Mass.) and L. V. Melendez. *J Nat Cancer Inst* 49(1):261-271, 1972.

Properties of herpesviruses which are cytotoxic or oncogenic for South American monkeys species are reviewed. Three herpes viruses produce cytotoxic infections in some monkeys: *Herpesvirus T*, *H. simplex* and spider monkey herpesvirus (*H. ateles* type 1). Hosts for infections with these viruses are either not susceptible, susceptible but not fatally so, or fatally affected. The basis for these differences in susceptibility in monkeys is probably genetic, but details are unclear. Characteristic pathogenic changes in susceptible monkeys infected with cytotoxic herpesviruses include development of intranuclear inclusions, development of multinucleated giant cells and degenerative changes leading to cell death or lysis. The oncogenic herpesviruses discussed are *H. saimiri*, which causes malignant lymphoma, and *H. ateles*, which is associated with malignant lymphoma and leukemia in spider monkeys. (43 references)

4313 AETIOLOGICAL FACTORS IN SQUAMOUS CELL SKIN CANCER. (E.) Swanbeck, G. (Karolinska Inst., Stockholm, Sweden). *Brit J Derm* 85(4):394-396, 1971.

External factors operative in producing squamous cell skin cancer (SCSC) are reviewed. Frequency of occurrence of SCSC is highest on the external ear, face, scalp, neck, genitals and hands of men and the legs of women. The nearly tenfold higher incidence of SCSC on the external ear of men compared with women indicates the etiologic importance of the sun-radiation factor. Geographic frequency of occurrence at specific sites on the body shows higher frequency of occurrence on head, hands, and lower limbs in residents of southern Sweden than residents of northern Sweden. Doubling of SCSC incidence rate among white people for each 3° 48' south in latitude in the northern hemisphere is a striking illustration of the cancer-promoting properties of solar radiation. Dimer formation between thymidine radicals in DNA by UV light and the mutation effect on DNA during replication are discussed. Experimental chemical induction of SCSC by coal-tar derivatives is reviewed in light of the widespread use of this material in the treatment of psoriasis and eczema. The frequency of SCSC occurrence following burn or mechanical injury suggests that epidermal atrophy is a predisposing factor. The cellular kinetics in epidermis is another important factor, since it may influence the carcinogenicity of other carcinogenic factors. (20 references)

4314 THE PROTOPLASMIC PATTERNS OF TISSUES AND TUMORS. (E.) Knox, W. E. (Harvard Med. Sch., Boston, Mass.). *Amer Sci* 60(4):480-488, 1972.

The application of tissue composition analysis to the understanding of neoplastic development is reviewed.

Various procedures have been used to itemize the kinds and amounts of the biochemical and especially the enzymatic components of different tissue systems. Comparison of normal and neoplastic tissue on this molecular level suggests that tumors resemble each other more than they resemble the normal tissue from which they arise. The diversity seen among tumors is confined to well-differentiated tumors; anaplastic tumors of various origins are similar. Tissue analysis of fetal tissue indicates that there is an analogy between the progressive differentiation of fetal tissue and the reverse of the process, i.e., loss of differentiation, in tumor cells. It appears that the same enzymes change in fetal and in neoplastic tissues. (16 references)

- 4315 THE SV40 GENOME IN TRANSFORMED MAMMALIAN CELLS. (Pol.) Steplewski, Z. (Inst. Oncol., Gliwice, Poland). *Postepy Hig Med Dosw* 25(4):571-612, 1971.

The state of the art of research into the SV40 virus genome in transformed mammalian cells is reviewed. Discussions on viral multiplication, cell transformation and subsequent hybridization are included. Activation of infectious SV40 in heterokaryocytes, detection of T-antigen by immunofluorescence and internuclear transfer are reviewed. Techniques for isolation of infectious SV40 and for infection of cell hybrids are described. The possibility of SV40 genome activation in transformed cells is noted. This activation may be accomplished by means of cell fusion with SV40-susceptible monkey kidney cells. Where the virus genome is defective, double fusion techniques permit recombination as well as activation of the virus. (103 references)

- 4316 BIOENERGETICS AND THE PROBLEM OF TUMOR GROWTH. (E.) Racker, E. (Dept. Biochem, Cornell U., Ithaca, N.Y.). *Amer Sci* 60(1):56-63, 1972.

The current status of research on the mechanisms initiating and controlling biological energy and their relationship to tumor growth is reviewed. Energy formation in cells by the two pathways of glycolysis and oxidative phosphorylation is discussed. Of the two major hypotheses of oxidative phosphorylation, the chemical hypothesis involves three high-energy intermediates: 1) a nonphosphorylated intermediate of the oxidation chain ($A \sim X$) which arises by oxidation of the substrate ($A_{reduced}$); 2) a second nonphosphorylated intermediate without a respiratory component; and, 3) a third phosphorylated intermediate ($X \sim P$). The chemiosmotic hypothesis has as its key feature translocation of protons from one side of the membrane to the other, which takes place during mitochondrial oxidation of substrates. Fundamentally, the difference between the two hypotheses lies in the steps leading to $X \sim Y$ formation. Experimental evidence supporting one or the other of these hypotheses does not as yet permit an

objective decision in either direction. The numerous investigative efforts to determine the role of phospholipids in oxidative phosphorylation are reported. It is proposed that a multitude of primary lesions induced by virus, carcinogens or mutations have in common the ability to cause persistent alteration in the intracellular pH (and perhaps temperature), and thereby upset the normal regulating mechanisms that prevent uncontrolled growth. Further, it is proposed that tumors can be caused by these disturbances in regulatory action. (49 references)

- 4317 CHROMOSOME ABNORMALITIES AND CARCINOGENESIS. (E.) Pogosianz, H. E. (Acad. Med. Sci., Moscow, USSR) and E. L. Prigogina. *Neoplasma* 19(4): 319-325, 1972.

Laboratory studies of the role of chromosome aberration in carcinogenesis are summarized. Mutagenic and carcinogenic effects in mammalian cells of chemical carcinogens, including hydroxyurethane and methyl nitrosourea, were investigated. Karyotype analyses of human tumors and of tumors of the Hungarian hamster were also performed. In the course of these studies, a correlation was noted between high ploidy and lack of morphological differentiation in human seminomas. The incidence of inborn chromosome aberrations in hematopoietic cancer patients is under continuing investigation. Taken together, these studies suggest that chromosome mutations in tumors represent a secondary phenomenon. (32 references)

- 4318 PART VII. CANCER AND INFECTIOUS DISEASES RELATED TO GEOCHEMICAL ENVIRONMENT. IS THERE A PARTICULAR KIND OF SOIL OR GEOLOGIC ENVIRONMENT THAT PREDISPOSES TO CANCER? (E.) Armstrong, R. W. (Sch. Pub. Hlth., U. Hawaii, Honolulu). *Ann NY Acad Sci* 199: 239-248, 1972.

Research on correlations between soil composition and cancer occurrence is reviewed. In France, high mortality from all cancer types is reportedly associated with magnesium-poor soils. Soil drainage conditions and organic matter contents have been linked to cancer in Welsh studies. In the Netherlands, cancer frequency is high in areas with peat soils. Studies of migrant populations suggest that variations in cancer mortality are likely to be due to local differences in environment rather than to the genetic makeup of the populations. The association between soil composition and cancer is probably mediated by the food chain. However, the extreme complexity of the relationships between soil composition, food chain, and cancer is emphasized. (59 references)

- 4319 SOME CLINICAL ASPECTS OF THE PARA-ENDOCRINE SYNDROMES. (E.) Ross, E. J. (U. College Hosp. Med. Sch., London, England). *Proc Roy Soc Med* 65:59-60, 1972.

The significance of hormone secretion by human cancer cells is discussed. Among the polypeptide hormones produced by cancers of various sites are corticotrophin, vasopressin, gonadotrophin, erythropoietin and insulin. It appears that copious secretion of cortisol in ACTH-secreting tumors hastens metastatic spread and shortens survival of bronchial oat-cell carcinoma patients. Investigations of adrenocortical activity in cancer patients has shown a raised plasma cortisol concentration. However, it is apparently not the case that most tumors secrete corticotrophin. Rather, tumors may secrete a corticotrophin-releasing factor which acts through the patients' pituitaries. (2 references)

- 4320 BURKITT'S LYMPHOMA AND *HERPESVIRUS SAIMIRI* LYMPHOMA: COMPARATIVE ASPECTS. (E.) Epstein, M. A. (U. Bristol Med. Sch., England). *J Nat Cancer Inst* 49(1):213-217, 1972.

Herpesvirus saimiri lymphoma development in an animal model may provide information relevant to the etiology and study of Burkitt's lymphoma in man. There are several differences, however, between *H. saimiri* lymphoma and Burkitt's lymphoma. *H. saimiri* lymphoma does not occur under natural conditions as does Burkitt's lymphoma. *H. saimiri* is apparently nonpathogenic for its natural host, the squirrel monkey; it causes malignant tumors only when inoculated into such animals as owl monkeys or marmosets. Unlike Burkitt's lymphoma, which is usually well-differentiated and which involves bizarre sites and rarely invades peripheral lymph nodes, *H. saimiri* lymphoma consists of a marked, widespread reticulum cell invasion of many organs, especially the liver, kidney, spleen, lymph nodes and adrenals. *H. saimiri* and Epstein-Barr (EB) virus, the presumed etiological agent of Burkitt's lymphoma, also differ in their patterns of cell transformation *in vitro*. Unlike *H. saimiri*, EB virus does not infect a wide range of monolayer test tissue cultures. Although the EB viral genome is present in all cells of an infected culture, only a relatively small proportion of these cells replicate virus, resulting in cell lysis and death. In contrast, virus production by lysis is fairly widespread in *H. saimiri*-infected cultures. New methods have enabled the infection of human embryo cells with EB virus. The cells become transformed but do not produce virus. Despite these differences, if *H. saimiri* can be made to induce lymphoma in its natural host, perhaps in association with some environmental co-factor as has been implicated with Burkitt's lymphoma, its study may provide information pertinent to the etiology of Burkitt's lymphoma. (34 references)

- 4321 RECENT ADVANCES IN NEUROBLASTOMA. (E.) Finkelstein, J. Z. (Harbor Gen. Hosp., Los Angeles, Calif.) and G. S. Gilchrist. *California Med* 116(3):27-36, 1972.

Advances in research on the pathophysiology of neuro-

blastoma are reviewed. Neuroblastoma, one of the more common infantile tumors, shows wide histopathological variation from tumor to tumor and even within the same tumor; cells may be undifferentiated and sarcoma-like, or fully mature. A unique clinical feature of neuroblastoma is its high rate of spontaneous regression during the first year of life. Neuroblastoma also shows a tendency to mature to the more benign ganglioneuroma. Maturation to the more benign form may be mediated by a serum factor, a protein which apparently works to stimulate RNA synthesis. The association of neuroblastoma with neurofibromatosis (von Recklinghausen's disease) is described, and treatment of neuroblastoma is discussed. (56 references)

- 4322 CARCINOMA OF THE STOMACH. (E.) Das, M. M. (N. R. S. Med. Coll., Calcutta, India). *J Indian Med Assoc* 58(4):125-127, 1972. (11 references)

- 4323 BLADDER CARCINOMA. (E.) Prout, G. R., Jr. (Massachusetts Gen. Hosp., Boston). *N Engl J Med* 287(2):86-90, 1972. (50 references)

- 4324 PRIMARY LIVER-CELL CARCINOMA. (E.) Anonymous. *Med J Aust* (16):783-784, 1972. (18 references)

- 4325 ACUTE LEUKAEMIA IN ADULTS. THE EXPERIENCE AT ROYAL PRINCE ALFRED HOSPITAL, 1965-1970. (E.) Wilkinson, T. (Royal Prince Alfred Hosp., Sydney, Australia), H. Kronenberg and K. A. Rickard. *Med J Aust* (16):785-788, 1972. (7 references)

- 4326 A THEORY OF CARCINOGENESIS AND OUR FIGHT AGAINST CANCER. (E.) De Ocampo, G. (Philippine Eye Res. Inst., U. Philippines). *Phil J Surg Spec* 27(1):1-23, 1972. (24 references)

- 4327 EPIDERMAL CARCINOMA OF THE MOUTH AND PHARYNX 1960-1964. (E.) Farr, H. W. (New York, N.Y.) and K. Arthur. *J Laryngol Otol* 86(3):243-253, 1972. (24 references)

- 4328 TONSILLECTOMY AND LEUKEMIA. (E.) Cuneo, J. M. (Cty. Nassau Dept. Hlth., Mineola, N.Y.). *Lancet* (7755):846-847, 1972. (4 references)

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- 4331 MICROINVASIVE CARCINOMA OF THE CERVIX. (E.) Savage, E. W. (Sch. Med., U. Illinois, Chicago). *Am J Obstet Gynecol* 113(5):708-717, 1972. (74 references)
- 4332 BURKITT'S LYMPHOMA OF THE NASOPHARYNX. (E.) David, S. S. (Tirunelveli Med. Coll. Hosp., India). *J Laryngol Otol* 86(4):387-393, 1972. (26 references)
- 4333 SECULAR TRENDS OF MALIGNANT TUMORS OF THE TESTIS IN WHITE MEN. (E.) Petersen, G. R. (Sch. Public Hlth. Community Med., U. Washington, Seattle) and J. A. H. Lee. *J Nat Cancer Inst* 49(2):339-354, 1972. (41 references)
- 4334 RNA TUMOR VIRUSES -- TERMINOLOGY AND ULTRA-STRUCTURAL ASPECTS OF VIRION MORPHOLOGY AND REPLICATION. (E.) Dalton, A. J. (Natl. Cancer Inst., Bethesda, Md.). *J Nat Cancer Inst* 49(2):323-327, 1972. (6 references)
- 4335 SV40 PROTEINS. (E.) Anonymous. *Nature* 238(5361):188-189, 1972. (No references)
- 4336 EIGHTY YEARS OF IMMUNOTHERAPY: A REVIEW OF IMMUNOLOGICAL METHODS USED FOR THE TREATMENT OF HUMAN CANCER. (E.) Currie, G. A. (Royal Cancer Hosp., Lab., Surrey, England). *Br J Cancer* 26(3):141-153, 1972. (62 references)
- 4337 SALIVARY GLAND TUMORS IN ATOMIC BOMB SURVIVORS. (E.) Gross, L. (New York, N. Y.). *JAMA* 220(5):728, 1972. (5 references)
- 4338 PRIMARY LEIOMYOSARCOMA OF THE KIDNEY: REPORT OF A CASE AND REVIEW OF THE LITERATURE. (E.) Loomis, R. C. (Eugene Hosp. Clin., Oregon). *J Urol* 107(4):557-560, 1972. (30 References)
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- 4340 GYNECOLOGIC CANCER IN CHILDREN. (E.) Acosta, A. (Baylor Coll. Med., Houston, Tex.), A. L. Kaplan and R. H. Kaufman. *Am J Obstet Gynecol* 112(7):944-952, 1972. (16 References)
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4353 CAN FLUORIDE CAUSE LUNG CANCER? (E.)
Anonymous. *Fluoride* 5(4):169-171, 1972.
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4354 CANCER IN MAN AT SITE OF PRIOR BENIGN
LESION OF SKIN OR MUCOUS MEMBRANE: A
REVIEW. (E.) Dunham, L. J. (Natl. Cancer Inst.,
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4355 METACHRONOUS CANCER OF THE LARGE INTESTINE.
(E.) Lockhart-Mummery, H. E. (St. Mark's
Hosp., London, England), R. J. Heald and M. Chir.
Dis Colon Rectum 15(4):261-264, 1972. (1 reference)

4356 CANCER OF THE HEAD AND NECK - NASOPHARYN-
GEAL CANCER. (E.) Rubin, P. (U. Rochester
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(3):390-393, 1972. (No references)

4357 PHA -BLASTOGENESIS IN RELATIONSHIP TO THE
CELL-TYPE AND SOURCE IN ACUTE LEUKEMIA.
(E.) Astaldi, G. (Hosp. Tortona, Italy), L. Massimo,
F. Dagna, P. G. Mori and A. Fossati. *Blut* 24(3):153-
160, 1972. (160 references)

4358 CANCER OF THE LIP. (E.) Yonkers, A. J.
(U. Nebraska Coll. Med., Omaha) and C. T.
Yarrington, Jr. *Laryngoscope* 82(4):625-630, 1972.
(12 references)

4359 SUMMARY OF INFORMAL DISCUSSION ON BIOSTATIS-
TICAL AND EPIDEMIOLOGICAL FACTORS IN
HODGKIN'S DISEASE. (E.) Smithers, D. W. (Royal
Marsden Hosp., London, England). *Cancer Res*
31:1866-1868, 1971. (No references)

4360 CANCER HAZARD FROM WOOD DUST AND IN THE
BOOT AND SHOE INDUSTRY. (E.) Hadfield,
E. H. (Wycombe Gen. Hosp., Bucks, England). *Ann
Occup Hyg* 15:39,41, 1972. (11 references)

- 4361 HISTOPATHOLOGIC STUDIES ON EFFECTS OF HYPOPHYSECTOMY ON EXPERIMENTAL HEPATOCARCINOGENESIS IN RATS. (Jap.) Yokota, Y. (Nara Med. U., Japan). *J Nara Med Ass* 22(213):192-205, 1971.

Intact and hypophysectomized male rats were fed a diet containing 3'-methyl-4-dimethylaminoazobenzene (3'-Me-DAB), 2-fluorenylacetaide (2-FAA) or ethiomine for eight months. Hypophysectomized rats given 3'-Me-DAB or 2-FAA did not develop liver cancer, but hypophysectomized rats given ethiomine developed liver cancer or nodular hypertrophy. Liver cancers were induced in rats hypophysectomized after feeding with 3'-Me-DAB for three months but not in rats hypophysectomized after feeding with 2-FAA for three months. The effect of hypophysectomy following an ethiomine diet was not clear. Hydrocortisone significantly increased the activity of tryptophan pyrrolase in the livers of hypophysectomized rats fed 3'-Me-DAB. It did not increase liver tryptophan pyrrolase activity in hypophysectomized rats fed ethiomine or in intact rats. Hypophysectomy seemed to have varied effects on artificial growth of liver cancer due to differences of metabolic mechanisms of the various carcinogens. Pituitary hormone appeared to have a definite influence on the transition of a nodular growth into a cancerous growth, but had no clear influence on cancer growth itself.

- 4362 VITAMIN A-INDUCED MODIFICATION OF BENZO[a]PYRENE METABOLISM IN SYRIAN HAMSTER CELL CULTURES. (E.) Rasmussen, R. E. (U. California, Sch. Med., San Francisco), I. Y. Wang and T. T. Crocker. *J Nat Cancer Inst* 49(3):693-700, 1972.

With repeated passage, cultures of Syrian hamster embryo cells lost both the ability to convert benzo[a]pyrene (BP) to metabolic products and to bind BP to cellular components. Treatment of such late-passage cells with vitamin A, at levels of 1 µg/ml or less, restored their BP metabolizing activity. This effect was not immediate but required at least two days of exposure to vitamin A, suggesting that extensive subcellular changes were occurring. The restoration of BP metabolizing activity was observed as increased binding of ³H-BP to cell components as well as an increase in specific enzymatic activity of cell-free preparations from vitamin A-treated cells.

- 4363 CHEMICAL CARCINOGENESIS AND HUMORAL ANTIBODY SYNTHESIS. (E.) Brai, M. (Pub. Hlth. Res. Inst., New York, N.Y.), A. Patrucco and A. G. Osler. *J Immun* 109(2):317-323, 1972.

Swiss Webster mice were injected s.c. with 0.2 ml 3-methylcholanthrene (3-MCA) given alone or three days before or after antigenic stimulation by i.p. injection of sheep erythrocytes (SRBC) or human serum albumin (HSA). The effect of 3-MCA on primary and secondary humoral immune responses to the antigens was observed by hemolytic antibody

titrations. 3-MCA failed to suppress anti-SRBC or anti-HSA antibody titers; though all mice given 3-MCA developed tumors, antibody titers were similar in 3-MCA-treated and untreated mice. 3-MCA did not diminish secondary immune antibody responses, which were monitored after booster injections of antigen. At the time of sacrifice, the weight of each mouse and its extirpated spleen was recorded for calculation of the spleen index. The elevated indices in the tumor-bearing animals were believed the result of decreased body weight and toxic splenomegaly associated with the presence of the tumor.

- 4364 AM AUTORADIOGRAPHIC STUDY OF THE EARLY EFFECTS OF 7,12-DIMETHYLBENZ(a)ANTHRACENE AND PROGESTERONE ON DNA SYNTHESIS IN RAT MAMMARY EPITHELIAL CELLS AND SUBSEQUENT TUMOUR DEVELOPMENT. (E.) Jabara, A. G. (Dept. Path. Statistics, U. Melbourne, Australia), P. H. Toyne and R. J. Fisher. *Brit J Cancer* 26(4):265-273, 1972.

Experiments were undertaken to determine (1) the early effects of dimethylbenz(a)anthracene (DMBA) or progesterone, or the two in combination, on DNA synthesis in adult female Sprague-Dawley rat mammary epithelial cells and (2) whether there was any correlation between the extent of DNA synthesis observed in the first 96 hr after administration of the drugs and subsequent tumor development. Animals received daily s.c. injections of 3 mg progesterone for 25 or two days prior to receiving a single dose of 30 mg DMBA by gastric intubation. Treated rats were injected i.p. with ³H-thymidine. Two hr later, mammary glands were removed and the number of cells which incorporated label was determined by autoradiography. Administration of DMBA alone caused an insignificant reduction in DNA synthesis below control levels in the first 96 hr, whereas progesterone significantly increased DNA synthesis. Administration of progesterone plus DMBA resulted in an increase in DNA synthesis above both control and DMBA values but less than that produced by progesterone alone. A two-way analysis of variance revealed no interaction between DMBA and progesterone in relation to mammary epithelial cell DNA synthesis. Mammary carcinomas (and one adenoma) occurred only in rats which received DMBA with or without progesterone. No correlation was found between the extent of DNA synthesis observed in mammary glands biopsied between six and 96 hr after DMBA administration and the occurrence of tumors in the host rats 135 days later.

- 4365 CARCINOGENICITY OF DERIVATIVES OF 7,12-DIMETHYLBENZ(a)ANTHRACENE. (E.) Flesher, J. W. (U. Kentucky Coll. Med., Lexington) and K. L. Sydnor. *Cancer Res* 31:1951-1954, 1971.

Eleven derivatives of 7,12-dimethylbenz(a)anthracene (DMBA) were tested for carcinogenicity in Sprague-Dawley female rats by the s.c. injection of 1.0 or 0.1 mg of compound dissolved in 0.1 ml of sesame oil on alternate days for 20 doses. Eight derivatives [7-hydroxymethyl-12-methyl-7-formyl-12-methyl-, 7-

methoxymethyl-12-methyl-7-acetoxymethyl-12-methyl-, 7-benzoyloxymethyl-12-methyl-, 7-iodomethyl-12-methyl-, 7-bromomethyl-12-methyl-, and 7-chloromethyl-12-methylbenz(a)anthracene] were carcinogenic at the 1-mg dose level, and 5 [benzoyloxymethyl-12-methyl-, 7-formyl-12-methyl-, 7-bromomethyl-12-methyl-, 7-hydroxymethyl-12-methyl-, and 7-iodomethyl-12-methylbenz(a)anthracene] were carcinogenic at the 0.1-mg dose level (200 days of observation). All compounds which were carcinogenic were ones which would be expected to be converted to 7-hydroxy-DMBA *in vivo*. These results indicate that metabolic activation of DMBA is necessary for activity. They are also consistent with the hypothesis that the ultimate carcinogen of polycyclic hydrocarbons is a carbonium ion. It is proposed that DMBA is hydroxylated to 7-hydroxy-DMBA, which is then converted to a derivative (e.g., a sulfate ester) that would be expected to be a good leaving group and which would generate a highly reactive carbonium ion. The carbonium ion could then react with critical nucleophiles to initiate the chain of cellular events which result in cancer.

4366 CARCINOGENICITY OF ORGANIC FRACTIONS OF PARTICULATE POLLUTANTS COLLECTED IN NEW YORK CITY AND ADMINISTERED SUBCUTANEOUSLY TO INFANT MICE. (E.) Asahima, S. (Case Western Reserve U. Sch. Med., Cleveland, Ohio), J. Andrea, A. Carmel, E. Arnold, Y. Bishop, S. Joshi, D. Coffin and S. S. Epstein. *Cancer Res* 32(10):2263-2268, 1972.

Groups of randomly bred infant Swiss mice were given s.c. injections of suspensions of (a) an organic extract of particulate atmospheric pollutants collected in New York City; (b) derived acidic, basic, neutral, aliphatic, aromatic, and insoluble fractions; and (c) three oxyneutral subfractions, in total doses of 10, 20, and 40 mg. Each test group consisted of a minimum of 44 mice; concurrent controls were comprised of 81 untreated and 86 solvent-treated mice. There were wide variations in the overall carcinogenicity and incidence of tumors in various organs in different test groups. High incidences of hepatomas were found in males given injections of the basic fraction and to a lesser extent in males and females given injections of the organic extract. The incidence of lymphomas was high, particularly in females given injections of basic, aliphatic, and aromatic fractions and oxyneutral subfractions. Additionally, high incidences of solitary and multiple pulmonary adenomas were found in mice given injections of basic, neutral, and aromatic fractions and oxyneutral subfractions. Coexistent multiple tumors were also found in mice given injections of basic and aromatic fractions and oxyneutral subfractions. Injection site tumors were rare.

4367 EARLY EFFECTS OF 12-O-TETRADECANOYL-PHORBOL-13-ACETATE ON THE INCORPORATION OF TRITIATED PRECURSOR INTO DNA AND THE THICKNESS OF THE INTERFOLLICULAR EPIDERMIS, AND THEIR RELATION TO TUMOR PROMOTION IN MOUSE SKIN. (E.) Raick, A. N.

(Dept. Path., U. Toronto, Ontario, Canada), K. Thumm and B. R. Chivers. *Cancer Res* 32:1563-1568, 1972.

Female Swiss Webster ICR mice were treated with 0.0016-0.16 μ moles 12-O-tetradecanoyl-phorbol-13-acetate (TPA). Extensive skin ulceration resulted in mice given 0.16 μ mole TPA and some ulceration was caused by 0.016 μ mole. Mice given 0.00016-0.016 μ mole TPA after application of TPA or 7,12-dimethylbenz(a)anthracene had markedly thickened interfollicular epidermis (IFE). The increase in IFE thickening and the rate of thickening were correlated with TPA dose. A second dose of TPA (0.016 μ mole) one week after the initial 0.016 μ mole dose induced 1.5-2 times the IFE thickening induced by a single TPA dose. A single application of TPA (0.00016-0.16 μ mole) initially inhibited the uptake of thymidine-methyl- 3 H into mouse skin DNA; however, a marked stimulation of precursor uptake followed this inhibition. Precursor uptake by skin DNA returned to control levels thereafter. The degree of stimulation of precursor uptake by DNA correlated well with TPA dose up to 0.016 μ moles; no further increase in precursor uptake was associated with increasing TPA dose beyond this point. There was a correlation between increased IFE thickness and skin tumor promotion with 0.016 and 0.0016 μ mole TPA. However, 0.00016 μ mole induced a significant increase in IFE thickness and in precursor uptake by skin DNA but did not show tumor promoting activity.

4368 THE INHIBITION OF CROTON OIL-PROMOTED MOUSE SKIN TUMORIGENESIS BY STEROID HORMONES. (E.) Belman, S. (New York U. Med. Ctr., N.Y.) and W. Troll. *Cancer Res* 32(3):450-454, 1972.

The tumor-inhibiting effects of steroid hormones were studied and compared with steroid antiinflammatory and antimitotic activities. Tumors were induced on the backs of female Swiss Millerton mice with 25 μ g 7,12-dimethylbenz(a)anthracene. Two weeks later tumorigenesis was promoted by applying 0.2 ml of 0.5% croton oil in acetone three times a week. Steroids were applied to the same areas at 6 and 30 μ g (in acetone) concentrations five times a week starting at the time croton oil was applied. Each steroid was tested on 24 mice. Tumor inhibition was dose dependent in the order dexamethasone > Schering No. 11572 > prednisolone > hydrocortisone > cortisone. Antiinflammatory effects of the steroids was tested by applying a mixture of croton oil, acetone solvent and one of the test hormones to the right ear of mice and swabbing the left ear with solvent alone. Four hr following treatment the ears were cut off and weighed, then dried and reweighed. The order of antiinflammatory activity was Schering No. 11572 > dexamethasone = prednisolone > hydrocortisone > cortisone = control. In a third series of tests the mitotic activity of epidermal cells was observed. Croton oil and steroid in acetone solvent were applied to the dorsal skin of mice. Twenty-four hr later, colchicine was injected i.p. The animals were sacrificed 4 hr later and skin sections were prepared for histological examination. Findings

in this series indicated that cortisone acted as a stimulus and increased the mitotic rate. Hydrocortisone and prednisolone inhibited mitosis but only at high doses, while dexamethasone and the Schering compound inhibited mitosis at all concentrations tested.

- 4369 INFLUENCE OF SOME NITROFURANS ON CARCINOGENESIS IN RATS FED 4-(DIMETHYLAMINO)-AZOBENZENE. (E.) Akao, M. (Inst. Food Microbiol., Chiba U., Japan), K. Kuroda, M. Kanisawa and K. Miyaki. *Gann* 62:479-484, 1971.

Four nitrofurans were compared for their effect on carcinogenesis induced by 4-(dimethylamino)azobenzene (DAB). The nitrofurans tested were 2-(2-furyl)-3-(5-nitro-2-furyl)acrylamide (N1), 2-amino-5-[2-(5-nitro-2-furyl)-1-(2-furyl)-vinyl-1]-1,3,4-oxadiazole (N2), 5-nitro-2-furaldehyde semicarbazone (N3), and 5-morpholinomethyl-3-(5-nitrofurfurylideneamino)-2-oxazolidone (N4). Male Donryu rats were maintained on a diet containing 0.06% DAB and 0.2% of a nitro-furan until they consumed 1 g of DAB (about 3.5 months), and succeeding on a basal diet for one month. The liver of these animals was compared histopathologically with those of the animals fed a diet containing DAB alone. The induction of histopathological changes in the liver due to the administration of DAB was almost completely inhibited by the concurrent administration of N1 or N2. A similar activity was noted in N3, but the activity was moderate, and hyperplasia of small bile ducts and regenerative cell nodules were seen in the liver of the animals fed DAB and N3. No such inhibitory activity was found in N4, and typical trabecular hepatoma, cholangiofibrosis and atypical cell growths were seen in the animals fed DAB and N4. The liver enzyme activity of metabolizing azo dye was not significantly changed by 3.5-months' administration of any of the nitrofurans. The effect of nitrofurans on the levels of free and protein-bound dyes in the liver was more important for the mode of their action in inhibiting DAB carcinogenesis. However, it was noted that N2 and N3, both of which inhibited DAB carcinogenesis, showed no significant activity to reduce the protein-bound dye level.

- 4370 CARCINOGENESIS WITH 3-METHYLCHOLANTHRENE IN UTRINE CERVIX OF MICE TREATED NEONATALLY WITH ESTROGEN. (E.) Forsberg, J.-G. (Inst. Anat., U. Bergen, Norway) and L. S. Breistein. *J Nat Cancer Inst* 49(1):155-172, 1972.

Virgin female NMRI mice were given s.c. injections of 5 µg estradiol-17β beginning on the day of birth and continuing for five days thereafter. Some hormone-treated mice had beeswax or beeswax-and-3-methylcholanthrene (MCA)-impregnated threads implanted in the uterine cervix. In mice given estradiol but no thread, a columnar epithelium with an abnormally wide extension developed in the cervical canal. The MCA-treated thread produced an irritation which in turn caused rapid

epidermization in the cervical canal. Columnar epithelium in these mice was replaced by squamous epithelium in the common cervical canal. In some cases, squamous epithelium grew under columnar epithelium, the latter tissues eventually being shed. The initial incidence of invasive lesions caused by the MCA-treated thread might have been influenced by epidermization and a changed gonadotropin pattern. The persistent production of ovarian estrogen in estradiol-treated mice apparently retarded the growth of lesions.

- 4371 C-TYPE PARTICLES IN PRIMARY AND TRANSPLANTED LUNG TUMORS INDUCED IN BALB/c MICE BY HYDRAZINE SULFATE: ELECTRON MICROSCOPIC AND IMMUNODIFFUSION STUDIES. (E.) Bucciarelli, E. (Perugia U. Med. Sch., Italy) and R. Ribacchi. *J Nat Cancer Inst* 49(3):673-684, 1972.

Primary lung tumors induced in BALB/c mice by hydrazine sulfate, transplants of these tumors in newborn and adult syngeneic hosts taken between the first and twenty-fourth transplant generations, and samples of normal tissue from tumor-bearing mice were studied in the electron microscope for the presence of virus particles. Immunodiffusion studies for the presence of type-C, group-specific viral antigens were done on both transplanted tumors and normal tissues of the same mice. The neoplastic cells of the primary and transplanted tumors retained the typical structure of the cell of origin, the type-B alveolar cell. Cylindrical, type-C, and intracisternal A virus particles were observed. Cylindrical particles were seen only in the primary tumors and, characteristically, originated from dark, granular, cyst-like areas of the neoplastic cells. C particles budded from the neoplastic cells or in intercellular spaces in 35% of primary tumors, 62.5% of transplanted tumors in newborn mice, and 31% of those transplanted into adults. Intracisternal A particles were seen in the neoplastic cells of 88% of the primary tumors, 25% of the tumors transplanted into newborns, and in 12.5% of those grafted into adults. In 63.6% of the normal lung-tissue samples, only intracisternal A particles were observed. Type-C, group-specific viral antigens were demonstrated by immunodiffusion in the transplanted tumors but not in the normal organs of tumor-bearing mice. These data suggest a possible activation of type-C virus particles in type-B alveolar cells by a chemical carcinogen.

- 4372 EFFECT OF UNILATERAL URETER LIGATION ON DEVELOPMENT OF TUMORS IN THE URINARY SYSTEM OF RATS TREATED WITH N-BUTYL-N-(4-HYDROXYBUTYL)-NITROSOAMINE. (E.) Ito, N. (Nara Med. U., Japan), S. Makiura, Y. Yokota, Y. Kamamoto, Y. Hiasa and S. Sugihara. *Gann* 62(5):359-365, 1971.

The effect of unilateral ureter ligation on the development of tumors in the renal pelvis, ureter, and urinary bladder of male Wistar strain rats treated with N-butyl-N-(4-hydroxybutyl)nitrosoamine was investigated. The activities of β-glucuronidase

in homogenates of liver, kidney, and bladder of rats after unilateral ureter ligation were also examined. The incidence of kidney and ureter tumors in rats treated with N-butyl-N-(4-hydroxybutyl)nitrosamine was much higher after ligation of one ureter. The present results showed that unilateral ligation of the ureter was a good method to induce transitional cell carcinomas in the kidney and ureter of rats treated with N-butyl-N-(4-hydroxybutyl)nitrosamine. Hyperplasia of the epithelium of the renal pelvis and ureter was occasionally seen in carcinogen-treated rats. It was suggested that the hyperplastic changes were precursors of transitional cell carcinoma of the renal pelvis and ureter in rats receiving N-butyl-N-(4-hydroxybutyl)nitrosamine. The activity of β -glucuronidase was raised in tumors of the urinary bladder but the activity of this enzyme in liver and kidney tissues was not influenced by the administration of N-butyl-N-(4-hydroxybutyl)nitrosamine.

4373 ACCUMULATION OF ^3H -ESTRADIOL IN TESTES AND PITUITARY GLANDS OF MICE OF STRAINS DIFFERING IN SUSCEPTIBILITY TO TESTICULAR INTERSTITIAL CELL AND PITUITARY TUMORS AFTER PROLONGED ESTROGEN TREATMENT. (E.) Bollengier, W. E. (Yale U. Sch. Med., New Haven, Conn.), A. J. Eisenfeld and W. U. Gardner. *J Nat Cancer Inst* 49(3):847-852, 1972.

Male mice from four different inbred strains differed in susceptibility to testicular interstitial cell tumors (ict) (susceptible A and BALB/c strains) and pituitary tumors (susceptible C57 strain) after prolonged exposure to estrogens. Tritiated estradiol (^3H -E2) was administered to determine possible strain differences in estradiol localization in testes and pituitary glands. The testes of mice of all strains retained more ^3H -E2 at 1 hr after injection than did plasma or fat, but showed no consistent differences distinguishing mice from strains susceptible to ict. The testes retained much less radioactivity 4 hr after injection and did not show a lower accumulation of radioactivity when ^3H -E2 was given 1 hr after a high dose of diethylstilbestrol. The accumulation in the testes was highly variable between experiments, and other experimental approaches are believed necessary to study estrogen interaction with the interstitial cell. The pituitary glands of all strains had high levels of radioactivity at 1 and 4 hr. Pituitary ^3H -E2 accumulation was reduced after previous treatment with diethylstilbestrol. Chromatographic estimation of the extracted free estrogen from testes and pituitary glands of mice of all 4 strains showed approximately 90% in the estradiol fraction and about equal amounts in the estriol and estrone fractions. Strain differences in pituitary radioactivity could not be associated with the tendency toward pituitary tumors.

4374 EFFECTS OF AFLATOXINS ON NUCLEIC ACID AND NUCLEAR PROTEIN SYNTHESIS IN ISOLATED PERFUSED REGENERATING RAT LIVER. (E.) Gerber, G. B. (Euratom Radiobiol. Dept., C.E.N./S.C.K., Mol,

Belgium). *Environ Physiol* 1(2):55-60, 1972.

The action of aflatoxin B_1 on synthesis of DNA and nuclear proteins was studied in isolated regenerating rat liver perfused 24 hr after partial hepatectomy with a mixture of heparinized rat blood, Ringers solution, and glucose (total volume, 40 ml). Following equilibration, 0, 100, or 500 μg aflatoxin B_1 in 0.1 ml dimethylsulfoxide was added to the perfusate. Twenty min later ^3H -lysine and ^{14}C -thymidine were added. Liver samples were removed after 15, 30, or 60 min and total cell homogenates or purified nuclear preparations were analyzed for incorporation of the appropriate precursor in DNA, total cell protein, nuclear globulins, acid proteins, histones, and residual proteins. Incorporation of lysine into total serum was linear after a 30 min delay and was not affected by 100 or 500 μg aflatoxin. Lysine incorporation into total liver proteins was inhibited less than 20% by aflatoxin. Incorporation of thymidine into DNA was inhibited 67-75% by 500 μg and 30-60% by 100 μg aflatoxin. Incorporation of lysine into histones and acidic nuclear proteins was depressed to about the same extent as incorporation of thymidine into DNA. Inhibition of lysine incorporation into residual proteins and nuclear globulins was absent or less marked.

4375 BINDING OF CHEMICAL CARCINOGENS TO NUCLEAR PROTEINS OF RAT LIVER. (E.) Jungmann, R. A. (Northwestern U. Med. Sch., Chicago, Ill.) and J. S. Schweppe. *Cancer Res* 32(5):952-959, 1972.

The binding of *N*-hydroxy-*N*-2-fluorenylacetyl- ^{14}C (N-HO-FAA- ^{14}C), *p*-dimethylaminoazobenzene- ^{14}C (DAB- ^{14}C), and 7,12-dimethylbenz(a)anthracene- ^3H (DMBA- ^3H) to histones and acidic proteins of rat liver nuclei was studied. After the injection of the radioactive carcinogens into rats, liver histone fractions F1, F2a1, F2a2, F2b, and F3 were isolated by selective acid extraction. DNA and acidic proteins were extracted with 4 M CsCl at pH 11.6 and 14 and were separated by equilibrium density centrifugation. Histones and acidic proteins were purified by Sephadex chromatography. Maximum levels of bound radioactivity were present in liver histones at 30 to 60 min and in liver nuclear acidic proteins at 60 to 90 min after a single injection of carcinogen. Significant amounts of radioactivity were associated with liver DNA in all experiments. Under the experimental conditions, the hepatocarcinogens N-HO-FAA- ^{14}C and DAB- ^{14}C were bound preferentially to liver histone fractions F2a1 and F2a2, whereas administration of DMBA- ^3H led to the preferential radioactive labeling of the liver histones F1 and F2b. There appeared to be some specificity of carcinogen binding by the nuclear proteins, because pretreatment of rats with nonradioactive carcinogen significantly reduced the extent of labeling after injection of the chemically identical radioactive carcinogen. Pretreatment with nonradioactive carcinogen that was chemically different from the injected radioactive carcinogen did not markedly alter uptake of radioactivity observed without pretreatment.

- 4376 ENHANCEMENT OF URINARY BLADDER TUMORIGENESIS IN HAMSTERS BY COADMINISTRATION OF 2-ACETYLAMINOFLUORENE AND INDOLE. (E.) Oyasu, R. (Northwestern U. Med. Sch., Chicago, Ill.), T. Kitajima, M. L. Hopp and H. Sumie. *Cancer Res* 32(10):2027-2033, 1972.

Hamsters treated with 2-acetylaminofluorene (AAF) were studied to test the effects of dietary indole and excess DL-tryptophan and the initial age of the animals on the development of bladder tumors. Neonatal males and females were given i.p. injections of AAF, 5 mg/100 g body weight, three times weekly until weaning. They were then fed a synthetic diet containing AAF with or without 1.6% indole or 2.0% DL-tryptophan. Enhancement of tumorigenesis in the urinary bladder was evident only when indole was added to the diet containing a low dose of AAF (0.03%). Twenty-four of 27 hamsters fed the combination diet for ten months developed tumors (89%); 20 of them were invasive. On the other hand, 13 of 26 on the diet containing AAF alone developed bladder tumors (50%); eight of them were invasive. The difference in incidence was significant ($p < 0.01$). Development of bladder tumors appeared slightly delayed when older hamsters (initially 4 wk old) were used, but after 11 months all animals developed bladder tumors. As was observed in rats, added indole or tryptophan protected the liver from AAF injury and greatly reduced the development of cholangiocarcinomas.

- 4377 THE CARCINOGENICITY OF INTRAVENOUS NICKEL CARBONYL IN RATS. (E.) Lau, T. J. (U. Connecticut Sch. Med., Farmington), R. L. Hackett and F. W. Sunderman, Jr. *Cancer Res* 32(10):2253-2258, 1972.

The carcinogenicity of i.v. nickel carbonyl, $\text{Ni}(\text{CO})_4$, was tested in Sprague-Dawley rats. In 72 rats (Group A) that survived a single 50% lethal dose injection of $\text{Ni}(\text{CO})_4$ (2.2 mg nickel per 100 g), the incidence of malignant tumors (8.3%) was not significantly greater than the incidence in 47 rats in the control group (4.3%). In 121 rats (Group B) that survived six 5% lethal dose injections of $\text{Ni}(\text{CO})_4$ (0.9 mg nickel per 100 g) at intervals of two or four weeks, the incidence of malignant tumors (15.7%) was significantly greater than in the controls ($p < 0.05$). The 19 malignant tumors in Group B included six undifferentiated sarcomas (lung, pleura, liver, pancreas, uterus, and abdominal wall), three fibrosarcomas (neck, pinna, and orbit), three carcinomas (liver, kidney, and breast), one s.c. hemangioendothelioma, one leukemia, and five lymphomas (lung). This study demonstrates that multiple parenteral injections of $\text{Ni}(\text{CO})_4$ can induce diverse malignant tumors in varied organs and tissues of the rat.

- 4378 THE EFFECT OF VITAMIN A ACID ON GLYCOPROTEIN SYNTHESIS IN SKIN TUMORS (KERATOACANTHOMAS). Levinson, S. S. (Dept. Nutrition Food Sci., Massachusetts Inst. Technol., Cambridge) and G.

Wolf. *Cancer Res* 32(10):2248-2252, 1972.

The metaplasia of rabbit ear skin tumors (keratoacanthomas to mucus-secreting tissue in response to topical application of vitamin A acid [retinoic acid (RA)] was explored biochemically. A 48-hr application of RA stimulated glucosamine- ^{14}C and fucose- ^3H uptake into glycoprotein 5- to 10-fold. The glycoprotein was converted to glycopeptides by proteolytic digestion and was fractionated stepwise on diethylaminoethyl Sephadex A-50. While the uptake of fucose- ^3H was near zero in the 0.2 N fraction from untreated tumors, it was about 1400 dpm/mg (wet weight of tissue) in the equivalent fraction from RA-treated tumors. Glucosamine- ^{14}C uptake into this 0.2 N fraction was stimulated 2- to 3-fold. The effect cannot result from changes in precursor pool size, since other glycopeptide fractions increased only slightly or decreased upon RA treatment. Further purification of the fraction on Sephadex G-75 yielded several glycopeptide components, only one of which showed fucose- ^3H uptake when taken from RA-treated tumors. This component showed a single, symmetrical, ^{14}C , ^3H -labeled peak when rechromatographed on Sephadex G-75 and Sephadex G-50. A time study demonstrated considerable stimulation of isotope uptake into glycoproteins only 4 hr after RA treatment. Radioautography demonstrated that the radioactivity taken up on RA stimulation was in the squamous and connective tissue cells and not in the leukocytes.

- 4379 TOXIC RESPONSE OF RATS TO CYCLAMATES IN CHOW AND SEMISYNTHETIC DIETS. (E.)

Friedman, L. (Bureau Foods, Food Drug Admin., Washington, D.C.), H. L. Richardson, M. E. Richardson, E. J. Lethco, W. C. Wallace and F. M. Sauro. *J Nat Cancer Inst* 49:751-764, 1972.

Cyclamates were fed to rats in two independently conducted studies. In study one, sodium and calcium cyclamate in commercial chow diets were fed, at dietary levels from 0.4-10%, to male and female weanling Osborne-Mendel rats for 101 weeks; in study two, 1 and 2% calcium cyclamate in semisynthetic diets containing 10 and 20% casein were fed to male weanling Holtzman rats for 75 weeks. In both studies, adverse reactions were noted. With the semisynthetic diet, growth rate was depressed, soft stools were produced, and the rate of kidney and urinary bladder lesions was increased. These adverse reactions did not appear to be affected by the protein content of the diet. No observed cytogenetic damage was produced by calcium cyclamate ingestion. With the chow diet, survival decreased and urinary bladder and kidney lesions increased; this increase was much more marked in severity and incidence than that with the semisynthetic diets. The lesions noted with the highest frequency in the kidneys were nephrocalcinosis and calyceal polypoidosis, and in the urinary bladder, epithelial hyperplasia, thickening or edema of the urinary bladder wall, and mucosal papilloma. Transitional cell carcinoma with varying degrees of invasion was detected in the urinary bladders of three of the 23 rats receiving calcium cyclamate in

the chow diets. Two of these carcinomas were in rats fed diets containing only 0.4% of this compound. Bladder calculi were also occasionally present and were in two of the bladders with carcinomas. These lesions were not seen in any rats fed control diets.

4380 INHIBITION OF RAT LIVER RIBONUCLEIC ACID POLYMERASE BY THE CARCINOGEN *N*-HYDROXY-2-FLUORENYLACETAMIDE. (E.) Zieve, F. J. (VA Hosp., Minneapolis, Minn.). *J Biol Chem* 247(18):5987-5995, 1972.

A single i.p. injection of the carcinogenic arylhydroxamic acid *N*-hydroxy-2-fluorenylacetamide given to male rats inhibited the two RNA polymerase activities of isolated liver nuclei by as much as 80%. Low doses of the carcinogen inhibited the Mg^{2+} -dependent polymerase activity preferentially; high doses inhibited the $Mn^{2+} + (NH_4)_2SO_4$ -dependent activity to a greater extent. Inhibition was detectable 15 min after injection of the compound and was maximal in 1 hr. Several related noncarcinogenic compounds and carcinogenic arylhydroxamic acids which were inactive toward the liver completely lacked the inhibitory effect shown by *N*-hydroxy-2-fluorenylacetamide. Female rats, which develop few liver tumors on administration of *N*-hydroxy-2-fluorenylacetamide, were refractory to the inhibition of liver RNA polymerase by this compound. The depression of RNA synthesis by *N*-hydroxy-2-fluorenylacetamide was not due to decreased permeability of the nuclear membrane to substrates, nor to increased hydrolysis of newly synthesized RNA. Similar types of RNA were made in the control and treated rats, and the template capacities of liver chromatin and DNA were not affected by the carcinogen. These data suggest that the inhibition of RNA synthesis by *N*-hydroxy-2-fluorenylacetamide is due to inactivation of the RNA polymerases and not to decreased availability of DNA for transcription.

4381 MUTAGENICITY OF *N*-NITROSOPIPERAZINES FOR *SALMONELLA TYPHIMURIUM* IN THE HOST-MEDIATED ASSAY. (E.) Zeiger, E. (Genetic Toxicol. Branch, Food Drug Admin., Washington, D.C.), M. S. Legator and W. Lijinsky. *Cancer Res* 32:1598-1599, 1972.

Salmonella typhimurium was injected into the peritoneal cavities of mice prior to i.m. inoculation with 1-nitroso-, 1,4-dinitroso-, or 1-nitroso-4-methylpiperazine. These agents were not mutagenic when tested directly against *S. typhimurium* without mediation by a host for the microorganism. In the host-mediated system, however, the three compounds were mutagenic for *S. typhimurium*, as evidenced by increases in his g-46 reversion frequencies in mice given the compounds. The mutagenicity of the nitrosopiperazines in the host-mediated system was apparently a function of the metabolism of nitrosamines.

4382 ROLE OF OVARIAN HORMONES IN MAMMARY TUMORIGENESIS BY A CONTINUOUS ORAL ADMINISTRATION OF *N*-NITROSOBUTYLUREA IN WISTAR/FURTH RATS. (E.) Takizawa, S. (Res. Inst. Nuclear Med. Biol., Hiroshima U., Japan) and T. Yamasaki. *Gann* 62(6):485-493, 1971.

Mammary tumors, mostly adenocarcinoma, were successfully induced in young female rats of Wistar/Furth (W/Fu) strain by a continuous oral administration of *N*-nitrosobutylurea (NBU) in a daily dose of 2.5 or 5 mg per rat, with a relatively short latent period ranging from 6 to 8 months. A larger dose of NBU (10 mg per day) caused marked suppression in body growth, estrous cycle, and the induction rate of mammary tumors. Ovariectomy prior to NBU treatment also abolished the mammary tumorigenic effect of NBU, while orchidectomy was apparently not effective in eliciting mammary tumor in male rats. Restoration of mammary tumor development was attained in castrated rats of both sexes either by supplemental treatment of biweekly injections of 0.4 mg of progesterone and 0.01 mg of estradiol benzoate combined, or by ovarian isograft implanted under the kidney capsule. There was a slowdown in the restoration of mammary tumor development in the ovariectomized and hormone-treated rats as compared to the male counterparts. Nevertheless, shortly after the cessation of hormone treatment in the 7th month after the beginning of NBU treatment, there occurred a rapid increase in induction rate of mammary tumors in the ovariectomized and hormone-treated rats. The castrated male rats were found to be a useful tool for testing the mammary tumorigenicity of unknown agents, if conditioned adequately with ovarian hormones, by their excellent productivity of mammary tumors in terms of incidence, multiplicity, and growth rate of the tumor.

4383 EXPERIMENTAL INDUCTION OF EPIDERMOID CARCINOMA IN THE LUNGS OF RATS BY CIGARETTE SMOKE CONDENSATE. (E.) Stanton, M. F. (Nat'l. Cancer Inst., Bethesda, Md.), E. Miller, C. Wrench and R. Blackwell. *J Nat Cancer Inst* 49(3):867-877, 1972.

Epidermoid carcinomas and preneoplastic lesions characterized by keratinizing squamous metaplasia were induced in the lungs of female, Osborne-Mendel rats by direct injection into the lung of 0.05-0.10 ml warm, liquefied beeswax containing either crude cigarette smoke condensate (CSC) or heptane soluble fraction (HSF) of this condensate. Control pellets containing beeswax and tricaprillin or beeswax and either anthracene, unburned cigarette tobacco, or cigarette ash were enveloped by non-reactive epithelial tissue in a mild granulation tissue stroma. Beeswax pellets containing either CSC or HSF were enveloped by metaplastic epithelium in 45 of 55 rats dying the 1st year after implantation. During the 2d year, 106 of the 303 remaining rats died. Of these, 44 had metaplastic lesions and 31 had epidermoid carcinomas at the pellet site. No dose-response relationship was noted over the relatively narrow range of 12-72

mg HFE used. The consistently high incidence of neoplasms induced by the condensate of < 5 cigarettes indicates a highly sensitive system for study of the carcinogenicity of various CSC fractions. The metaplastic response, which develops within four weeks at the pellet site, may be of further value in the rapid assessment of tobacco products and other materials potentially carcinogenic for the lung.

- 4384 AUTORADIOGRAPHIC STUDY ON LOCALIZATION OF FIBRINOGEN IN RABBIT LUNG CANCER. (E.) Ogura, T. (Osaka U. Med. Sch., Japan), F. Hirao, E. Tsubura and Y. Yamamura. *Gann* 62(5):367-372, 1971.

The distribution of ^{131}I -labeled fibrinogen was studied by macro- and micro-autoradiography in ten rabbits bearing lung cancer induced by intra-bronchial infusion of 3-methylcholanthrene and 4-nitroquinoline 1-oxide or 3-methylcholanthrene alone. The localization of fibrinogen was invariably observed in the non-cancerous pulmonary tissues around and adjacent to the induced cancer tissues, irrespective of histological type of cancer tissues. However, the localization of fibrinogen in cancer tissue itself was observed in a few rabbits and it was observed limitedly in the interstitial spaces and desquamated cells. The extrapulmonary tumors by the transpleural invasion of the induced cancer showed the most preferential localization of fibrinogen. It is concluded that fibrinogen localization in and around the cancer tissue of rabbits resulted from deposition in cancer tissue itself and an interaction of tumor tissues with the host. It is postulated that similar events would occur in human patients with lung cancer because no distinct difference lies in macro- and microscopic findings of lung cancer between humans and rabbits.

- 4385 HISTOPATHOLOGICAL AND ULTRASTRUCTURAL STUDIES ON ESOPHAGEAL TUMORS IN RATS TREATED WITH N-NITROSOPIPERIDINE. (E.) Ito, N. (Nara Med. U., Japan), Y. Kamamoto, Y. Hiasa, S. Makiura, M. Marugami, Y. Yokota, S. Sugihara and K. Hirao. *Gann* 62(6):445-451, 1971.

The histogenesis of esophageal tumors in male Wistar strain rats on oral administration of 0.03% N-nitrosopiperidine was studied by light and electron microscopy. Hyperplasia of the esophageal epithelium was seen within 4 wk and papilloma within 8 wk. Cancer developed after 12 wk administration of N-nitrosopiperidine. After administration of N-nitrosopiperidine for 20 wk, 9 of 11 rats (81.8%) had developed esophageal cancer. Histologically, the esophageal cancer in rats induced by N-nitrosopiperidine was a squamous cell carcinoma, which was rich in cornification and closely resembled those produced in the esophagus on administration of other chemical carcinogens. No adenocarcinoma or benign neoplasia of the esophagus was observed. Histological changes in the esophageal epithelium

increased in frequency and extent with the period of administration of N-nitrosopiperidine. The present investigation suggests that hyperplasia is a precursor of esophageal carcinoma in rats administered with N-nitrosopiperidine but that cornification and hyperkeratosis of the esophageal epithelium were not significantly preneoplastic changes.

- 4386 LIVER MICROSOMAL METABOLISM OF AFLATOXIN B_1 TO A REACTIVE DERIVATIVE TOXIC TO *SALMONELLA TYPHIMURIUM* TA 1530. (E.) Garner, R. C. (U. Wisconsin Med. Ctr., Madison), E. C. Miller and J. A. Miller. *Cancer Res* 32:2058-2066, 1972.

A reduction in the survival of *Salmonella typhimurium* TA 1530 was observed when the bacteria were incubated with aflatoxin B_1 , rat liver microsomes, and a reduced nicotinamide adenine dinucleotide phosphate-generating system. The lethality appeared to depend on the formation of a metabolite of aflatoxin B_1 by a mixed-function oxygenase system. The killing was very rapid; only 1% of the bacteria were able to form colonies after 2 min of incubation with large amounts of microsomes and aflatoxin B_1 . Attempts to separate the toxic metabolite from the microsomal system were not successful. Toxic metabolites for *S. typhimurium* TA 1530 were also formed if aflatoxin B_1 was replaced by either aflatoxin G_1 or sterigmatocystin in the microsome-mediated toxicity assay. Except for aflatoxin G_1 , the derivatives that were tested either had much less activity or were inactive. The livers from a number of other species of rodents and a single autopsy sample of human liver also were active in the microsome-mediated aflatoxin B_1 toxicity assay. The addition of RNA or DNA to the incubation mixture inhibited the killing of the bacteria. The RNA (which was reisolated after its incubation with aflatoxin B_1), liver microsomes, and a reduced nicotinamide adenine dinucleotide phosphate-generating system showed a low, broad absorption, with a maximum at 366 to 370 nm. This high wavelength absorption was not removed by Sephadex G-10 chromatography of the RNA or by extraction procedures and appeared to be attributable to covalently bound aflatoxin B_1 derivative(s). The formation of the conjugated RNA was dependent on reduced nicotinamide adenine dinucleotide phosphate and was inhibited by the addition of aniline; the amount formed was a function of the activity of the mixed-function oxygenases in the incubation mixture. It is tentatively suggested that the derivative that is toxic to *S. typhimurium* TA 1530 and the one that reacts with nucleic acids are identical. The possible relationship of this derivative to the hepatocarcinogenicity of aflatoxin B_1 is discussed.

- 4387 LYMPHATIC LEUKEMIA AND PULMONARY TUMORS IN FEMALE SWISS MICE FED BRACKEN FERN (*PTERIS AQUILINA*). (E.) Pamukcu, A. M. (Coll. Vet. Med., U. Ankara, Turkey), E. Ertük, J. M. Price and G. T.

Bryan. *Cancer Res* 32:1442-1445, 1972.

Forty Swiss mice were fed a mixture of grain diet and bracken fern (two parts grain to one part bracken) on alternate weeks for 60 weeks, for a total mean maximum dose of 315 g bracken/mouse. All of the 33 mice surviving more than 30 weeks developed lymphatic leukemia involving lymph nodes, kidney, liver and lungs. No mice given grain diet alone without bracken fern developed leukemia. In addition, five of the surviving experimental mice developed multiple primary lung tumors. Though bracken fern has been associated with urinary bladder and intestinal tumorigenesis, neither bladder nor intestinal tumors were seen in bracken-fed mice in these experiments.

4388 URINARY EXCRETION OF FREE AND CONJUGATED FORMS OF 3-HYDROXYANTHRANILIC ACID.

(E.) Watanabe, M. (Natl. Inst. Hyg. Sci., Tokyo, Japan), K. Minegishi and Y. Tsutsui. *Cancer Res* 32(10):2049-2053, 1972.

Urinary excretion of free and conjugated forms (glucuronide and sulfuric ester) of 3-hydroxyanthranilic acid, a metabolite of tryptophan which is suspected to have carcinogenic action, was studied. The patterns of excretion of these three substances in the urine of humans, rats, and guinea pigs were determined by fluorometry. The conjugated forms were estimated after separation by stepwise elution from diethylaminoethyl Sephadex column chromatography and thin-layer chromatography. Hydrolysis of these conjugated forms added to the urine was also studied. The patterns of urinary excretion of these compounds change markedly in different animal species. The compounds excreted were mainly a nonconjugated form in humans, the sulfuric ester in rats, and the glucuronide in guinea pigs. When tryptophan was administered, the nonconjugated form increased mainly in humans while the sulfuric ester increased mainly in rats. No marked increase of the metabolites was found in guinea pigs. On the other hand, there was no significant decrease in the conjugated forms that were added to the urines, except in the case of the glucuronide in rat urine.

4389 ABSENCE OF STAINABLE IRON FROM PRENEOPLASTIC AND NEOPLASTIC LESIONS IN RAT LIVER WITH 8-HYDROXYQUINOLINE-INDUCED SIDEROSIS. (E.)

Williams, G. M. (Natl. Cancer Inst., Bethesda, Md) and R. S. Yamamoto. *J Nat Cancer Inst* 49(3):685-692, 1972.

Detailed comparative studies were conducted on the progressive increase in stainable iron deposition in normal, preneoplastic, and neoplastic tissues of rats fed diets containing 8-hydroxyquinoline (HQ), with or without further supplements of iron as ferrous gluconate (FG). HQ induced hepatic iron deposition and this was enhanced by FG at all time points. However, even very minimal liver lesions induced by the hepatocarcinogens diethylnitrosamine or N-2-

fluorenylacetamide, barely recognizable by standard hematoxylin and eosin staining techniques, stood out clearly because they did not accumulate stainable iron like the adjoining hepatocytes. Hepatic hyperplastic and neoplastic lesions of increasing severity seen during continuing carcinogen treatment characteristically did not exhibit siderosis. Thus iron stains in the livers of rats fed HQ and FG permit the sensitive and reliable detection of early hyperplastic or neoplastic lesions. Rats ingesting HQ in addition to the carcinogens had a lower incidence of hepatic malignancy.

4390 MAMMARY CARCINOGENESIS IN FEMALE AND MALE MICE RECEIVING CONTRACEPTIVES OR GESTAGENS.

(E.) Rudali, G. (Curie Fdn., Inst. Radium, Paris, France), E. Coezy and R. Chemama. *J Nat Cancer Inst* 49(3):813-819, 1972.

Three widely used estrogen-progestin mixtures (Enovid, Ovulen, and Lutestral) and their gestagens were investigated as potential carcinogens in the mammary gland of C3H, RIII, and (C3H X RIII)_{F1} intact female mice. The various contraceptives, despite their estrogen content, did not accelerate or raise the frequency of mammary carcinogenesis in these animals. Norethynodrel and chlormadinone acetate significantly delayed the appearance of the tumors. All three contraceptives produced, with a high rate and after short latencies, mammary cancers in castrated (C3H X RIII)_{F1} males. Norethynodrel was as potent as mestranol. Chlormadinone acetate did not produce mammary cancers in these males. Some castrated control males developed spontaneous mammary carcinomas late in life, probably induced by adrenal secretions. The castrated male mouse of susceptible strains seems promising material for the establishment of a potential carcinogenic risk for the mammary gland.

4391 RETICULOSES AND EPIDERMAL TUMORS IN HAIRLESS MICE AFTER TOPICAL SKIN APPLICATIONS OF CANTHARIDIN AND ASIATICOSIDE. (E.)

Laerum, O. D. (Inst. Gen. Exp. Path., U. Oslo, Norway) and O. H. Iversen. *Cancer Res* 32:1463-1469, 1972.

Hr/hr hairless mice were given 3-methylcholanthrene (MCA) by topical painting 14 days before the start of a lifelong course of painting with 0.016% cantharidin dissolved in benzene. Other mice were painted with cantharidin alone, MCA and lifelong 0.1% asiaticoside, asiaticoside alone, or MCA and benzene. Cantharidin in benzene was a weak but complete carcinogen; mice given cantharidin and MCA developed squamous carcinomas in 7.1% of cases and mice given cantharidin alone developed carcinomas in 6.3% of cases. Benzene after MCA gave a 2.9% carcinoma incidence. Asiaticoside after MCA produced sarcomas of the dermis in 3.4% of mice; asiaticoside alone produced a 2.5% sarcoma incidence. In mice given cantharidin and MCA, carcinomas developed after 16 months of observation. Prior to carcinoma appearance, mice given cantharidin and MCA had a

lower incidence of skin papillomas than mice given MCA and benzene. This suggested that in the early stages of painting, cantharidin inhibited tumor growth. On autopsy, it was found that mice given cantharidin and MCA had developed reticuloses and malignant lymphomas in 56% of cases, while the incidence of these tumors in mice given MCA and benzene was 25%. Cantharidin alone, and MCA and asiaticoside, produced reticuloses and lymphomas in 28% of cases. Cantharidin apparently penetrated the skin to cause reticuloendothelial system tumors in treated mice.

- 4392 SYSTEMIC PROMOTING ACTION OF PHORBOL IN LIVER AND LUNG CARCINOGENESIS IN AKR MICE. (E.) Armuth, V. (Weizmann Inst. Sci., Rehovot, Israel) and I. Berenblum. *Cancer Res* 32(10):2259-2262, 1972.

Newborn male and female AKR mice receiving a single s.c. injection of dimethylnitrosamine (DMN) and, after a 2-wk interval, repeated i.p. injections of phorbol, developed lung adenomas and hepatomas in a high percentage of survivors. When a higher dose of DMN was injected into 10-day-old AKR mice with subsequent phorbol treatment, the incidence of lung adenomas and hepatomas was low; while no such tumors appeared in the untreated mice or in those receiving phorbol alone, and very few tumors appeared in the DMN control mice. The results thus demonstrate a pronounced promoting action by phorbol on lung and liver carcinogenesis provided that the initiating stimulus (by DMN) was given soon after birth. Phorbol, whether administered alone or after initial treatment with DMN, failed to increase the spontaneous incidence of thymic leukemia.

- 4393 RIBOSOME MONOMERS IN RAT LIVER FOLLOWING ADMINISTRATION OF DIMETHYLNITROSAMINE. (E.) Vernie, L. N. (Netherlands Cancer Inst., Amsterdam), W. S. Bont and P. Emmelot. *Cancer Res* 31:2189-2195, 1971.

Adult rats were injected i.v. with 50 mg/kg of dimethylnitrosamine (DMNA). Five hr later, the rats were killed, their livers were removed, and free and membrane-bound liver polyribosomes were isolated. Polyribosome preparations were subjected to sucrose gradient centrifugation. DMNA administration led to a marked increase in the 77S ribosomes present in free and membrane-bound polyribosome preparations. The 77S particles were not labeled by radioactive amino acid *in vivo*, and their presence in the membrane-bound polyribosomes appeared to be mainly artifactual. When 77S particle-containing polyribosome fractions were applied to Sephadex G-25 and eluted with buffer containing 0.5 mM Mg^{++} , most sedimenting material appeared as 59S particles. In this, the 77S ribosomes resembled "runoff" ribosomes, i.e., ribosomes released from normal polyribosomes *in vitro* under conditions of amino acid incorporation at $(Mg^{++}) < 7mM$. The inhibition of amino acid incorporation in polyribosomal preparations

from DMNA-treated liver was a function of the amount of 77S ribosomes in these preparations. It was concluded that DMNA causes accumulation of runoff type ribosome monomers in the liver at the expense of polyribosomes which otherwise function normally in amino acid incorporation.

- 4394 COORDINATED BIOCHEMICAL AND MORPHOLOGIC EXAMINATION OF HAMSTER TRACHEAL EPITHELIUM. (E.) Kaufman, D. G. (Natl. Cancer Inst., Bethesda, Md.), M. S. Baker, C. C. Harris, J. M. Smith, H. Boren, M. B. Sporn and U. Saffiotti. *Nat Cancer Inst* 49(3):783-792, 1972.

A respiratory epithelium of the hamster was examined by autoradiographic and biochemical techniques. Normal morphology was preserved in tracheas maintained *in vitro* for up to 3 hr. Biochemical analyses could be performed on epithelial cells obtained from the tracheal segments. Maintenance of isolated tracheal segments *in vitro* permitted far greater incorporation of radioactively labeled precursors as compared to administration *in vivo*. 3H -5-uridine was incorporated into high molecular weight RNA *in vitro* and "maturation" of ribosomal RNA species occurred *in vitro*. Biochemical events were correlated with cell type by concurrent quantitative autoradiography. Basal cells incorporated less 3H -5-uridine than mucous or ciliated cells. Correlated biochemical and morphologic study may be a means of evaluating biochemical changes in the presence of altered cell populations after carcinogen administration.

- 4395 REPAIR MECHANISM IN SENDAI VIRUS CARRYING HeLa CELLS AFTER DAMAGE BY 4-HYDROXYAMINO-QUINOLINE 1-OXIDE. (E.) Satoh, T. (Temple U. Sch. Med., Philadelphia, Pa.) and N. Yamamoto. *Cancer Res* 32(2):440-443, 1972.

HeLa cells infected with Sendai virus (HJV) and established as a carrier culture (HeLa HJV) were treated with 4-nitroquinoline 1-oxide (4NQO) or its metabolite, 4-hydroxyaminoquinoline 1-oxide (4HAQO). Cellular "inactivation" (measured by colony-forming ability seven days after treatment) and diaphorase activity (assayed spectrophotometrically) were determined. Both HeLa and HeLa (HJV) cells demonstrated similar diaphorase activity, indicating that both types were capable of producing the same amounts of 4HAQO from 4NQO. Incubation in 4HAQO (10 μM) for periods required for 10- to 100-fold inactivation of HeLa cells caused only 30-60% inactivation of HeLa (HJV) cells. This result was similar to the previously reported UV- and 4NQO-sensitivities of these cells and indicated that HeLa (HJV) cells have a greater capacity to repair damaged genomes than HeLa cells. When HeLa and HeLa (HJV) cells were incubated one hr at 37 C with 4HAQO (10^{-5} to 10^{-6} M), colony-forming ability decreased as 4HAQO concentration increased. HeLa (HJV) cells were again more resistant to 4HAQO than HeLa cells. The reparability of 4HAQO-damaged (1.0 μM) herpes simplex virus (HSV) was determined by plaque assay in HeLa and HeLa (HJV) cells. Incubation periods required for 10- to 100-fold inactivation of HSV

assayed on HeLa cells produced 3- to 10-fold inactivation on HeLa (HJV) cells, indicating that HeLa (HJV) cells are also more effective than HeLa cells in repairing foreign genomes.

- 4396 TRANSFORMATION OF HUMAN EMBRYO LUNG CELLS BY THE ACTION OF URETHANE AND INFLUENZA VIRUS. (E.) Frolov, A. F. (Res. Inst. Epidemiol. Microbiol. Parasitol., Kiev, USSR), A. M. Shcherbinskaya and N. E. Botsman. *Folia Biol* 17(6):421-423, 1971. 421-423, 1971.

Organ cultures of human embryonic lung were exposed to 2.0% urethane ethyl carbamate No. 13978 (24 hr) or infected with influenza virus type A2, strain 2260 (two hr) or were exposed to urethane followed by virus infection. Explants were stained and examined for morphological transformation 6, 12 and 15 days after the beginning of the experiment. Thirteen of 20 untreated explants became necrotic after one wk of cultivation and by 15 days signs of necrosis were evident throughout the whole explant. Diffuse cellular proliferation occurred primarily around the margins of the explants during the first days. Necrosis of explants treated with urethane was accelerated compared with controls but the patterns were essentially identical. Urethane not only induced diffuse proliferative changes like those seen in controls, but also caused formation of separate foci of hyperplastic tissue consisting of cells with oval or ring-shaped and, in some cases, hyperchromic nuclei. Virus infection induced proliferative changes which were evident after the 15th day. Foci of small polymorphic cells with hyperchromic nuclei were observed. Alveolar and bronchial lumens became filled with proliferating cells and eosinophilic masses. Mitotic anomalies were observed which, together with the changes in cell morphology, were interpreted as anaplasia. Combined treatment with urethane and influenza virus produced an accentuated hyperplastic response. Inter-alveolar partitions became thickened, proliferating alveolar cells filled bronchial and alveolar lumens, and normal pulmonary morphology was destroyed. Papillomatous structures consisting of large polymorphic cells were seen up to the 20th day. Cell "anaplasia" was common.

- 4397 ESTIMATION OF INTERSTRAND DNA CROSS-LINKING RESULTING FROM MUSTARD GAS ALKYLATION OF HeLa CELLS. (E.) Ball, C. R. (Sch. Med., Leeds, England) and J. J. Roberts. *Chem Biol Interact* 4(4):297-303, 1972.

An isopycnic gradient technique was used to quantitatively estimate the degree of intrastrand cross-linking of DNA in cultured HeLa cells resulting from treatment with the difunctional alkylating agent mustard gas. HeLa cells were grown in medium containing a density label (BUdR, 5 µg/ml, 20 hr) or in medium containing BUdR (three hr) followed by medium containing ³H-thymidine (³HTdR) and fresh BUdR (three hr), followed by incubation in medium containing fresh BUdR (one hr). The cells were then treated with mustard gas (0.1%, v/v) in methanol

or methanol only (control) for 30 min. Finally, DNA was isolated and analyzed by alkaline CsCl equilibrium density gradient centrifugation. DNA from 20 hr BUdR-labeled cells showed two peaks on CsCl gradients, one corresponding to the "light" template strand and one to the "heavy" newly synthesized strand. Treatment of these cells with mustard gas produced a third peak of intermediate density, which resulted from formation of covalent bonds between the "light" and "heavy" strands. A quantitative estimation of the degree of mustard gas-induced cross-linking was achieved by labeling the "heavy" newly synthesized DNA with a pulse of ³H-TdR. Under these conditions only cross-linked DNA strands and nonlinked "heavy" strands were radioactive. The relationship between mustard gas concentration and the extent of DNA cross-linking was investigated. The degree of cross-linking was calculated from the difference in areas under the plotted radioactivity curves between controls and mustard gas-treated cells. The amount of DNA cross-linking was linear for mustard gas concentrations between 0.5 µg/ml (9% cross-linking) and 2.0 µg/ml (35% cross-linking). This method was relatively insensitive for mustard gas concentrations less than 0.05 µg/ml due to shearing of DNA molecules during the phenol extraction.

- 4398 ALTERED MORPHOLOGY AND BEHAVIOUR OF KIDNEY FIBROBLASTS *IN VITRO*, FOLLOWING *IN VIVO* TREATMENT OF RATS WITH A CARCINOGENIC DOSE OF DIMETHYLNITROSAMINE. (E.) Hard, G. C. (Toxicol. Unit., Med. Res. Council Labs, Carshalton, England), R. Borland and W. H. Butler. *Experientia* 27:1208-1209, 1971.

Increase in cell size, nuclear size and number, abnormalities of mitochondria and nucleoli, and abnormal cells with cytoplasm filled with randomly arrayed microfilaments are characteristics of transformed fibroblast-like cells which initiate mesenchymal tumors and which may be found in persisting inflammatory lesions *in vivo* as early as 3 wk following dimethylnitrosamine (DMN) treatment of rats. To determine if similar changes occur *in vitro*, male Wistar rats fed sucrose and water for three days were injected i.p. with 60 mg/kg DMN. Renal cortical tissue was removed and cultured after seven days, and the cytological characteristics were compared with those of renal cortical cells cultured from normal controls. Fourteen days after initiation, control cultures consisted mainly of groups of epithelial cells surrounded by fibroblastic cells, while cultures from DMN-treated rats showed clusters of piled-up fibroblastic cells growing in disarray. Cells and their nuclei displayed considerable pleomorphism and nucleoli were enlarged. Some cells were multinucleate and abnormal mitoses were seen. Cells with retracted cytoplasm appeared to be detaching from cytoplasm of larger, multinucleated cells within the clusters. Electron microscopic observations confirmed the morphological alterations seen under light microscope. In addition, nucleolar fragmentation and cytoplasm filled with sheets of microfilaments were observed. These observa-

tions suggest that the cytological characteristics of cultured renal tissue from DMN-treated rats could be due to unimpeded *in vitro* development of cells transformed *in vivo*.

- 4399 TUMOUR FORMATION IN MICE BY URETHANE ADMINISTERED WITH RELATED CARBAMATES. (E.) Pound, A. W. (Dept. Path., U. Queensland, Brisbane, Australia). *Brit J Cancer* 26(3):216-225, 1972.

A tumor initiating dose of ethyl carbamate was administered to mice by s.c. injection together with a dose of one of the homologous esters or an ethyl N-alkyl derivative. The homologues used were the methyl, *n*-propyl and *n*-butyl esters, and the derivatives were the N-methyl, N-ethyl and N-*n*-propyl ethyl esters. The mice were then given promoting treatment with croton oil for 28 weeks. Neither the homologous esters nor the N-substituted derivatives of ethyl carbamate had any influence on the yield of tumors in the skin, lung, or liver. However, increasing the dose of ethyl carbamate increased the yields of tumors.

- 4400 DNA BINDING AND INHIBITION OF DNA SYNTHESIS AFTER 7,12-DIMETHYLBENZ(a)ANTHRACENE ADMINISTERED DURING THE EARLY PREREPLICATIVE PHASE IN REGENERATING RAT LIVER. (E.) Marquardt, H. (Sloan-Kettering Inst. Cancer Res., New York, N. Y.), F. S. Philips and A. Bendich. *Cancer Res* 32:1810-1813, 1972.

7,12-Dimethylbenz(a)anthracene (DMBA), given i.v. 24 hr after partial hepatectomy when DNA replication is maximal, binds tightly to DNA, inhibits its synthesis, and induces neoplastic changes in regenerating rat liver. DMBA injected i.v. 5 hr after partial hepatectomy (*i.e.*, during the early prereplicative phase) inhibits DNA synthesis for at least 48 hr. The amount of tritiated DMBA bound to DNA by 11 hr equals the maximum amount found in intact rat liver; however, from 11 to 24 hr the amount bound to DNA increases 2- to 3-fold (in untreated regenerating rat liver, DNA synthesis begins 16 hr after partial hepatectomy). In the small intestine, in which DNA synthesis is continuous and relatively constant in rate, the amount of DMBA bound to DNA is maximal by 11 hr. The amount of DNA-bound benz(a)anthracene given i.v. 5 hr after partial hepatectomy decreases from 11 to 24 hr. Binding of DMBA in regenerating rat liver persists for at least four weeks; in small intestine the amount of DNA-bound carcinogen decreases at a rate suggesting loss by cell renewal. It appears that, on entry into the replicative phase, DNA becomes more susceptible to binding and the bound carcinogen persists in surviving cells.

- 4401 ANTIGENIC DIVERSITY OF TUMORS CHEMICALLY INDUCED WITHIN THE PROGENY OF A SINGLE CELL. (E.) Basombrio, M. A. (Inst. Cancer Res., Philadelphia, Pa.) and R. T. Prehn. *Int J Cancer* 10:1-8, 1972.

BALB/c 3T3 mouse cells were cloned and cells from

different clonal sublines were placed in diffusion chambers with 3-methylcholanthrene (MCA) and implanted into abdomens of thymectomized, X-irradiated BALB/cCR mice. Of 47 mice given diffusion chambers containing MCA-transformed clonal cells, 23 developed tumors. The antigenic characters of these tumors were determined by immunizing mice with cells of different tumors and challenging recipients with tumor cells. Results showed that tumors induced by the various transformed cloned cells had different antigenic determinants, even though all tumors had been derived from the same cell. It was concluded that the antigenic diversity of chemically induced tumors could not be explained solely on the basis of cloning pre-existing variants.

- 4402 PLASMA PROTEIN SYNTHESIS BY N-2-FLUORENYLACETAMIDE-INDUCED PRIMARY HEPATOCELLULAR CARCINOMAS AND HEPATIC NODULES. (E.) Becker, F. F. (New York U. Sch. Med., N.Y.), K. M. Klein and R. Asofsky. *Cancer Res* 32(5):914-920, 1972.

Hepatic nodules and hepatocellular carcinomas were induced in rat livers by the ingestion of N-2-fluorenylacetamide. The ability of these tissues to synthesize normal plasma proteins was examined *in vitro* by immunoelectrophoresis radioautography. Two patterns of protein synthesis were detected when these tissues were compared with that of normal livers. The first, suppression of protein production, was seen mainly in nodules examined soon after the cessation of carcinogen ingestion. The second, acceleration of production, was seen in nodules examined later in their history and in most hepatocellular carcinomas. The pattern of protein synthesis often varied from one nodule to another within a single liver. In addition, the type of alteration in production of one protein within a single nodule was often independent of that which affected others. These findings suggested that the alterations in protein synthesis were specific for selective effects of the carcinogen and that they were related to events in carcinogenic evolution.

- 4403 THE EFFECT OF BENZPYRENE, PHENOBARBITAL, AND CARBON TETRACHLORIDE ON SUBCELLULAR METAL DISTRIBUTION AND MICROSOMAL ENZYME ACTIVITY. (E.) Moffitt, A. E., Jr. (United States Pub. Hlth. Serv., Cincinnati, O.), J. R. Dixon, F. C. Phipps and H. E. Stokinger. *Cancer Res* 32:1148-1153, 1972.

Male rats were given a single 8 mg dose of benzo(a)-pyrene (BP) intratracheally; other rats were given 75 mg/kg/day phenobarbital for three days, and a third group was given carbon tetrachloride p.o. in single doses of 0.25, 0.50 or 1.00 mg/kg. Rats were killed 24, 72 or 240 hr after treatment and lungs and liver were removed. Subcellular fractions of lungs and livers were prepared by differential centrifugation and metal concentrations in subcellular organ fractions were determined by atomic absorption spectrophotometry. The BP dose caused a fourfold increase in lung microsomal copper at 72 hr

as compared to untreated controls. BP also produced a sixfold increase in lung BP hydroxylase at 72 hr; this suggested that the increase in lung microsomal copper may have been associated with an increase in microsomal enzyme activity. BP also caused a fourfold increase in lung microsomal manganese, a 40% depression in nuclear manganese, a decrease in lung nuclear, mitochondrial and microsomal nickel, and a decrease in chromium in these lung fractions. Phenobarbital increased liver microsomal copper, manganese and zinc. However, carbon tetrachloride reduced liver microsomal copper, manganese and zinc, as well as liver aniline hydroxylase activity.

- 4404 RAPID DEVELOPMENT OF BRONCHIOLO-ALVEOLAR SQUAMOUS CELL TUMORS IN RATS AFTER INTRA-TRACHEAL INJECTION OF 3-METHYLCHOLANTHRENE. (E.) Schreiber, H. (Biol. Div., Oak Ridge Natl. Lab., Tenn.), P. Nettesheim and D. H. Martin. *J Nat Cancer Inst* 49(2):541-554, 1972.

Specific-pathogen-free inbred male Fischer 344 rats received intratracheal injections totaling 25 mg (5 mg per wk) or 10 mg (single injection) of 3-methylcholanthrene. Multiple, small tumor nodules developed in the lungs two wk following injection of the last 5 mg of the 25 mg dose or five wk after injection of the 10 mg dose. The tumors, which were identified histologically as bronchiolo-alveolar squamous cell carcinomas, spread rapidly into the lung parenchyma and occupied most of the lung area by 8 wk after injection of the last 5 mg of the 25 mg dose. Although the tumors were highly proliferative, they initially appeared histologically benign and were not readily transplanted by s.c. or i.m. transfer into adult and newborn isogenic hosts. However, two lung tumors transplanted five wk and one transplanted 13 wk after the last dose of the 25 mg series began to grow progressively five to eight months after transplantation. Serial passages of these tumors were successful.

- 4405 SKIN CARCINOGENESIS TESTS OF HYDROGENATED DERIVATIVES OF ANTHANTHRENE AND OTHER POLYNUCLEAR HYDROCARBONS. (E.) Lijinsky, W. (Eppley Inst. Cancer Res., Omaha, Neb.) and H. Garcia. *Z Krebsforsch* 77(3):226-230, 1972.

Five polynuclear hydrocarbons were tested for carcinogenicity by topical application to the skin of random bred Swiss female mice twice weekly for 50 to 72 weeks. Anthanthrene, 4,5-dihydroanthanthrene and 1,2,3,7,8,9-hexahydroanthanthrene were noncarcinogenic. 5,6-dihydro-7,12-dimethylbenz(a)anthracene and 6,7,8,9,10,12b-hexahydro-3-methylcholanthrene produced squamous cell papillomas and carcinomas of the skin in 50% and 67% of the animals, resp. Mean latent periods were 43 and 50 days, resp. These results support earlier findings that, given a polynuclear hydrocarbon molecule possessing some minimal chemical reactivity, the main criterion of carcinogenic activity is the size and shape of the molecule.

- 4406 ESTRADIOL RECEPTORS IN MOUSE MAMMARY TUMORS: ABSENCE OF THE TRANSFER OF BOUND ESTRADIOL FROM THE CYTOPLASM TO THE NUCLEUS. (E.) Shyamala, G. (Dept. Zool., U. California, Berkeley). *Biochem Biophys Res Commun* 46(4):1623-1630, 1972.

Spontaneous estradiol-independent mammary tumors were taken from GRS/A mice, incubated with 6-7-³H-estradiol-17 β (³H-E₂), homogenized, and tested by sucrose density centrifugation for cytoplasmic and nuclear binding of estradiol in tumor cells. Two discrete estradiol binding components were seen on sucrose density gradients; one had a sedimentation coefficient of 4-5S, the other of 8S. Total binding capacity for the 8S estradiol receptor was 0.02 pmoles/100 μ g DNA. Treatment of the tumor cytoplasm with proteolytic enzymes abolished ³H-E₂ binding, suggesting that the binding component was a protein. In these and other respects, the binding characteristics of the 8S component were similar to those of the 8S estradiol receptor complex of the uterus. Tumor cells, however, showed no significant intranuclear binding of ³H-E₂.

- 4407 A CORRELATIVE HISTOCYTOLOGICAL STUDY OF CARCINOMA AND EPITHELIAL ATYPIA OF THE PALATE AMONG INDIAN REVERSE SMOKERS. (E.) Mehta, F. S. (Tata Inst. Fund. Res., Bombay, India), B. E. Sahiar, D. K. Daftary, P. C. Gupta and J. J. Pundborg. *Brit J Cancer* 26(3):230-233, 1972.

A correlative histocytological study was made of six patients with palatal carcinomata and 342 patients with palatal lesions (primarily leukoplakias) associated with reverse smoking from the Srikakulam district of Andhra Pradesh. Among six histologically diagnosed carcinomata only two showed cytological findings typical of carcinoma. Of the 46 atypias diagnosed histologically among the other palatal lesions, only six (13%) were diagnosed cytologically. Findings show that cytological examination of precancerous and cancerous lesions located on the hard palate, which is a highly keratinized area of the oral cavity, may not be reliable enough for revealing premalignant or malignant changes.

- 4408 CARCINOGENESIS ASSAY OF SUBFRACTIONS OF CIGARETTE SMOKE CONDENSATE PREPARED BY SOLVENT-SOLVENT SEPARATION OF THE NEUTRAL FRACTION. (E.) Bock, F. G. (Roswell Park Mem. Inst., Buffalo, N.Y.), A. P. Swain and R. L. Stedman. *J Nat Cancer Inst* 49(2):477-483, 1972.

Carcinogenesis assay was conducted on subfractions of the neutral fraction (NF) of cigarette smoke condensate, subfractions that were prepared by solvent partition. Of the two major subfractions, the "methanolinsoluble" neutrals (MIN) were much more active than the "methanolinsoluble" neutrals (MSN). Distribution of MSN between nitromethane and carbon disulfide yielded two active fractions. Poor dose-response effects suggested that extraneous materials may reduce the activity of MSN. Analysis of the

recovery of MSN is difficult, but apparently there were significant losses during separation. On counter-current distribution (CCD), MIN yielded three active and two inactive subfractions. Recovery of the activity of MIN in the subfractions was excellent in comparison with an earlier separation with silicic acid chromatography. Recoveries might be improved if CCD is applied to the NF before the more rigorous chromatographic separations.

- 4409 EXPRESSION OF BENZ(a)ANTHRACENE-INDUCIBLE ARYL HYDROCARBON HYDROXYLASE ACTIVITY IN MOUSE-HAMSTER AND MOUSE-HUMAN SOMATIC-CELL HYBRIDS. (E.) Benedict, W. F. (Natl. Inst. Child Hlth. Human Devel., Bethesda, Md.), B. Paul and D. N. Nebert. *Biochem Biophys Res Commun* 48(2):293-298, 1972.

Somatic cell hybrids were formed by fusion of 3T3 mouse cells and human D98 cells or BHK hamster cells. Aryl hydrocarbon hydroxylase (AHH) could be induced by benz(a)anthracene (BA) in 3T3 cells, but there was no AHH induction by BA in BHK cells and only slight induction in D98 cells. In mouse-hamster hybrids treated with 13 μ M BA, AHH was induced in six of nine clones tested. AHH induction in these cells proceeded at levels comparable to those seen in parent 3T3 cells. In one clone with a 2S complement of mouse chromosomes, AHH induction proceeded at twice the level seen in 3T3 cells. The mouse-hamster cell hybrids which lacked BA-inducible AHH had a hamster chromosomal excess and/or deficiency of mouse chromosomes. BA-inducible AHH was seen in all of three hybrid clones of 3T3-D98 cells.

- 4410 REMOVAL OF BOUND CARCINOGEN DURING DNA REPAIR IN NONDIVIDING HUMAN LYMPHOCYTES. (E.) Lieberman, M. W. (Chester Beatty Res. Inst., London, England) and A. Dipple. *Cancer Res* 32:1855-1860, 1972.

Removal of alkylation products from the DNA of mammalian cells was studied in nondividing human lymphocytes damaged with 7-bromomethylbenz(a)anthracene, a carcinogenic alkylating agent that produces chemically stable products upon reaction with DNA. The reaction of 7-bromomethylbenz(a)anthracene-³H with cells in lymphocyte culture was complete in about 20 min. The unlabeled compound induced unscheduled (repair) DNA synthesis in lymphocytes maintained in hydroxyurea, and this process was complete in about 12 hr. The DNA of cells treated with the radioactive bromo- compound (1 μ M) exhibited a 15 to 17% loss of radioactivity in 12 hr, while exposure to a higher concentration of the agent (20 μ M) resulted in an 8 to 9% loss of radioactivity. Salmon sperm DNA alkylated by this agent exhibited no detectable loss of radioactivity after heating for 22 hr at 50 C. The major sites of attack of 7-bromomethylbenz(a)anthracene on lymphocyte DNA were the amino groups of guanine and adenine. Analysis of DNA isolated from treated lymphocytes at zero time and 12 hr later suggested that the damaged adenine nucleotides were removed more extensively than were the damaged guanine nucleotides and that participation in the cell cycle is not a precondition for removal of bound carcinogen.

- 4411 THE INFLUENCE OF PHYSOSTIGMINE ON THE ACTIVATION OF METHYLAZOXYMETHANOL ACETATE, A POTENT CARCINOGEN, BY A SERUM FACTOR *IN VITRO*. (E.) Poynter, R. W. (Sch. Med., Leeds, England), C. R. Ball, J. Goodban and T. Thackrah. *Chem Biol Interact* 4(2):139-143, 1972.

The effect of methylazoxymethanol (MAMAc), a chemically stable potent carcinogen, was studied using ³H-thymidine (³H-TdR) incorporation into DNA of cultured HeLa cells. Preincubation of MAMAc in medium containing 7% fetal calf serum at 37 C enhanced its ability to inhibit ³H-TdR uptake. The enhancing effect increased with increasing incubation time up to a maximum of 90% inhibition at 20 hr. Activation of MAMAc was apparently due to a factor in the serum as MAMAc preincubated in medium without serum had no enhanced inhibitory effect on ³H-TdR incorporation into DNA. Deacetylation of MAMAc was necessary for activation. Preincubation of MAMAc with the specific cholinesterase inhibitor physostigmine (3 x 10⁻⁵ M) indicated that this enzyme was involved. It was concluded that deacetylation by fetal calf serum cholinesterase was the initiating step in activation of MAMAc and that such a mechanism may be responsible for the *in vivo* activation of this carcinogen.

- 4412 PERINATAL CARCINOGENESIS BY URETHAN. (E.) Vesselinovitch, S. D. (Pritzker Sch. Med., U. Chicago, Ill.), N. Mihailovich, K. V. N. Rao and L. Itze. *Cancer Res* 31:2143-2147, 1971.

The neoplastic response following prenatal and/or neonatal exposure of (C57BL x C3H)F₁ mice to urethan was studied. Pregnant C57BL females received i.p. injections of urethan (0.5 mg/g body wt/dose) either daily (11th to 15th or 14th to 18th gestation days) or at three-day intervals (12th, 15th, and 18th day of gestation). Some pre-exposed neonates received two, three or five additional carcinogen injections. Animals were sacrificed at 48 wk of age and examined for tumors. Animals which had five daily intra-uterine urethan exposures developed hepatomas, lung adenomas, ovarian adenomas and granulosa cell tumors, and Harderian gland cystadenomas. A difference in sex response was seen only with liver tumors, where males had a higher incidence than females. The incidence of liver and lung tumors was significantly increased in animals exposed to urethan late in gestation. Combination of five prenatal and three or five postnatal urethan administrations produced a higher incidence of hepatomas, lung adenomas, ovarian tumors, and Harderian gland cystadenomas than did prenatal treatment alone or postnatal treatment alone. In addition, neonatal treatment with three or five doses of urethan produced malignant lymphocytic lymphomas involving the thymus.

- 4413 EFFECT OF CALCIUM CHROMATE DUST, INFLUENZA VIRUS, AND 100 R WHOLE-BODY X RADIATION ON LUNG TUMOR INCIDENCE IN MICE. (E.) Nettesheim, P. (Oak Ridge Natl. Lab., Tenn.) M.G. Hanna Jr., D. G. Doherty, R. F. Newell and A. Hellman. *J Nat Cancer Inst* 47(5):1129-1144, 1971.

Chronic inhalation exposure (five hr/day, five days a week for life) of C57BL/6 mice to calcium chromate (CaCrO_4) dust resulted in a fourfold increase in pulmonary adenoma incidence over that seen in filtered-air controls. Acute exposure to 100 R whole-body X radiation caused a similar increase in tumor incidence. The effects of the two tumorigenic insults were not additive. PR8 influenza virus infection suppressed spontaneous as well as X ray- and CaCrO_4 -induced pulmonary adenoma development. The overall lung adenoma incidence was higher in males than in females. CaCrO_4 also induced other pathological changes in the respiratory tract, such as epithelial necrosis and regenerative hyperplasia in the conducting airways, alveolar "bronchiolization," alveolar proteinosis, and emphysema-like changes, and suppressed the lymphoma incidence.

- 4414 RECIPROCAL RELATIONSHIP BETWEEN THE PRODUCTION OF ADRENAL DAMAGE BY 7,12-DIMETHYLBENZ(a)ANTHRACENE IN RATS AND THE INDUCTION OF LIVER DAMAGE BY VARIOUS TREATMENTS. (E.) Wheatley, D. N. (U. Med. Bldgs., Aberdeen, Scotland), M. E. Gerrard, I. R. Kernohan and A. R. Currie. *Brit J Cancer* 26: 99-107, 1972.

Carbon tetrachloride (CCl_4) (0.3 ml) was injected i.p. into rats before and after they received i.v. 3 mg of 7,12-dimethylbenz(a)anthracene (DMBA). Three days after DMBA administration, rats were killed and livers and adrenal glands were examined. CCl_4 protected rats against DMBA adrenocorticolysis when injected less than one hr before DMBA; no protection was afforded by CCl_4 after DMBA. DMBA given one hr before CCl_4 protected rats against lethal liver damage; this protection implied a reduction of CCl_4 hepatotoxicity. Evidently, the hepatotoxicity of CCl_4 was related reciprocally to the adrenocorticolytic effect of DMBA. *p*-Dimethylaminoazobenzene (DAB) injected into rats seven days before to one day after DMBA protected against DMBA's adrenal action when DAB was given from 3 hr to two days before DMBA, but did not protect when given after DMBA. Prior exposure of rats to DMBA potentiated the hepatotoxic effects of DAB. Partial hepatectomy of rats protected against DMBA adrenocorticolysis when livers were operated on from four to one day before DMBA. Partial hepatectomy also protected rats against DMBA when livers were partially removed 6 to 24 hr after DMBA.

- 4415 PATTERN OF 2-METHYL-4-DIMETHYLAMINOAZOBENZENE-BINDING PROTEINS IN THE LIVERS OF PARTIALLY HEPATECTOMIZED RATS AND OF CONTINUOUSLY DYE-FED RATS IN COMPARISON WITH 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE. (E.) Sugimoto, T. (Zool. Inst., Fac. Sci., U. Tokyo, Japan) and H. Terayama. *Cancer Res* 32:1878-1883, 1972.

Partially hepatectomized and sham-operated rats received 2-methyl-4-dimethylaminoazobenzene (2-Me-DAB) in a single dose (10 mg) and normal rats were fed a diet containing 0.06% 2-Me-DAB for 2-week and 1-month periods. The patterns of dye-binding proteins in the cytosols prepared from the livers of these rats were

investigated by chromatography on carboxymethylcellulose as well as by gel filtration in Sephadex G-100, and the results were compared with those of rats given 3'-methyl-4-dimethylaminoazobenzene (3'-Me-DAB) under the same conditions. It was found that 2-Me-DAB given in a single dose is preferentially bound to the slightly basic protein fractions (Fractions IV and VI) in sham-operated rats but to the nonbasic protein fraction (Fraction I) in partially hepatectomized rats, while 3'-Me-DAB is preferentially bound to Fraction I in both cases. Gel filtration of Fraction I revealed that 3'-Me-DAB is preferentially bound to the higher-molecular weight subcomponent (I-a) in both sham-operated and partially hepatectomized rats, while 2-Me-DAB is bound to the smaller-molecular-weight subcomponent (I-b) in the sham-operated rat liver but to I-a in the regenerating liver. For Fraction IV, 3'-Me-DAB is bound to the higher-molecular-weight subcomponent (IV-a) in sham-operated rats but to the lower-molecular-weight subcomponents (IV-b,c) in partially hepatectomized rats, while 2-Me-DAB is bound to the lower-molecular-weight subcomponents in both sham operated and partially hepatectomized rats. The results support a previous finding that dye binding to I-a target protein may be involved in chemical carcinogenesis.

- 4416 β -GLUCOSIDASE MODULATION IN PREWEANLING RATS AND ITS ASSOCIATION WITH TUMOR INDUCTION BY CYCASIN. (E.) Matsumoto, H. (Dept. Agricultural Biochem., U. Hawaii, Honolulu), Y. Nagata, E. T. Nishimura, R. Bristol and M. Haber. *J Nat Cancer Inst* 49(2):423-434, 1972.

Cycasin, an azoxy- β -glucoside, induces tumor growth when injected into developing but not mature rats. The active principle has been demonstrated to be the aglycone, methylazoxymethanol (MAM). Changes in β -glucosidase activity, therefore, were determined in tissues of various organs of preweanling Wistar strain rats. The enzyme activity of the small intestine increased gradually to a maximum around the 15th postnatal day and decreased rapidly to a minimum shortly after the weanling age of 21 days. There was comparatively little β -glucosidase activity in other tissues. Cycasin injected into growing rats did not modify the β -glucosidase activity of the various tissues. The enzyme activity in none of the tissues was affected by the nature of the substrate--either by the natural glucoside, cyasin, or the synthetic glucoside, *p*-nitrophenyl- β -D-glucoside. A single dose of cycasin, 1 mg/g body weight, administered s.c. or i.p. in Wistar rats between ages of 5-20 days induced a moderately high incidence of neoplasms after approximately 208 days. Subcutaneous inoculation of rats at 25 days of age, with an identical amount of cycasin, failed to initiate the tumor development. The incidence of tumors induced appeared to correlate well with the modulation of β -glucosidase activity in the intestinal mucosa of maturing rats. Most neoplasms induced by cycasin, had the characteristics of mesenchymal tumor of the kidney. A moderately high incidence of renal adenocarcinomas was also present, but hepatic malignancies were not frequent. The appearance of mesenchymal tumor is age related

and the peak of susceptibility coincides with the maximum β -glucosidase activity.

- 4417 EQUILIBRIUM CENTRIFUGATION STUDIES OF COLON DNA FROM MICE TREATED WITH THE CARCINOGEN 1,2-DIMETHYLHYDRAZINE. (E.) Hawks, A. (Middlesex Hosp. Med. Sch., London, England), E. Farber and P. N. Magee. *Chem Biol Interact* 4(2):144-148, 1972.

The chemical carcinogen 2-fluorenylacamide (FA) was shown by other investigators to be bound to glycogen and DNA of FA-induced hyperplastic rat liver nodules several weeks after its removal from the diet. To determine if this phenomenon applied to other organs and other carcinogens, DNA of 1,2-dimethylhydrazine (DMH)-induced colonic and rectal mouse tumors was analyzed by CsCl equilibrium density centrifugation. No minor DNA component in DMH-induced colonic nodules had a density of 1.73 g/cm³, as had been reported for FA-induced hyperplastic nodules. Analysis of liver DNA from mice injected with DMH also failed to demonstrate this minor peak, although an amylase-sensitive peak banding at a density of 1.68 g/cm³ was detected. It was concluded that the results obtained with FA cannot be generalized to include all forms of neoplasia.

- 4418 DIETARY AFLATOXINS AND HUMAN LIVER CANCER. IV. INCIDENCE OF PRIMARY LIVER CANCER IN TWO MUNICIPAL POPULATIONS OF THAILAND. (E.) Shank, R. C. (Dept. Nutr., Massachusetts Inst. Tech., Cambridge), N. Bhamarapravati, J. E. Gordon and G. N. Wogan. *Fd Cosmet Toxicol* 10(3):171-179, 1972.

Field studies were conducted to determine the possible relation between food-borne mycotoxins, particularly the aflatoxins, and primary liver cancer among certain populations in Thailand. According to a diet survey conducted over a one-yr period (mid-June 1969 to mid-June 1970), villagers in the Province of Ratburi ingested an average of 45-77 ng total aflatoxins/kg body wt daily, while the value found for the Province of Songkhla was 5-8 ng/kg/day. Epidemiologic investigations on the occurrence of primary liver cancer were performed coincident with the diet studies in urban areas of these two provinces. Primary liver cancer incidence in the Songkhla area was found to be approximately the same as in the eastern United States and northwestern Europe, whereas the incidence was three to six times greater in the Ratburi area, in both urban and rural populations. Thus the consumption of aflatoxins appears to have had a direct relationship to the occurrence of primary liver cancer in these regions of Thailand.

- 4419 DETECTION OF ACTIVATING ENZYMES FOR 4-NITROQUINOLINE 1-OXIDE ACTIVATION WITH A MICROBIAL ASSAY SYSTEM. (E.) Fukuda, S. (Temple U. Sch. Med., Philadelphia, Pa.) and N. Yamamoto. *Cancer Res* 32(2):435-439, 1972.

4-Nitroquinoline 1-oxide (4NQO) has been shown to

inactivate the DNA repair-deficient mutants, *her*- and *recA*, of *Salmonella typhimurium* to a much greater extent than the wild-type cell. Bacteriophage P22 was insensitive to 4NQO but was rapidly inactivated by 4-hydroxyamino-quinoline 1-oxide (4HAQO), a reduction product of 4NQO. These results implied that *S. typhimurium* could convert 4NQO to 4HAQO and that 4HAQO was reacting with the genomes. When phage P22 was treated with (4HAQO) (10⁻⁶M) and assayed on *S. typhimurium* strains lysogenic for P221, a rapid inactivation of P22 (30 min.) and a greatly increased frequency of recombination between P22 and the prophage P221 were observed. This phage assay system was used to search for either activating enzymes which convert 4NQO to 4HAQO or a reactive intermediate substance that inactivates bacteriophage. When fractions from bacterial homogenates separated by diethylaminoethyl (DEAE)-cellulose were incubated with 4NQO, BADG and bacteriophage P22C₂, one sharp peak was found which could inactivate the bacteriophage. The fractions from bacterial homogenates were also analyzed for 4NQO reducing and diaphorase activities. The peak showing both activities was found to correspond to the peak for phage inactivation. Samples from the incubation mixture containing 4NQO, NADH, and P22C₂ produced the same effects in the phage assay system as had previously been observed for 4HAQO. It was therefore concluded that the bacterial diaphorase converted 4NQO to 4HAQO and that 4HAQO reacted with the phage genome. Experiments with rat liver cytosol fractions showed that there were two peaks eluting from DEAE-cellulose which could activate 4NQO and which also possessed diaphorase activity.

- 4420 MAMMARY TUMORIGENESIS BY SUBCUTANEOUS ADMINISTRATION OF A MIXTURE OF MEGESTROL ACETATE AND ETHYNYLESTRADIOL IN WISTAR RATS. (E.) Hisamatsu, T. (Sch. Med., Showa U., Tokyo, Japan). *Gann* 63(4):483-485, 1972.

The carcinogenic activity of an 8:1 mixture of megestrol acetate, a synthetic progesterone, and ethynylestradiol, a synthetic estrogen, was studied. Female Wistar strain rats received s.c. injections of 5, 10 or 15 mg/kg of the mixture once every other day for 30 days. Two of ten rats receiving 5 mg, four of eight rats receiving 10 mg, and two of nine rats receiving 15 mg, developed one or two mammary fibroadenomas per animal between 240 and 320 days after the start of the experiment. None of ten control animals developed tumors.

- 4421 STUDIES ON *AGROBACTERIUM TUMEFACIENS*: CONDITIONS FOR MUTAGENESIS BY *N*-METHYL-*N'*-NITRO-*N*-NITROSO-GUANIDINE AND RELATIONSHIPS OF *A. TUMEFACIENS* MUTANTS TO CROWN-GALL TUMOR INDUCTION. (E.) Langley, R. A. (Dept. Plant Pathol., U. California, Davis) and C. I. Kado. *Mutat Res* 14(3):277-286, 1972.

Agrobacterium tumefaciens were exposed to up to 500 μ g/ml *N*-methyl-*N'*-nitro-*N*-nitrosoguanidine at pH 5.0-7.5 for three hr; induced mutants were tested

for ability to induce crown-gall tumor on sunflower. Optimum mutant induction by nitrosoguanidine was seen at 250 µg/ml at pH 6.5. Antibiotic-resistant mutants of *A. tumefaciens* and amino acid auxotrophs were tested on sunflower. All of the selected antibiotic-resistant mutants (resistant to neomycin, kanamycin and rifampicin) were as virulent as wildtype *A. tumefaciens* in inducing crown-gall tumors. This indicated that mutations conferring resistance to antibiotics did not directly affect tumorigenic virulence of *A. tumefaciens*. Mutants resistant to neomycin were also resistant to kanamycin and *vice versa*. Amino acid auxotrophs obtained by nitrosoguanidine treatment showed varying degrees of virulence on sunflower. Some auxotrophs requiring histidine, leucine or tryptophan had lost their virulence. Nonvirulent auxotrophs, when supplemented with the required amino acid, grew *in vivo* nearly as well as prototrophic *A. tumefaciens*; this indicated that the alteration of virulence of *A. tumefaciens* did not depend on the growth of the organism.

4422 INDUCTION OF TUMORS IN THE BRAIN, KIDNEY, AND OTHER EXTRA-MAMMARY GLAND ORGANS BY A CONTINUOUS ORAL ADMINISTRATION OF N-NITROSOBUTYLUREA IN WISTAR/FURTH RATS. (E.) Takizawa, S. (Res. Inst. Nuclear Med. Biol., Hiroshima U., Japan) and H. Nishihara. *Carcin* 62(6):495-503, 1971.

A continuous oral administration of N-nitrosobutylurea (NBU) for six months induced a variety of tumors besides mammary tumors in variously conditioned Wistar/Furth (W/Fu) rats of both sexes. The animals were castrated before the NBU treatment or castrated and supplemented with biweekly injections of 0.4 mg of progesterone and 0.01 mg of estradiol benzoate or with an ovarian graft under the kidney capsule. Leukemias of myeloid and undifferentiated-cell types developed in even rats with a mean latent period of 237±37 days, kidney tumors mostly of the so-called nephroblastoma and clear-cell carcinoma in eight rats with a latent period of 289±34 days, and brain tumors in 14 rats, mostly oligodendrogliomas except one case of ependymoma, with a latent period of 320±21 days, out of 64 rats. In a few rats, tumors of the thyroid, liver, caecum, duodenum, and peripheral nerve were found. No evidence has been obtained of hormonal implications in the genesis and progression of the afore-mentioned tumors other than mammary tumors.

4423 TUMORIGENESIS BY CADMIUM. (E.) Lucis, O. J. (Dept. Path., Dalhousie U., Halifax, N.S., Canada), R. Lucis and K. Aterman. *Oncology* 6:53-67, 1972.

Male Wistar rats were injected s.c. or in the liver with $^{109}\text{CdCl}_2$ or $^{65}\text{ZnCl}_2$. The highest amounts of radioactive Cd were distributed in liver, kidney, pancreas and spleen; no tumors developed in these organs. However, ^{109}Cd was also found in testes, which did develop tumors. After one s.c. injection

of $^{109}\text{CdCl}_2$, skin at the area of injection showed a high ^{109}Cd concentration; liver did not retain ^{109}Cd at the injection site after intrahepatic injection. ^{109}Cd in testes reached maximum concentrations within six hr after injection, while ^{65}Zn was deposited in testes continuously for at least 20 days. Twenty-four hr after s.c. injection of unlabeled CdCl_2 (0.02-0.03 mM/kg), testes showed necrosis of seminiferous tubules. By 48 days, marked proliferation in interstitial cells in testes was seen, and by 11 months, testes of all animals were fibrosed and contained nodules of interstitial cells. Fibrosarcoma developed at the s.c. injection sites in two cases.

4424 METABOLISM OF POLYCYCLIC AROMATIC HYDROCARBONS IN CELL CULTURES. (E.) Huberman, E. (Med. Sch., U. Wisconsin, Madison), J. K. Selkirk and C. Heidelberger. *Cancer Res* 31:2161-2167, 1972.

Transformed and untransformed mouse prostate cells were treated with tritiated 3-methylcholanthrene (MCA), benzo(a)pyrene, 9,10-dimethyl-1,2-benzanthracene, 1,2,5,6-dibenzanthracene or 1,2,3,4-dibenzanthracene and maintained under conditions favoring malignant transformation. The metabolism of the polycyclic aromatic hydrocarbons to water- and organic-soluble products was observed. The amount of conversion of MCA to water-soluble metabolites was proportional to cell number in both exponentially growing and contact-inhibited cells. MCA metabolism to water-soluble products increased with time and was proportional to the amount of MCA up to 10^3 - 10^4 µmoles/ 3×10^6 cells. Above this dose level, increased dose did not produce increased rates of water-soluble metabolite production. The highest production of water-soluble metabolites was obtained from benzo(a)pyrene and the lowest from 1,2,5,6-dibenzanthracene. Susceptibility of cells to the cytotoxic effects of MCA was closely correlated with amount of water-soluble metabolite production. The major metabolites from 1,2,5,6-dibenzanthracene were dihydrodiols; from 9,10-dimethyl-1,2-benzanthracene, dihydrodiols and hydroxymethyl derivatives predominated. Phenols were produced in smaller amounts from both these compounds.

4425 CARCINOGENESIS IN PULMONARY EPITHELIA IN MICE ON DIFFERENT LEVELS OF VITAMIN A. (E.) Smith, W. E. (Hlth. Res. Inst., Fairleigh Dickinson U., Madison, N.J.), E. Yazdi and L. Miller. *Environ Res* 5(9):152-163, 1972.

Lungs from 82 fetal or neonatal BALB/c mice were minced and implanted with 20-methylcholanthrene (MCA) into the right posterior thigh muscles of adult male BALB/c mice. Bronchial, bronchiolar or alveolar-like structures developed at implant sites. Squamous cell carcinomas arose in 9 of 56 mice maintained on an adequate diet supplemented by vitamin A, in 4 of 58 given an adequate diet without supplementary vitamin A, but in none of 25 given a diet deficient in vitamin A. The first tumor was found 64 days after lung cell-MCA implantation; it developed in a mouse on the adequate diet. With the lowest MCA dose (0.01M) there were many adenocarcinomas and a few poorly differen-

tiated squamous cell carcinomas. Well-differentiated carcinomas developed with larger MCA doses (0.02 and 0.04 M).

- 4426 DNA REPAIR FOLLOWING EXPOSURE OF HUMAN LYMPHOCYTES TO 4-NITROQUINOLINE-1-OXIDE. (E.) Jacobs, A. J. (U. Southern California Sch. Med., Los Angeles), R. L. O'Brien and P. Paolilli. *Int J Cancer* 10:118-127, 1972.

Human lymphocytes were treated with UV radiation (70 ergs/mm²) in the presence of varying concentrations of hydroxyurea (HU). Uptake of ³H-thymidine by these lymphocytes was observed as a measure of DNA replicative synthesis. ³H-thymidine uptake was suppressed in HU-treated, UV-exposed lymphocytes; suppression was proportional to HU concentration. When lymphocytes were treated with 4-nitroquinoline-1-oxide (4-NQO) instead of UV, unscheduled DNA synthesis increased with exposure to up to 10⁻⁵ M 4-NQO; at higher concentrations, DNA synthesis appeared to be suppressed. Replicative DNA synthesis was suppressed in 4-NQO-treated cultures, at all 4-NQO concentrations. In related experiments, human lymphocytes were treated with phytohemagglutinin-M and bromodeoxyuridine (BUDR); BUDR was taken up by DNA in replicative synthesis. Following BUDR treatment and incorporation, BUDR was removed and cells were treated with 4-NQO and ³H-thymidine. DNA from these cells was fractionated by cesium chloride gradient centrifugation into a BUDR-containing fraction of replicated DNA and a light DNA fraction. The heavy fraction of DNA from 4-NQO-treated cells, fraction devoid of replicated DNA, contained ³H-thymidine. This was thought to represent repair DNA synthesis.

- 4427 THE RELEVANCE OF CHEMICO-BIOLOGICAL INTERACTIONS FOR THE TOXIC AND CARCINOGENIC EFFECTS OF AROMATIC AMINES. V. THE PHARMACOKINETICS OF RELATED AROMATIC AMINES IN BLOOD. (E.) Groth, U. (Max-Planck Inst., Munich, West Germany) and H.-G. Neumann. *Chem Biol Interact* 4:409-419, 1972.

Male and female Wistar rats were studied for the distribution of radioactivity after single or repeated administration of 1.2 or 1.5 mg of ³H-labeled *trans*-4-dimethylaminostilbene (*trans*-DAS), *cis*-4-dimethylaminostilbene (*cis*-DAS), and 4-dimethylaminobenzyl (DABB). Total blood radioactivity, radioactivity bound to plasma proteins, and radioactivity bound to red cell constituents were determined from 5 to 216 hr after stomach feeding of the compounds. *Trans*-DAS produced higher levels of blood radioactivity than the other two compounds (e.g., 5 hr after *trans*-DAS feeding, total blood radioactivity was 12.9 nmole/g blood compared with 5.2 and 7.0 nmole/g blood 5 hr after feeding with *cis*-DAS and DABB, resp.). The higher levels induced by *trans*-DAS were due to enhanced binding of metabolites, primary to hemoglobin. Gel-filtration experiments indicated that radioactivity was bound to plasma proteins, predominantly albumin, to a comparable degree a few hours after administration of all three compounds. Part of the *trans*-stilbene activity and most of the *cis*-stilbene

and dibenzyl activity was loosely bound and removable by extraction with organic solvents. Erythrocytes contained considerably more radioactivity after administration of *trans*-DAS. On gel filtration most of the radioactivity migrated with hemoglobin and was only partly extractable with organic solvents. The decrease in red cell radioactivity appeared to be related to the life span of red cells. The pattern of unbound plasma metabolites analyzed by radio gas chromatography was similar to that in the liver and kidney, but differed from that in erythrocytes. Of the metabolites extracted from hemoglobin, *trans*-acetylaminostilbene and *trans*-aminostilbene had the highest affinity for hemoglobin.

- 4428 DIETHYL PYROCARBONATE: FORMATION OF URETHAN IN TREATED BEVERAGES. (E.) Löfroth, G. (Wallenberg Lab., Stockholm, Sweden) and T. Gejvall. *Science* 174(4015):1248-1250, 1972.

The antimicrobial food additive diethyl pyrocarbonate (DEP) was labeled with tritium and added in amounts of 250 or 500 µl/l to orange juice, white wine or beer. In isotope dilution analyses with the labeled DEP, addition of 250 µl/l of DEP to orange juice resulted in the formation of 0.2 mg carcinogenic urethan, while addition of 500 µl/l DEP to white wine or beer resulted in the formation of 1-3 mg/l urethan.

- 4429 BENIGN BREAST DISEASE IN WOMEN ON ESTROGEN THERAPY: A PATHOLOGIC STUDY. (E.) Fechner, R. E. (Baylor Coll. Med., Houston, Tex.). *Cancer* 29(2):273-280, 1972.

Microscopic examinations were performed on breast tissue from 41 women with fibrocystic disease (FCD) and two with fibroadenoma; all patients had been taking estrogens. Breast tissues from 41 women with FCD who were not on estrogens were also examined. Heterogeneous tissue changes in the breasts of FCD women on estrogens were qualitatively indistinguishable from those in women not on estrogens. Apocrine metaplasia was slightly more common in the hormone-treated group. Breasts with severe hyperplasia tended to be concentrated in the 36-45 yr age range in hormone-treated patients; severe hyperplasia was more evenly distributed among various ages in non-hormone-treated patients. Thirty-nine percent of hormone-treated patients had epithelial hyperplasia compared to 32% of nonhormone-treated patients; this difference was not statistically significant.

- 4430 ON THE CORRELATION BETWEEN THE HEPATOCARCINOGENICITY OF THE CARCINOGEN, *N*-2-FLUORENYLACETAMIDE, AND ITS METABOLIC ACTIVATION BY THE RAT. (E.) Gutmann, H. R. (VA Hosp., Minneapolis, Minn.), D. Malejka-Giganti, E. J. Barry and R. E. Rydell. *Cancer Res* 32:1554-1561, 1972.

Female Sprague-Dawley rats and female Fischer 344

rats were injected i.p. with 2.3 mg/100 g *N*-2-fluorenylacetylamide (2-FAA) three times/wk for 1 month. 2-FAA produced mammary adenocarcinomas in 92% of Sprague-Dawley rats but produced no tumors in Fischer rats. When tracer methods were used to measure the biliary excretion of *N*-hydroxy-2-FAA-¹⁴C, it was found that Sprague-Dawley rats excreted 25% of the 2-FAA as *N*-hydroxy-2-FAA-¹⁴C, while only 1-2% of a similar dose of 2-FAA-¹⁴C was excreted as the *N*-hydroxy metabolite by Fischer rats. *N*-hydroxy-2-FAA administered to Fischer rats by the same schedule that had been ineffective with 2-FAA caused a high incidence of liver tumors. Susceptibility to *N*-hydroxy-2-FAA carcinogenesis coincided with the extent of sulfonation of the hydroxyamino acid by hepatic arylsulfotransferase *in vivo* and *in vitro*. This enzyme was low in Sprague-Dawley rats, which were refractory to *N*-hydroxy-2-FAA hepatocarcinogenesis, and high in Fischer rats.

4431 RAPID INDUCTION OF BLADDER CANCER IN RATS WITH *N*-METHYL-*N*-NITROSOUREA. I. HISTOLOGY. (E.) Hicks, R. M. (Middlesex Hosp. Med. Sch., London, England) and J. St. J. Wakefield. *Chem-Biol Interact* 5(2):139-152, 1972.

Rats were given *N*-methyl-*N*-nitrosourea (MNU) as a single 2 mg dose injected into the bladder. Though no tumors developed, bladder epithelium showed basal cell necrosis and stripping of epithelium within two days after treatment. Stripped areas regenerated rapidly and hyperplasia was seen within 2-8 wk. A single dose of 3 mg MNU by urethral catheter was lethal. Four 1.5 mg doses, given by urethral catheter over a 6 wk period, were not lethal but produced bladder carcinomas in all rats kept for 30 wk. In these rats, early bladder changes included necrosis, stripping of epithelium and hyperplastic regrowth. Papillomas formed in bladder by 12 wk after MNU. Epithelial cells diverged more widely from the normal cell type in rats given a total of 6 mg MNU than in rats given one 2 mg dose. Squamous metaplasia was apparent by 4 wk after 6 mg MNU. Squamous cell tumors developed as squamous cells invaded the bladder's muscle wall. Carcinomas appeared by 12 wk.

4432 EFFECT OF PAPAIN ON THE CARCINOGENESIS BY *P*-DIMETHYLAMINOAZOBENZENE (DAB). (E.) Ambara, T. (Kumamoto U. Med. Sch., Japan), T. Ogata and G. Tokaji. *Kumamoto Med J* 24(3-4):124-134, 1971.

Male Wistar rats were fed *p*-dimethylaminoazobenzene (DAB) or a carcinogen-free diet for 77-83 days. When DAB doses totaled approximately 500 mg, one group of rats (A) was given 25 weekly i.p. injections of 0.25 ml papain solution/100 mg body wt; the other DAB-fed rats (group B) were not given papain. Rats not fed DAB (group C) were also given papain. Papain did not affect the final rate of liver tumor formation in DAB-fed rats but appeared to accelerate tumor formation in its early stages. The mitotic index of liver

cells of group A rats after a single injection of papain was 977 cells in mitosis/100,000 cells compared with 28 mitoses/100,000 cells in group B rats given no papain. Papain without DAB induced no tumors. There were no significant differences between group A and B rats with regard to tumor incidence in each lobe of the liver or to sites of metastasis of liver tumors.

4433 POLYCYCLIC HYDROCARBON-PRODUCED TOXICITY, TRANSFORMATION, AND CHROMOSOMAL ABERRATIONS AS A FUNCTION OF ARYL HYDROCARBON HYDROXYLASE ACTIVITY IN CELL CULTURES. (E.) Benedict, W. F. (Nat'l. Inst. Child Hlth. Human Development, Nat'l. Inst. Hlth., Bethesda, Md.), J. E. Gielen and D. W. Nebert. *Int J Cancer* 9(2):435-451, 1972.

Rat hepatoma tissue culture cells (HTC), mouse L cell derivatives (A9), HeLa cells, fetal rat hepatocytes and fetal hamster secondary cells were treated with benzo(a)pyrene (BP), 3-hydroxybenzo(a)pyrene or 7,12-dimethylbenz(a)anthracene (DMBA) for 24 hr. Cytotoxicity, cell transformation and chromosome abnormalities were observed in cultures treated with the three polycyclic hydrocarbons; hydrocarbon treatment was in some cases combined with treatment with α -naphthoflavone (ANF) or phenobarbital. BP (1 μ g/ml) was toxic to rat hepatocytes; this effect was prevented by phenobarbital or ANF. BP was not toxic to HTC, A9 or HeLa cells, which contain little or no aryl hydrocarbon hydroxylase (AHH) activity. However, BP was toxic to HTC, A9 and HeLa cells grown with fetal rat hepatocytes in the presence of phenobarbital (fetal rat cells had high levels of basal and benz(a)anthracene-(BA)-inducible AHH). A correlation between chromatid breakage and cytotoxicity was evident in fetal hamster cells and in HeLa cells treated with BP, 3-hydroxybenzo(a)pyrene or DMBA. Aneuploidy was seen in hydrocarbon-treated hamster fetal cell cultures in which there were transformed foci but no toxicity or chromatid breaks. This finding suggests that aneuploidy is more closely associated with malignant transformation than is chromosomal breakage, while chromosomal breakage is related to cytotoxicity. BA or ANF competitively inhibited the hydroxylation of DMBA or BP. Transformation was never observed in fetal hamster secondary cells exposed to DMBA plus excessive amounts of BA. This suggests that BA or its metabolites may prevent a specific effect by which DMBA or a DMBA metabolite causes cell transformation.

4434 CELL LOSS AND PROLIFERATION INDUCED BY *N*-2-FLUORENYLACETAMIDE IN THE RAT LIVER IN RELATION TO HEPATOMA INDUCTION. (E.) Albert, R. E. (New York U. Med. Ctr., New York), F. J. Burns, L. Bilger, D. Gardner and W. Troll. *Cancer Res* 32(10):2172-2177, 1972.

Cell loss and replacement were examined in relation to tumor induction following various doses and ex-

posure patterns of the carcinogen *N*-2-fluorenylacetylamide (2-FAA) in the diet of male albino rats. In Experiment 1, the hepatic DNA was prelabeled by the injection of thymidine-³H (TdR-³H) into weanling animals, and the loss of the tritium activity was measured at various times after the start of the carcinogen treatment. In Experiment 2, single injections of TdR-³H were given at various times during continuous exposure to the carcinogen at levels of 0.03, 0.01, and 0.003%. The uptake of TdR-³H in hepatic DNA, the parenchymal cell-labeling index, and the total hepatic DNA were determined. In Experiment 3, the incidence of hepatic carcinoma was determined for various exposure durations to 0.03, 0.01, 0.003, and 0.001% 2-FAA. At 42 days after the start of administration of 0.03% 2-FAA, the uptake of TdR-³H in the hepatic DNA increased markedly. With 0.03% 2-FAA, the pulse labeling index increased progressively between 42 and 120 days, while the pulse labeling index for 0.01% 2-FAA showed no increase until 120 days. With 0.03% 2-FAA, the prelabeled DNA decreased markedly between 42 and 72 days, while the total hepatic DNA increased by about 15 to 20% by 72 days. The tumor data showed that a 365-day exposure to 0.01% 2-FAA was approximately equivalent to a 112-day exposure to 0.03% 2-FAA, i.e., an equivalent tumor yield for equal total doses. However, 28- and 56-day exposures to 0.03% 2-FAA were far less effective than 112-day exposures to 0.01% 2-FAA. The data suggest that, at 0.03%, the carcinogen produced an increase in the parenchymal cell replication rate that correlated with the tumor incidence and that, when the carcinogen was stopped early enough to prevent tumors, very little of the original DNA was lost and the replication rate of the parenchymal cells was only slightly increased.

- 4435 UTERINE AND MAMMARY NEOPLASIA AND OTHER CHANGES (AMYLOIDOSIS) IN C₃H MICE, RELATED TO OVARECTOMY, ESTROGEN AND METHYLCHOLANTHRENE. (E.) Wessely, Z. (Long Island Jewish Med. Ctr., Jamaica, N.Y.) and J. V. Klavins. *Oncology* 26:33-52, 1972.

Cords impregnated with 3-methylcholanthrene (MC) were inserted in the uteri of virgin C₃H mice; some mice were given s.c. injections of 50 µg estradiolbenzoate after MC, while others were castrated. Uterine tumor development was observed for 48 wk. Twenty-three of 82 mice given MC alone and 18 of 58 mice given estrogen after MC, developed cervical squamous carcinomas (difference not statistically significant). In castrated animals, tumor incidence was significantly less than in animals receiving estrogen but not significantly different from that in animals receiving MC alone (6 of 43 mice castrated after MC developed tumors). Tumor differentiation was better in estrogen-treated mice than in castrated mice. Dysplasia and hyperplasia were more common in MC- and estrogen-treated animals. Estrogen increased the PAS-positive material (probably neutral mucopolysaccharides) in endometrial stroma and the acid mucopolysaccharides in cervical subepithelial tissues. Mammary carcinomas and liver amyloidosis were also associated with estrogen treatments.

- 4436 CORRELATIONS BETWEEN CARCINOGENIC TRACE METALS IN WATER SUPPLIES AND CANCER MORTALITY. (E.) Berg, J. W. (Natl. Cancer Inst., Bethesda, Md.) and F. Burbank. *Ann NY Acad Sci* 199:249-264, 1972.

The product of the frequency of detection of trace metals in drinking water systems and the average detected metal concentration was determined for ten basin areas in the United States. Areas were ranked according to the size of this statistic and the rank order was compared with the rank order of the areas for mortality from 34 types of cancer. Positive correlations between trace metals in drinking water and cancer mortality were found in 28 cases, eight more than expected. The excess of positive correlations came mainly from cadmium (correlated with oral and pharyngeal cancer, esophageal cancer, breast cancer, intestinal cancer) and lead (correlated with intestinal cancer, kidney cancer, ovarian cancer, all leukemias). For chromium, cobalt and iron there were no positive correlations significant at the 5% level.

- 4437 ACUTE ULTRASTRUCTURAL EFFECTS OF BENZO(a)-PYRENE AND FERRIC OXIDE ON THE HAMSTER TRACHEOBRONCHIAL EPITHELIUM. (E.) Harris, C. C. (Natl. Cancer Inst., Bethesda, Md.), M. B. Sporn, D. G. Kaufman, J. M. Smith, M. S. Baker and U. Saffiotti. *Cancer Res* 31:1977-1989, 1971.

Tracheobronchial epithelial ultrastructural changes were studied in young adult male Syrian golden hamsters following intratracheal instillation of benzo(a)-pyrene or pyrene carried on ferric oxide particles. The acute cellular changes included focal replacement of the tracheobronchial columnar epithelium with pleomorphic cells which showed ultrastructural features characteristic of atypical squamous cells. Polylobulated nuclei and pleomorphic nucleoli were characteristically found after multiple instillations of benzo(a)pyrene-ferric oxide. Instillation of ferric oxide alone or the noncarcinogenic hydrocarbon, pyrene-ferric oxide, resulted in reversible basal cell hyperplasia. The atypical squamous cells induced by benzo(a)pyrene-ferric oxide were ultrastructurally similar to hyperplastic epithelial cells described in the bronchi of smoking dogs and neoplastic squamous cells described in human bronchogenic carcinoma.

- 4438 PRETUMOR CHANGES OF THE EPITHELIUM INDUCED BY TRANSPLACENTAL EFFECT OF NITROSOMETHYLUREA IN ORGAN CULTURES OF EMBRYONAL LUNG TISSUE OF MICE. (Rus.) Kolesnichenko, T. S. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow). *Vopr Onkol* 17(11):68-75, 1971.

Characteristics of the transplacental effect of nitrosomethylurea on embryonal lung tissue of mice (BD-IX) in organ cultures were studied. Nitrosomethylurea (5 mg) was injected s.c. in mice begin-

ning from the 14-16th day of pregnancy up to a total dose of 20 mg. On the 19-20th day of pregnancy, the animals were killed to extract the lung from 12 embryos for organ cultures to be examined 7, 14, 21, 28, and 33 days from culturing. Experimental cultures were more viable *in vitro* than the control cultures. With the prolongation of the experiment, dystrophic changes increased in control cultures, while pretumor changes increased in experimental cultures. From the seventh day, morphological characteristics of control and experimental cultures diverged. One of the first changes was diffuse hyperplasia of the alveolar and bronchial epithelium, leading to extensive proliferation and local hyperplasia (17-33 days), pericapsular growths and isolated complexes of epithelial cells. Local proliferation sites were found in 61/416 (14.6%) cultures. Adenomatous changes observed in 88/416 (21.15%) reflect the transplacental carcinogenic effect of nitrosomethylurea.

- 4439 ALTERNATIVE WAYS OF THYMIDYLATE BIOSYNTHESIS IN MOUSE TUMORS WITH VARIED SENSITIVITY TO 5-FLUOROURACIL. (Rus.) Meiren, D. V. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow) and A. K. Belousova. *Biokhimiia* 36(6):1210-1216, 1971.

Biosynthesis of thymidylate as affected by 5-fluorouracil was studied in 5-fluorouracil-sensitive La leukemia cells and their stable variant La/FU, and in 5-fluorouracil-stable Ehrlich's ascitic tumor cells. The short-term incubation medium was Krebs-Ringer phosphate buffer with 0.1% glucose and the long-term medium was Eagle's medium with glutamic acid, 10% bovine serum and antibiotics. Both media contained C^{14} -formate and C^{14} -thymidine in concentrations $1 \cdot 10^{-6}$ - $5 \cdot 10^{-5}$ M and 5-fluorouracil in concentrations $1 \cdot 10^{-6}$ - $1 \cdot 10^{-3}$ M. In short-term incubation (one hr) with C^{14} -formate and C^{14} -thymidine, La and La/FU leukemia cells incorporated both precursors in DNA thymine two to three times more intensively than Ehrlich's ascitic tumor cells. Under these conditions, the biosynthesis of thymidylate from thymidine was greater in all tumor cells studied than the biosynthesis from desoxyuridylic acid. On the other hand, in view of the low concentration of endogenic thymidine, synthesis of thymidylate from thymidine did not occur and DNA thymine was mainly synthesized from desoxyuridylic acid in long-term (24 hr) incubation. Fluorouracil in a concentration of $1 \cdot 10^{-5}$ M and higher suppressed synthesis of DNA thymine from desoxyuridylic acid. The 5-fluorouracil concentration should be increased 100 times ($1 \cdot 10^{-3}$ M) to suppress such synthesis in La/FU leukemia cells. Incorporation of C^{14} -formate into DNA thymine (synthesis of thymidylate from desoxyuridylic acid) in Ehrlich's ascitic carcinoma cells with the same concentration (10^{-3} M) of 5-fluorouracil was inhibited only by 70%. There was a correlation between the sensitivity of the tumors to pyrimidine analogs and the degree of suppression of biosynthesis of thymidylate from desoxyuridylic acid under the influence of 5-fluorouracil.

- 4440 BIOANTIOXIDANTS VIEWED AS REGULATORS OF FREE-RADICAL OXIDATION PROCESSES OCCURRING AT DIFFERENT STAGES OF HEPATOCARCINOGENESIS. (Ukr.) Sydoryk, Ye. P. (Inst. Oncol. Prob. Ukrainian SSR Acad. Sci., Kiev, USSR), T. M. Yurkivs'ka and Ye. A. Bahley. *Ukr Biokhim Zh* 44(3):365-368, 1972.

Liver lipid antioxidant activity (AOA) and free radical oxidation processes were studied during different stages of 4-dimethylaminoazobenzene (4-DAB)-induced hepatocarcinogenesis in male mongrel rats. Two-months-old rats received 12 mg of 4-DAB in their daily rice diet, while a related control group received 4-aminoazobenzene (4-AB), a noncarcinogenic azo-compound. Lipids were extracted from liver homogenates prepared at different histomorphologically defined stages of the disease and AOA was evaluated according to the inhibition of the methylolate oxidation rate. Decreased AOA (from 2000 to below 1000 conventional U) was ascertained in both experimental and control animals two to four wk after beginning of the experiment. Increases in AOA appeared during the second month and reached a peak of 5000 conventional U during the third month of early carcinogenesis. Another AOA peak of above 7000 C.U. was observed in the sixth month of carcinogenesis, coinciding with the progressive growth of the tumor. After eight months of 4-DAB treatment, AOA decreased and its fluctuations were attributed to the varying rates of hepatoma cell multiplication. The biochemiluminescence kinetics curves obtained with liver homogenates prepared during various stages of hepatocarcinogenesis indicated that considerable free radical process alterations occurred in the early stages of the disease, when maximum luminescence was 34% lower than the related control peak. Two months after the beginning of DAB treatment, this peak was 46% lower than in the controls. Luminescence homogenates prepared from adenomatous tissue and from hepatocellular cancer tissue were 58% and 70% lower, resp., than that of control animal liver homogenates, indicating that liver homogenate biochemiluminescence decreases along with the carcinogenic process.

- 4441 INFORMATION THEORETICAL MODEL OF CARCINOGENESIS. (Ger.) Schaltegger, H. (Inst. Org. Chem. U. Bern, Switzerland). *Chimia* 26:303-307, 1972.

A universal biological information transformation model of carcinogenesis is presented. It is based on the assumption that external stimuli are transformed electrically by nerve receptors into RNA and proteins and, from these proteins, are again transformed electrically back to the external environment. Phenomenologically and thermodynamically, two kinds of information may be distinguished: reciprocal action between organism and environment, or kinetic information; and chemically stored information as "structural information", or potential information. Transfer of information from the environment via the receptors involves the central nervous system, peripheral nervous system and the intramural nervous system. The potential information is transferred

by the code molecules, DNA, RNA and proteins. These two groups of transformation are considered reversible under certain conditions, since the storage processes deal with cells that are not capable of division. The irreversible processes are associated with aging and with cancer, since the cells involved are able to divide, as for example in epithelial and parenchymal tissues.

4442 GLYCOLYTIC ENZYMES AND GLYCOLYSIS IN LUNGS AND PRIMARY LUNG CARCINOMAS IN MAN. (Ger.)

Sydow, G. (Inst. Cancer Res., Berlin, West Germany) and G. P. Wildner. *Acta Biol Med Germ* 27(3):651-654, 1971.

Studies of normal and primary cancerous lung tissue in humans are reported, including lactic acid formation and activities of hexokinase, phosphofructokinase, aldolase, and pyruvate kinase. The tissues were obtained immediately following surgery, normal tissue being taken from the same patient who had primary lung cancer. The results revealed an increased activity of glycolytic enzymes and lactic acid formation in the cancerous tissue compared to the normal tissue. Protein content is lower in the tumor tissue. Only about 20% of the 50 cancer cases show results close to normal tissue. The lactic acid content of the tumors is three times as high as the normal. Increased glycolytic metabolism may also be detected *in vivo*, in lung cancer, but large deviations in the individual normal lung tissues must be anticipated.

4443 ARYL HYDROCARBON (BENZOPYRENE) HYDROXYLASE IS STIMULATED IN HUMAN LYMPHOCYTES BY MITOGENS AND BENZ(a)ANTHRACENE. (E.) Whitlock, J. P., Jr. (Natl. Cancer Inst., Bethesda, Md.), H. L. Cooper and H. V. Gelboin. *Science* 177(4049):648-649, 1972.

The levels and inducibility of aryl hydrocarbon hydroxylase (AHH) were examined in resting and phytohemagglutinin (PHA)- or pokeweed mitogen (PWM)-stimulated human peripheral lymphocytes. Spectrofluorometric analysis showed that, although the endogenous AHH activity of unstimulated lymphocytes was low compared with that of rat liver microsomes or hamster embryo cells, stimulation with mitogens caused a two-fold increase in enzyme activity. Mitogen-treated cells preexposed to benz(a)anthracene showed a three- to eight-fold greater activity than unstimulated lymphocytes. Highest AHH activity was found in PWM-stimulated, benz(a)anthracene-treated cells. This finding is consistent with the previously reported observation that PWM stimulates endoplasmic reticulum proliferation in human lymphocytes more intensely than PHA. Therefore, AHH activity may be a useful biochemical marker for quantitative changes in the endoplasmic reticulum of differentiating lymphocytes.

4444 SPONTANEOUS REGRESSION OF CHEMICALLY INDUCED MALIGNANT LYMPHOMA IN SWISS MICE. (E.)

Rice, J. M. (Natl. Cancer Inst., Bethesda, Md.) and J. K. Davidson. *Cancer Res* 31:2008-2017, 1971.

Five-week-old female random-bred Swiss-Webster mice were given a single i.p. injection of 1-ethyl-1-nitrosourea (ENU, 1 μ ole/g). In two different experiments, 246 of 462 and 94 of 152 mice developed thymic or nonthymic malignant lymphoma between ten and 35 wk after treatment. A total of 38 of these cases underwent spontaneous regression accompanied by rapid wt loss and development of severe, usually fatal hypoplastic anemia. An additional 19 cases showed histological evidence of incipient regression at autopsy. Regression was characterized histologically by cellular depletion and fibrosis of lymphoid tissues and of visceral lymphoma deposits. Lymphomas that subsequently regressed could be transplanted by grafting lymph node cells into neonatal recipients during the rapidly proliferative phase of the disease. The anemia occurred only in those animals with regressing tumors and was not due to hemorrhage.

4445 TRANSFORMATION OF HAMSTER EMBRYO CELLS BY EPOXIDES AND OTHER DERIVATIVES OF POLYCYCLIC HYDROCARBONS. (E.) Huberman, E. (McArdle Lab., U. Wisconsin, Madison), T. Kuroki, H. Marquardt, J. K. Selkirk, C. Heidelberger, P. L. Grover and P. Sims.

Cancer Res 32(7):1391-1396, 1972.

Hamster embryo cells were exposed *in vitro* to: dibenz(a,h)anthracene (DBA) and its K-region derivatives; benz(a)anthracene (BA) and some of its derivatives; 3-methylcholanthrene (MCA), chrysene, phenanthrene and their K-region epoxides; 7-methylbenz(a)anthracene (MBA) and its K-region epoxide, 7-bromo-MBA, 7,12-dimethylbenz(a)anthracene (DMBA), and 7-bromo-DMBA. The K-region epoxide of DBA was more active in producing malignant transformation than DBA, the K-region phenol or the K-region *cis*- or *trans*-dihydrodiols. The K-region DBA phenol was the most cytotoxic DBA derivative, followed by the *cis*- and *trans*-dihydrodiols. The epoxide of BA was the most active transforming agent in the BA family of derivatives but the *cis*-dihydrodiol also transformed hamster cells. The *trans*-dihydrodiol of BA did not transform and was not cytotoxic. K-region epoxides of MCA, chrysene and phenanthrene were also more active transformers and more cytotoxic than the parent hydrocarbons. MBA was a more active transformer than its K-region epoxide when exposed to cells for seven days, but not when exposed to cells for four days. 7-Bromo-MBA and 7-bromo-DMBA were equally as active as their parent hydrocarbons in producing transformation.

4446 MYCOTOXINS AND THEIR ROLE IN THE ETIOLOGY OF NEOPLASIA IN MAN AND ANIMALS. (Pol.)

Aleksandrowicz, J. (Acad. Med., Cracow, Poland), B. Smyk, M. Czachor, M. Dulak and Z. Schiffer. *Pol Arch Med Wewn* 47(10):331-338, 1971.

comparison was made between the presence of fungi perfecti in the residences (and sometimes food) of 10 individuals with different forms of neoplasms and their presence in the homes of 170 healthy subjects. A statistically significant difference in frequency of occurrence of *Penicillium meleagrimum* and known oncogenic fungi (*Aspergillus flavus*, *Cladosporium herbarum*, *Rhizopus nigricans* and *Alternaria phylla*) was detected among the two groups. These fungi were present, resp., in 105, 83, 80, 54 and 31 of the 210 patients' residences as compared with 15, 29, 35 and 14 of the 170 control residences. Among leukemic subjects, *penicillium meleagrimum* and *Aspergillus flavus* were found with significant frequency in homes of patients with chronic lymphocytic leukemia or lymphosarcoma but not in homes of chronic granulocytic or acute leukemia patients. Investigation of nine residences of married couples in which husband and wife developed neoplastic disease within 2 yr of each other revealed a more frequent occurrence of the fungi (especially *A. flavus* : 8/9) among patients than among controls (2/9). A study of eight "cancer houses" (in which more than three persons developed cancer within 5 yr) also revealed frequent occurrence of *A. flavus* (7/8) and *P. meleagrimum* (6/8) when compared with controls (1/8 each). Further studies on the role of the penicillium, which is not carcinogenic but frequently accompanies fungi with oncogenic properties, are in progress.

4447 THE EFFECT OF ATMOSPHERIC FACTORS ON THE OCCURRENCE OF SKIN CANCERS. (Pol.) Szyroki, (Dermatol. Clin. PAM, Szczecin, Poland) and Z. Salewicz. *Przegl Dermatol* 58(5):569-573, 1971.

Analysis of records of 729 skin cancer patients (467 men, 267 women) treated between 1951-1969 revealed that average age was 59.2 yr for both sexes combined, 55 yr for women and 56.9 yr for men. Morbidity was greatest (53.5% of all patients) between the ages of 50-60; 28.1% of the patients were under 50 and 0.5% were under 30 years of age. Place of residence (village or town) seemed to have no effect on skin cancer incidence, but occupational exposure did: 16.6% exposed as opposed to 23.2% occupationally non-exposed and 18.2% occupational undefined. Lesions were localized on exposed parts of the body in 97.6% of the patients and on covered parts in only 2.4%. Lesions were found most frequently on the lower lip (19.2%), especially among men (255 of 467 as opposed to 16 of 262 women); cheek (19.2%), especially among men (79 of 262 as compared to 61 of 467 men); nose (5.7%) and forehead (5.9%). Histologic classification of lesions revealed that epithelioma basocellulare occurred more frequently among women (55.4%), carcinoma spinocellulare more frequently among men (87.3%).

4448 INTERACTION OF CARCINOGENIC METALS WITH TISSUE AND BODY FLUIDS. (E.) Weinzierl, (Strangeways Lab., Cambridge, England) and M. Webb. *J Cancer* 26(4):279-291, 1972.

Allic cobalt, nickel, cadmium, zinc and copper were

mixed with sterile horse serum and the dissolution of the metals in serum was observed. The carcinogenic metals, nickel and cadmium, dissolved slowly in serum; their rates of dissolution were the same in the presence or absence of oxygen. In contrast, cobalt and copper dissolved more quickly in the presence of oxygen. In all "metal sera," the cations were bound, although in different proportions, by proteins as well as by small diffusible molecules. Radioactive nickel implanted in rat muscle *in vivo* dissolved rapidly; 80% of dissolved nickel was distributed among small diffusible components of muscle tissue. Cobalt also dissolved readily in rat muscle, its solubility in this system exceeding that in horse serum. Copper, cadmium and zinc also dissolved in muscle *in vivo* and bound to small diffusible molecules, rather than to protein components. Metallic ions were not bound by specific cation carriers, either *in vivo* or *in vitro*, but were distributed among a number of components. Solubility was not specific for carcinogenic metals, either in serum or in muscle.

4449 EFFECTS OF LONG-TERM ADMINISTRATION OF ESTROGEN ON THE OCCURRENCE OF MAMMARY CANCER IN WOMEN. (E.) Burch, J. C. (St. Thomas Hosp., Nashville, Tenn.) and B. F. Byrd, Jr. *Obstet Gynecol Surv* 27(5):375-377, 1972.

4450 CARCINOMA OF THE BREAST DURING ESTROGEN REPLACEMENT THERAPY. (E.) Fechner, R. E. (Baylor Coll. Med., Houston, Tex.). *Cancer* 29(3):566-573, 1972.

4451 EFFECTS OF 3,4-BENZOPYRENE PRETREATMENT ON THE HEPATOTOXICITY OF CARBON TETRACHLORIDE IN RATS. (E.) Pitchumoni, C. S. (New York Med. Coll., New York, N. Y.), R. J. Stenger, W. S. Rosenthal and E. A. Johnson. *J Pharmacol Exp Ther* 181(2):227-233, 1972.

4452 COMBINATION OF ENZYME HISTOCHEMISTRY AND RADIOAUTOGRAPHY: A NEW METHOD APPLIED TO ANALYSIS OF HEPATOCARCINOGENESIS. (E.) Kitagawa, T. (Cancer Inst., Tokyo, Japan) and H. Sugano. *Gann* 63(4):509, 1972.

4453 UNUSUAL PROLIFERATION OF BILE-DUCT CELLS IN ICR FEMALE MICE GIVEN 2,7-FLUORENYLBISACETAMIDE WHILE NURSING SUCKLINGS. (E.) Kimura, I. (Aichi Cancer Ctr. Res. Inst., Nagoya, Japan), F. Sakuma, Y. Ito, O. Nishio and S. Yasukawa. *Gann* 63(4):507-508, 1972.

4454 CANCER OF THE OESOPHAGUS AND ALCOHOLIC DRINKS IN EAST AFRICA. (E.) Diller, R. F. B. (Baylor Coll. Med., Texas Med. Ctr., Houston). *Lancet* (7753):743, 1972.

4455 INHIBITION BY ERGOCORNINE OF INITIATION AND GROWTH OF 7,12-DIMETHYLBENZANTHRAcene-INDUCED MAMMARY TUMORS IN RATS: EFFECT OF TUMOR SIZE. (E.) Clemens, J. A. (Eli Lilly Company, Indianapolis, Ind.) and C. J. Shaar. *Proc Soc Exp Biol Med* 139(2):659-662, 1972.

- 4456 STORAGE LEVELS OF DDT METABOLITES IN MOUSE TISSUES FOLLOWING LONG TERM EXPOSURE TO TECHNICAL DDT. (E.) Tomatis, L. (Internatl. Agency Res. Cancer, Lyon, France), V. Turusov, B. Terracini, N. Day, W. F. Barthel, R. T. Charles, G. B. Collins and M. Boiocchi. *Tumori* 57(6):377-396, 1971.
- 4457 THE EFFECT OF URETHANE ON PROTEIN BIOSYNTHESIS. (E.) de Kock, D. H. (Dept. Chem., U. Stellenbosch, South Africa) and A. C. Neethling. *S Afr Med J* 46(11):299-300, 1972.
- 4458 METABOLISM OF BUTYL(4-HYDROXYBUTYL)NITROSOAMINE IN RATS. (E.) Okada, M. (Tokyo Biochem. Res. Inst., Tokyo, Japan) and E. Suzuki. *Gann* 63(3):391-392, 1972.
- 4459 *IN VITRO* CULTURE OBSERVATIONS ON NEURINOMA INDUCED EXPERIMENTALLY IN THE RAT BY ETHYLNITROSOUREA. (E.) Fornatto, L. (Clin. Nervous Mental Dis., U. Turin, Italy) and D. Schiffer. *Acta Neuropathol* 20:199-206, 1972.
- 4460 REACTION OF NITROSOUREAS WITH POLYCYTIDYLATE TEMPLATES FOR RIBONUCLEIC ACID POLYMERASE. (E.) Ludlum, D. B. (U. Maryland Sch. Med., Baltimore) and P. N. Magee. *Biochem J* 128(3):729-731, 1972.
- 4461 INFLUENCE OF 1,10-PHENANTHROLINE ON PATHOLOGIC CHANGES IN LIVER OF ETHIONINE FED RATS. (E.) Brada, Z. (Papanicolaou Cancer Res. Inst., Miami, Fla.), M. Chvapil and S. Bulba. *Life Sci* 11:277-286, 1972.
- 4462 DEVELOPMENT OF HEPATOMAS IN MICE TREATED WITH BENZENE HEXACHLORIDE. (E.) Nagasaki, H. (Nara Med. U., Kashihara, Japan), S. Tomii, T. Mega, N. Marugami and N. Ito. *Gann* 62(5):431-432, 1971.
- 4463 INDUCTION OF HYPERPLASIA IN MOUSE SALIVARY GLAND ISOGRAFTS. (E.) Hoshino, K. (Hlth. Sci. Ctr., U. Western Ontario, Canada) and C. D. Lin. *Eur J Cancer* 7(5):373-376, 1971.
- 4464 ESTROGEN, VAGINAL CANCER, AND VAGINAL DEVELOPMENT. (E.) Forsberg, J.-G. (Dept. Anatomy, U. Bergen, Norway). *Am J Obstet Gynecol* 113(1):83-87, 1972.
- 4465 ESTABLISHMENT AND CYTOLOGICAL OBSERVATION OF A CELL LINE FROM RAT FIBROSARCOMA INDUCED BY 3-METHYLCHOLANTHRENE. (E.) Nagura, H. (Nagoya U. Sch. Med., Japan). *Tohoku J Exp Med* 106:147-163, 1972.
- 4466 METABOLIC ALTERATIONS OF LIVER REGENERATION. VIII. ENHANCED SYNTHESIS OF DNA IN THE LIVER OF 5-AZACYTIDINE-TREATED RATS SUBJECTED TO PARTIAL HEPATECTOMY. (E.) Cihak, A. (Czechoslovak Acad. Sci., Prague), M. Seifertova, J. Vesely and F. Sorm. *Int J Cancer* 10:20-27, 1972.
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- 4468 MUTAGENICITY OF CHEMICAL CARCINOGENS IN *NEUROSPORA CRASSA*. (E.) Ong, T.-m. (Oak Ridge Natl. Lab., Tenn.) and F. J. de Serres. *Cancer Res* 32:1890-1893, 1972.
- 4469 DOSE-RESPONSE RELATIONSHIPS OF THE BLADDER TUMORIGEN 2-NAPHTHYLAMINE: A STUDY IN BEAGLE DOGS. (E.) Conzelman, G. M., Jr. (Christ Hosp. Inst. Med. Res., Cincinnati, Ohio) and J. E. Moulton. *J Nat Cancer Inst* 49(1):193-205, 1972.
- 4470 INDUCTION OF URINARY BLADDER TUMORS IN ACI/N RATS BY BUTYL(3-CARBOXYPROPYL) NITROSOAMINE, A MAJOR URINARY METABOLITE OF BUTYL (4-HYDROXYBUTYL)-NITROSOAMINE. (E.) Hashimoto, Y. (Tokyo Biochem. Res. Inst., Japan), E. Suzuki and M. Okada. *Gann* 63:637-638, 1972.
- 4471 EFFECT OF 4-NITROQUINOLINE 1-OXIDE AND RELATED CARCINOGENS ON THE VISCOSITY OF DNA AT ELEVATED TEMPERATURES. (E.) Okano, T. (Pharmaceutical Inst., Tohoku U., Sendai, Japan) and S. Takenaka. *Gann* 63:639-644, 1972.
- 4472 KARYOKINESIS AND NUCLEAR STRUCTURE DURING HEPATOCARCINOGENESIS. I. MITOSIS AND MITOTIC DISORDERS OBSERVED IN HEPATOCYTES AND HEPATOMA CELLS OF THE NITROSOMORPHOLINE-DAMAGED RAT LIVER. (Ger.) Romen, W. (Inst. Path., U. Wuerzburg, Germany) and P. Bannasch. *Virchows Arch (Zellpathol)* 11:24-33, 1972.
- 4473 A CASE OF INVOLUTIONAL BENZENE MYELOPATHY, DEVELOPED INTO ACUTE LEUKEMIA. (It.) Cuna, G. R. della (Labor Found. Clin., U. Pavia, Italy) A. Favino, G. P. Biscaldi and G. Pollini. *Haematol Arch* 57(1-2):65-89, 1972.
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- 4476 HYDRAZINE SULFATE - INDUCED LUNG AND MAMMARY GLAND TUMORS IN PREGNANT AND PSEUDOPREGNANT BALB/c/CbSe MICE. (It.) Biancifiore, C. (Inst. Path. Anat. Histol. U. Pisa, Italy). *Lav Ist Anat Istol Patol Perugia* 31(3):79-90, 1971.

- 4477 BETEL QUID INDUCEMENT OF EPITHELIAL ATYPIA IN THE BUCCAL MUCOSA OF BABOONS. (E.) Hamner, J. E., III (Natl. Inst. Hlth., Bethesda, Md.). *Cancer* 30(4):1001-1005, 1972.
- 4478 FLUORANTHENES: QUANTITATIVE DETERMINATION IN CIGARETTE SMOKE, FORMATION BY PYROLYSIS, AND TUMOR-INITIATING ACTIVITY. (E.) Hoffman, D. (American Hlth. Fdn., New York, N.Y.), G. Rathkamp, S. Nesnow and E. L. Wynder. *J Nat Cancer Inst* 49(4): 1165-1175, 1972.
- 4479 LIVER REGENERATION AND HEPATIC COLLAGEN DEPOSITION IN RATS WITH DIMETHYLNITROSAMINE-INDUCED CIRRHOSIS. (E.) Haney, A. (U. Arizona Coll. Med., Tucson), E. E. Peacock, Jr. and J. W. Madden. *Ann Surg* 175(6):863-869, 1972.
- 4480 REACTION OF ALKYLATING MUTAGENS AND CARCINOGENS WITH NUCLEIC ACIDS: DETECTION AND ESTIMATION OF A SMALL EXTENT OF METHYLATION AT O-6 OF GUANINE IN DNA BY METHYL METHANESULPHONATE *IN VITRO*. (E.) Lawley, P. D. (Chester Beatty Res. Inst., Chalfont St. Giles, Bucks, England) and S. A. Shah. *Chem-Biol Interact* 5(4):286-288, 1972.
- 4481 ASSOCIATION OF NUCLEIC ACIDS AND CELLULAR MEMBRANES INDUCED BY A CARCINOGEN, β -PROPIOLACTONE. (E.) Kubinski, H. (U. Wisconsin Sch. Med., Madison), P. R. Andersen and L. M. Kellicutt. *Chem-Biol Interact* 5(4):279-283, 1972.
- 4482 SUPPRESSOR MUTATIONS INDUCED BY 4-NITRO-QUINOLINE 1-OXIDE AND 4-HYDROXYAMINO-QUINOLINE 1-OXIDE IN *ESCHERICHIA COLI*. (E.) Ishizawa, M. (Fac. Med., Kyushu U., Fukuoka, Japan) and H. Endo. *Gann* 63:511-515, 1972.
- 4483 GENETIC CHARACTERIZATION OF DIETHYLNITROSAMINE-INDUCED PURPLE ADENINE (*ad-3*) MUTANTS IN *NEUROSPORA CRASSA*. (E.) Malling, H. V. (Oak Ridge Natl. Lab., Tenn.) and F. J. de Serres. *Cancer Res* 32(6):1273-1277, 1972.
- 4484 LANTHANUM-INDUCED ALTERATIONS IN CELLULAR ELECTROLYTES AND MEMBRANE POTENTIAL IN EHRlich ASCITES TUMOR CELLS. (E.) Levinson, C. (Texas Med. Sch., San Antonio), T. M. Mikiten and T. C. Smith. *J Cell Physiol* 79:299-308, 1972.
- 4485 APPARENT INCREASES IN TUMOUR NAD^+ LEVELS INDUCED BY TREATMENT WITH VITAMIN K_1 OR ITS SYNTHETIC SUBSTITUTES. (E.) Calcutt, G. (United Bristol Hosp., England) and S. M. Ting. *Biochem Pharmacol* 21(6):894-896, 1972.
- 4486 MALIGNANT MESOTHELIOMA IN CHILDHOOD. (E.) Grundy, G. W. (Natl. Cancer Inst., Bethesda, Md.) and R. W. Miller. *Cancer* 30(5):1216-1218, 1972.
- 4487 MAINTENANCE OF EPITHELIAL CELL DIFFERENTIATION: THE MODE OF ACTION OF VITAMIN A. (E.) De Luca, L. (Natl. Cancer Inst., Bethesda, Md.), N. Maestri, F. Bonanni and D. Nelson. *Cancer* 30(5):1326-1331, 1972.
- 4488 HEMANGIOENDOTHELIOMA OF THE LEG FOLLOWING METALLIC FIXATION OF THE TIBIA. (E.) Dube, V. E. (St. Joseph Mercy Hosp., Mason City, Iowa) and D. E. Fisher. *Cancer* 30(5):1260-1266, 1972.

See also:

- * (Rev): 4301, 4302, 4303, 4304, 4317, 4323, 4330, 4342, 4348, 4350, 4353
- * (Phys): 4494, 4500
- * (Viral): 4504, 4505, 4520, 4568, 4582, 4588
- * (Immun): 4619, 4626, 4642, 4679, 4681, 4686, 4703
- * (Path): 4782, 4784
- * (Epid): 4825, 4834

- 4489 COCARCINOGENIC ACTION OF MECHANICAL DAMAGE AND X-RAY IRRADIATION ON INTRAMANDIBULAR TISSUE OF MICE. (E.) Eulderink, F. (J. A. Cohen Inst. Radiation Path. Radiation Protection, Leiden, The Netherlands) and Th. G. van Rijssel. *J Nat Cancer Inst* 49:821-827, 1972.

The effect of combined X-ray irradiation and continuous mechanical irritation was studied. Chronic mechanical irritation of enamel-forming epithelium by implantation of nylon threads or steel wires in alveolar sockets of (♀ WLLf X ♂ O₂₀)F₁ mice, which induces intramandibular carcinoma, was combined with X-ray irradiation of the head in a single dose of 500 or 1000 rads. These doses did not induce tumors when applied without other treatment. Implantation and irradiation together caused a marked increase of the number of induced tumors as compared with implantation alone. Both carcinomas and benign mesenchymal tumors (osteofibromas) developed. At a dose level of 500 rads, this increase was significant for carcinomas and for all types of tumor; at a dose of 1000 rads this was true for all tumors but not for carcinomas alone. Combined with thread implantation, irradiation gave more tumors in a dose of 500 rads than in one of 1000 rads; for carcinomas this was statistically significant. At higher dose levels the cell-damaging action of the X rays probably interferes with the carcinogenic influence.

- 4490 LEUKAEMIA, MALIGNANCIES AND OTHER LATE EFFECTS FOLLOWING ADMINISTRATION OF THOROTRAST. (E.) Da Silva Horta, J. (Fac. Med., U. Lisbon, Portugal), J. D. Abbott, L. Cayolla da Motta and M. Helena Tavares. *Z Krebsforsch* 77(3):202-216, 1972.

Cancer incidence in 1178 Portuguese patients exposed to Thorotrast (a stabilized solution of thorium dioxide) for diagnostic purposes between 1930-1955 was investigated. A control population matched for age and sex but injected with a nonradioactive agent served for comparison. The study showed a gross excess of liver hemangioendotheliomas (16 histologically confirmed cases) in Thorotrast-treated subjects. Cholangiocarcinomas and hepatomas of the liver were also frequently present in the Thorotrast population. There were three primary bone tumors and five cases of lung cancer. The latter could not be unequivocally attributed to Thorotrast, since the smoking habits of the Thorotrast-exposed subjects were unknown. Twenty-two fatal blood dyscrasias, especially myeloid leukemias, occurred in the Thorotrast group. These blood dyscrasias appeared about 20 yr after irradiation in contrast to the five to seven year latent period of dyscrasias induced by external irradiation.

- 4491 THE EFFECT OF AGE AT EXPOSURE TO A SUB-LETHAL DOSE OF FAST NEUTRONS ON TUMORIGENESIS IN THE MALE RAT. (E.) Castanera, T. J. (Naval Radiol. Defense Lab., San Francisco, Calif.), D. C. Jones, D. J. Kimeldorf and V. J. Rosen. *Cancer Res* 31:1543-1549, 1971.

Male Sprague-Dawley rats aged one month ("juveniles") or 21 months ("old") were given a single whole body dose of 215 rads of fast neutron irradiation; 3-month-old rats ("young adults") were given 230 rads. Rats were observed for life and the incidence of primary epithelial and nonepithelial, benign and malignant tumors was tabulated. Irradiated juveniles showed significant excesses over nonirradiated controls in all tumor categories except malignant epithelial tumors. Irradiated young adults showed excess tumor incidence only in the malignant epithelial and malignant nonepithelial categories. Irradiated old rats did not show significant excesses in any tumor category. Irradiated juveniles differed from irradiated young adults in having excesses of benign nonepithelial tumors. Also, while irradiated juveniles had significant excesses of multiple malignant epithelial tumors, the excesses of tumor incidence in this category were much greater for young adults. The skin, kidneys and Langerhan's islands in the two younger groups showed marked susceptibility to radiation. Juvenile breast tissue, bone, thyroid, peripheral nerves and skeletal muscles were especially susceptible, as were young adult lungs.

- 4492 THE EFFECT OF AGE, FRACTIONATION, AND DOSE ON RADIATION CARCINOGENESIS IN VARIOUS TISSUE OF MICE. (E.) Vesselinovitch, S. D. (Pritzker Sch. Med., U. Chicago, Ill.), E. L. Simmons, N. Mihailovich, K. V. N. Rao and L. S. Lombard. *Cancer Res* 31:2133-2142, 1972.

Mice of the C57BL/6 x C3H F₁ strain were given X-irradiation beginning on the first, 15th or 42nd day of life. X-irradiation to a total dose of 320 R was delivered in either a single dose, or in two doses four days apart, or in four doses four or seven days apart. Some mice were given 480 R of irradiation as four exposures seven days apart. Tumor incidence at 86 wk was observed. Among tumors developed, usually late in life, by irradiated mice were malignant melanomas, hepatomas, lung adenomas, Harderian gland cystadenomas and ovarian tumors. Irradiation increased tumor incidence. The incidence of malignant lymphoma did not vary among mice irradiated at different ages, but irradiation increased lymphoma incidence from less than 1% in unirradiated mice to 11.36%. The 480 R dose was more lymphomagenic than the smaller doses. Age at irradiation did not affect hepatoma incidence, but irradiation increased hepatoma incidence in males. The four dose, 320 R total at four-day intervals was the most effective schedule for causing hepatoma. Irradiation increased lung adenoma incidence, but no irradiation schedule was more tumorigenic than the others. Infant and adult mice were more likely to develop Harderian gland tumors after irradiation than were newborns. Age also influenced ovarian tumor incidence; one-day-old mice were less responsive to irradiation than were infants or adults. The types of tumors developed by 86 wk old irradiated mice were also seen in unirradiated mice allowed to live for 166 days.

4493. ASPECTS OF THE BIOLOGY AND RADIATION RESPONSE OF CLONED C3H MOUSE MAMMARY CARCINOMA CELLS *IN VITRO* AND *IN VIVO*. (E.) Cohn, N. K. (U. Wisconsin Med. Sch., Madison), and K. H. Clifton. *Europ J Cancer* 7(6):505-514, 1971.

Twenty cell lines were established from nine primary or transplanted mammary carcinomas from C3H/Wr mice. In general, cell lines from tumors that had been transplanted and grew well *in vivo* were more readily established than those from primary tumors or tumors which were difficult to transplant. Both epithelioid and spindle cell types were observed in outgrowths from all tumors. With the exception of two spindle cell lines, all lines gave rise to tumors after inoculation in histocompatible mice. Studies with two representative cloned epithelioid and one cloned spindle cell line showed that tumors grew more rapidly from cultured cells which had been recently passed in mice than from long-term cultured cells. Experiments designed to determine if this mouse-passage effect resulted from pronounced antigen differences between long-term cultured cells and the most mice were negative. Data from an experiment in which $^{125}\text{IUdR}$ -labelled cells were employed indicated that a greater percentage of the inoculated mouse-passaged cells survived to contribute to tumor formation compared with long-term cultured cells. When lethally irradiated cells were included in the inocula, the effective number of *in vitro* colony-forming units required for tumor formation *in vivo* was found to be about 2 and 3 for the epithelioid cell lines, resp. The three cell lines studied had differing radiosensitivity (D_0) values when irradiated *in vitro*. The D_0 for irradiation *in vivo* of one passaged epithelioid cell line was similar to the D_0 of the transplanted tumor strain from which it was derived.

4494. COMPARATIVE STUDIES ON INDUCTION AND REJOINING OF DNA SINGLE-STRAND BREAKS BY RADIATION AND CHEMICAL CARCINOGEN IN MAMMALIAN CELLS *IN VITRO*. (E.) Horikawa, M. (Dept. Radiat. Biol., Kanazawa U., Japan), M. Fukuhara, F. Suzuki, O. Nikaide and T. Sugahara. *Exp Cell Res* 70(2):349-359, 1972.

Mouse fibroblastic L cells, pig kidney cells and Ehrlich ascites tumor cells were exposed to X-irradiation (1-10 KR) or to 4-hydroxyaminoquinoline 1-oxide (4-HAQO). To investigate single stranded DNA breaks induced by irradiation of 4-HAQO, the treated cells were subjected to sedimentation analysis on 5-20% alkaline sucrose gradients. The repair rejoining of DNA breaks was observed during incubation of treated cells. Single-stranded DNA breaks were induced almost as a linear function of X-ray dose. 4-HAQO in concentrations higher than 1×10^{-5} M induced breaks, while 5×10^{-6} M doses did not induce breaks. Breaks induced by X-irradiation were rejoined by 15-60 min of cell incubation after irradiation; breaks induced by 4-HAQO were rejoined by three and 24 hr after treatment. Rejoining of DNA breaks consisted of a rapid rejoining process continuing for a short

time after the start of cell incubation after treatment and a subsequent slower process of longer duration. When X-irradiated or 4-HAQO-treated cells were treated with puromycin, rejoining of single-strand DNA breaks was completely suppressed, despite the fact that puromycin did not inhibit normal cell DNA synthesis. Pretreatment of cells 72 hr before irradiation or 4-HAQO, and posttreatment 24 hr after irradiation or 4-HAQO, with hydroxyurea did not suppress rejoining of DNA breaks, even though hydroxyurea was extremely inhibitory of normal DNA synthesis.

4495. ADENOCARCINOMA OF THE UTERINE BODY FOLLOWING USE OF INTRAUTERINE CONTRACEPTIVE DEVICE. (E.) Harrison, R. F. (Mater Misericordiae Hosp., Dublin, Ireland). *Obstet Gynaecol Surv* 27(5):390, 1972.

4496. DNA CHAIN ELONGATION AND JOINING IN NORMAL HUMAN AND XERODERMA PIGMENTOSUM CELLS AFTER ULTRAVIOLET IRRADIATION. (E.) Buhl, S. N. (U. Tennessee, Oak Ridge Grad. Sch. Biomed. Sci.), R. M. Stillman, R. B. Setlow and J. D. Regan. *Biophys J* 12(9):1183-1191, 1972.

4497. EFFECTS OF WHOLE BODY IRRADIATION ON THE INDUCTION OF IMMUNOLOGICAL TOLERANCE BY THRESHOLD DOSE OF SOLUBLE RABBIT γG . (E.) Fujiwara, M. (Inst. Med. Sci., U. Tokyo, Japan), I. Tamanci and T. Tsuchiya. *Jap J Exp Med* 42(1):67-73, 1972.

4498. BRAIN TUMORS IN IRRADIATED MONKEYS. (E.) Haymaker, W. (NASA, Ames Res. Ctr., Moffett Field, Calif.), L. J. Rubinstein and J. Miquel. *Acta Neuropathol* 20:267-277, 1972.

4499. PRIMARY CANCER OF THE LIVER FOLLOWING TREATMENT OF POLYCYTHAEMIA VERA WITH RADIOACTIVE PHOSPHORUS. (E.) Chudecki, B. (Royal Devon Hosp., Exeter, England). *Br J Radiol* 45(538):770-774, 1972.

4500. THOROTRAST-INDUCED HEPATOMA. (E.) Smoron, G. L. (Chicago Wesley Mem. Hosp., Ill.) and H. A. Battifora. *Cancer* 30(5):1252-1259, 1972.

4501. COMPETITIVE *IN VIVO* PROLIFERATION OF FOETAL AND ADULT HAEMATOPOIETIC CELLS IN LETHALLY IRRADIATED MICE. (E.) Micklem, H. S. (U. Edinburgh, Scotland), C. E. Ford, E. P. Evans, D. A. Ogden and D. S. Papworth. *J Cell Physiol* 79:293-298, 1972.

See also:

- * (Rev): 4329, 4337, 4350
- * (Chem): 4413
- * (Immun): 4741
- * (Epid): 4816

- 4502 NATURE OF VIRUS-PRODUCING ROUS SARCOMA CELLS IN HAMSTERS TREATED WITH ANTILYMPHOCYTE SERUM: IMMUNOCHEMICAL, CYTOGENETICAL, AND ELECTRON MICROSCOPIC OBSERVATIONS. (E.) Halleux, F. de (U. Louvain, Belgium), H. Van Den Berghe and A. Declève. *J Nat Cancer Inst* 48(6):1607-1618, 1972.

Two day old hamsters were inoculated s.c. with chicken tumor cells induced by the Bryan high-titer strain of Rous sarcoma virus (BH-RSV); tumors appeared only in inoculated hamsters treated with heterologous antilymphocyte serum. When the BH-RSV-induced tumors were tested in immunodiffusion tests against antihamster tissue immune serum, they showed reactions of identity; reactions of partial identity were seen when tumors were reacted against anti-chicken immune serum. Characteristic fluorescent patterns were seen with both antisera in immunofluorescence tests with the tumors. In these tests, antihamster serum stained connective tissue cells in the tumors, while antichicken serum stained tumorous cells. Mitotic figures in tumor cells showed the chromosome complement of both chick and hamster cells, hamster cell complements being more common. Under the electron microscope tumor cells were similar to chicken sarcoma cells. C-type virus particles were seen in all tumors; the number of particles increased from six hr to eight days after inoculation of Rous sarcoma cells.

- 4503 HEMATOPOIETIC CFU IN MICE INFECTED BY THE POLYCYTHEMIA-INDUCING FRIEND VIRUS. I. NUMBER OF CFU, AND DIFFERENTIATED PATTERN IN THE SPLEEN COLONIES. (E.) Wendling, F. (I.N.S.E.R.M., Orsay, France), P. E. Tambourin and P. Jullien. *Int J Cancer* 9(3):554-566, 1972.

C3H-He mice were inoculated i.v. with polycythemia-inducing Friend virus (FVP) preparations obtained from spleens of virus-infected mice. In some cases, mice were given 950 R whole-body X-irradiation. The number of colony-forming U (CFU) in spleen, femoral bone marrow and blood of infected mice was observed using an exogenous spleen colony assay. The total number of CFU in spleens of mice infected with FVP was 37,000-120,000 by 30 days after inoculation of virus; the numbers of CFU in spleens of uninfected mice was $4,720 \pm 460$. The number of CFU in bone marrow of infected mice was not different from that in uninfected mice. The number of CFU in blood of FVP-infected mice was 40,000, compared to 45 CFU in blood of uninfected mice. The fraction of CFU which settled in spleens of irradiated mice injected with spleen or marrow cells from normal or FVP-infected mice was determined. The proportion of CFU recovered from spleens of irradiated mice was similar in mice given normal or FVP-infected marrow cells; the proportion of CFU in spleens of irradiated mice given spleen cells from FVP-infected mice was decreased relative to that in spleens of irradiated recipients of normal spleen cells. The cytological characteristics of colonies developing in spleens of irradiated mice grafted with hematopoietic cells of normal or FVP-infected donors was investigated. No important differences were seen

between differentiation patterns of erythrocytic, granulocytic, megakaryocytic or mixed colonies produced by mice given normal or FVP-infected hematopoietic cells.

- 4504 INHIBITORY EFFECT OF CARCINOGENIC AROMATIC HYDROCARBONS ON TRANSFORMATION OF 3T3 CELLS BY SV40. (E.) Docherty, J. J. (Dept. Microbiol., U. Arizona, Tucson), P. P. Ludovici and G. T. Schloss. *Proc Soc Exp Biol Med* 140(3):969-973, 1972.

7,12-Dimethylbenz(a)anthracene (DMBA) or 3-methylcholanthrene (3-MC) were added to suspensions of 3T3 cells in concentrations of 0.0005-0.5 $\mu\text{g/ml}$ and the effect on 3T3 cell plating efficiency was observed. Doses of 0.0005 $\mu\text{g/ml}$ DMBA and 0.005 $\mu\text{g/ml}$ 3-MC had no toxic effect on cell plating efficiency. Accordingly, DMBA or 3-MC were added in these amounts to 3T3 cells 48 hr before cells were infected with SV40 (A group), at the time of SV40 infection (B group), or 24 hr after virus infection (C group). In groups A and B, where DMBA or 3-MC was in contact with cells for 48 hr or 3 hr, resp., the number of SV40-transformed 3T3 clones was not reduced. In group C, however, where carcinogens were in contact with cells for seven days, the transformation of 3T3 cells by SV40 was decreased. The percentage of transformed clones in DMBA- or 3-MC-treated SV40-infected cultures in groups A and B ranged from 3.2-1.8%. The percentage of transformed clones in infected group C cultures treated with carcinogens ranged from 1.0-2.0%. The carcinogens had no direct effect on SV40 infectivity when SV40 was incubated with 0.002-200.0 $\mu\text{g/ml}$ of carcinogens before being titrated on African green monkey cells.

- 4505 VIRUS PARTICLES IN RAT LEUKEMIAS INDUCED BY N-NITROSOBUTYLUREA. (E.) Kodama, T. (Hokkaido U. Sch. Med., Japan), M. Hosokawa, E. Gotohda, F. Sendo and H. Kobayashi. *Gann* 63(2):261-263, 1972.

C-type virus particles were identified by electron microscopy in leukemic tissues induced in Wistar-King-Aptekman/Mk rats by oral administration of N-nitrosobutylurea for four months. The virus particles were present in both primary and transplantable leukemia tissues and in cell cultures obtained from transplantable leukemia. Mature and immature C-type particles were observed in intercellular spaces; budding of virus particles was seen at the membrane surface of the leukemia cells. In general, the virus content of the specimens was low (one virus particle per 200-500 cells). Particle frequency was slightly increased in primary leukemia compared with transplantable leukemia, but no difference in frequency was seen in the stem cell and erythroblastic types of leukemia. No virus particles were observed in organs of normal controls or in control N-nitrosobutylurea-induced primary and transplantable mammary tumors.

06 LIGHT AND ELECTRON MICROSCOPIC STUDIES OF
TUMORS INDUCED BY SMALL PLAQUE VARIANT
CHICKEN EMBRYO LETHAL ORPHAN VIRUS. (E.)

sty, V. (Animal Path. Dept., U. Rhode Island,
ngston), V. J. Yates, J. Anderson, R. E. Wolke,
Pendola, and P. W. Chang. *Cancer Res* 32(10):
04-2113, 1972.

The light and electron microscopic appearances of
our solid tumors induced in hamsters by the
small-plaque variant of chicken embryo lethal
orphan virus were studied. The tumors were
composed of cells ranging from those that were
differentiated to those with fibroblastic
differentiation. Ultrastructurally, the neoplastic
cells were characterized by nuclei with irregular
contours; well-developed, rough endoplasmic
reticulum; mitochondria; and abundant, free
ribosomal clusters. One outstanding feature of
these cells was the wrapping of the cisternal
profiles of rough endoplasmic reticulum around the
mitochondria. Although no adenovirus particles
were discernible, virus-like particles resembling
either the intracytoplasmic hamster type A
particles or the Bernhard type were detected
in two of the four tumors examined. The sera from
two of the four tumor-bearing hamsters contained
small-plaque virus specific "T" antibodies, as
demonstrated by indirect immunofluorescent
techniques.

07 CIRCULATION OF LYMPHOID CELLS IN MICE IN-
FECTED WITH FRIEND LEUKEMIA VIRUS. (E.)

Winbridge, D. R. (London Hosp. Med. Coll., England)
and M. Bendinelli. *J Nat Cancer Inst* 49(3):773-781,
1972.

Friend virus (FV) depressed the immune response of
C57BL/c mice to sheep red cells (SRC) but not to
logeneic lymphoid cells. This difference was
at least partly due to the fact that the major re-
sponse to SRC occurred in the spleen, for FV infec-
tion had little effect when SRC were given by foot-
pad injection. In an attempt to explain the function
of the spleen, the circulation of lymphoid cells was
studied in normal and infected mice. As judged by
Cr-labeling, the lymphoid organs of infected mice
accepted cells more or less normally and the
ability of lymphoid cells from infected mice to
migrate to lymphoid tissue was probably unaltered, if
one allows for the dilution of lymphocytes by neo-
plastic cells in the spleen. ⁷⁵Se-labeling ex-
periments showed that the transit of circulating
lymphoid cells was greatly slowed in the infected
spleen. This might affect their ability to interact
with resident cells in those immune responses
dependent on lymphocyte cooperation.

08 THE EFFECT OF DIBUTYRYL CYCLIC ADENOSINE
MONOPHOSPHATE ON SYNTHESIS OF SULFATED
ACID MUCOPOLYSACCHARIDES BY TRANSFORMED FIBROBLASTS.

(E.) Goggins, J. F. (Natl. Inst. Dental Res.,
Bethesda, Md.), G. S. Johnson and I. Pastan.

J Biol Chem 247(18):5759-5764, 1972.

The effect of dibutyryl-cyclic adenosine 3',5'-
monophosphate and theophylline on the incorporation
of [³⁵S]sulfate into acid mucopolysaccharides by
3T3 and SV3T3 fibroblasts was studied. SV40 trans-
formation of 3T3 fibroblasts produced a marked
decrease in the rate of synthesis of acid mucopoly-
saccharides, in agreement with the data of others.
When the transformed cells were grown in medium
supplemented with dibutyryl-cyclic AMP and theo-
phylline for three days, they secreted, on the
basis of cell protein, approximately 250% more
labeled acid mucopolysaccharides during a 24-hour
labeling period than did the nontreated controls.
The secretion of a variety of sulfated acid muco-
polysaccharides was increased including chondroitin-
4- and -6-sulfate and dermatan sulfate. Comparison
of the rate of sulfate incorporation into acid
mucopolysaccharides and the rate of loss of
previously labeled acid mucopolysaccharides from
the cells indicated that the effect was due to a
greater rate of synthesis of these compounds at
the time of labeling rather than due to a decrease
in the rate of their degradation.

4509 STUDIES WITH HUMAN PAPILLOMA VIRUS MODELED
AFTER KNOWN PAPOVAVIRUS SYSTEMS. (E.)

Butel, J. S. (Baylor Coll. Med., Houston, Texas).
J Nat Cancer Inst 48(2):285-299, 1972.

Papilloma virus-bearing human wart tissue was
cultured and tested in complement fixation tests
with rabbit anti-papilloma virus serum. An aver-
age of 2.3×10^7 papilloma virus particles/complement
fixing U (equivalent to about 10^9 particles/ml)
were needed to fix complement in wart tissue
cultures. No virus hemagglutinin was detected.
Several species of host cell, including human
embryonic kidney (HEK), green monkey kidney, KB,
HeLa and human skin cells, were surveyed for sus-
ceptibility to papilloma virus replication and
transformation. These host cells failed to support
virus replication. Papilloma virus DNA in the
presence of DEAE dextran also failed to produce
morphological changes, cytopathic effect or viral
antigen in HEK cells. However, uptake of radio-
active precursor into DNA synthesized in cultures
of HEK cells was increased in the presence of
papilloma virus particles. Representatives of
major virus groups were tested for helper virus
activity with papilloma virus. No helper or
interfering interactions between papilloma virus
and the others were seen. Papilloma virus inocula-
tion produced no papillomas in sacrificed weanling
hamsters, and no virus-induced antigens were
detected in rejection tests with hamster cells
inoculated with papilloma virus and transplanted
into hamsters.

4510 PROPERTIES OF SOMATIC CELL HYBRIDS BETWEEN
MOUSE CELLS AND SIMIAN VIRUS 40-TRANS-
FORMED RAT CELLS. (E.) Noordaa, J. van der

(Hlth. Res. Lab., U. Amsterdam, Netherlands), A. van Haagen, J. M. M. Walboomers and H. van Someren. *J Virol* 10(1):67-72, 1972.

Primary rat cells were transformed with SV40 and fused by Sendai virus mediation with a strain of thymidine kinase-deficient 3T3 mouse cells (3T3TK⁻). Lactate dehydrogenase, 6-phosphogluconate dehydrogenase and indophenol oxidase patterns in four hybrid cell lines were observed, confirming the hybrid nature of these lines. The parental 3T3TK⁻ cells had a modal chromosome number of 63 and the rat cells a modal number of 42; hybrid cell lines at subculture 12 had modal chromosome numbers of 70-80, all telocentric or acrocentric. Over a year, only 10-20% of chromosomes were lost by hybrids. Neither SV40-transformed parent cells nor hybrid cell lines shed infectious SV40. Hybrids at subculture 15 contained SV40 T antigen. In agglutination, growth in soft agar and serum requirements, hybrid cells resembled the transformed parent line.

4511 CELL CYCLE-DEPENDENT ACTIVATION OF ROUS SARCOMA VIRUS-INFECTED STATIONARY CHICKEN CELLS: AVIAN LEUKOSIS VIRUS GROUP-SPECIFIC ANTIGENS AND RIBONUCLEIC ACID. (E.) Humphries, E. H. (McArdle Lab., U. Wisconsin, Madison) and H. M. Temin. *J Virol* 10(1):82-87, 1972.

Primary chick embryo fibroblasts were infected with Schmidt-Ruppin Rous sarcoma virus (SRV); attempts were made to detect avian leukosis virus group-specific (gs) antigen in both stationary and dividing SRV-infected cells. Indirect immunofluorescence, complement fixation and immunoabsorption fluorescence were used to test for avian leukosis gs antigens. Stationary SRV-infected cells showed no strong reactions for this gs antigen, even at 130 hr postinfection, while more than 80% of actively dividing cells possessed the antigen. It was known that stationary SRV-infected cells did not release infectious virus. In related experiments, attempts were made to bring about RNA-DNA hybridization between RNA from stationary SRV-infected cells and DNA from the B77 virus endogenous RNA-directed DNA polymerase. RNA from stationary infected cells hybridized only slightly with the B77 DNA. RNA from RSV-infected dividing cells contained 20- to 150-fold more avian leukosis virus-specific RNA than stationary infected cultures.

4512 ALTERATION OF SKIN IN GROSS LEUKEMIA. IV. TEST OF ALLOGRAFT HYPOTHESIS. (E.)

Mariani, T. (Pediatrics, Path. Radiation Res. Labs., U. Minnesota, Minneapolis), Y. Maruyama and R. A. Good. *J Nat Cancer Inst* 49(3):879-885, 1972.

To test the hypothesis that an immunologic response underlies the rejection of skin from syngeneic tumor-bearing animals, (C3H/Bi X DBA/2)F₁ recipients were given 400R total-body X irradiation, neonatally thymectomized, or both irradiated and

thymectomized. These animals were grafted with syngeneic skin from mice bearing Gross passage A tumors for 4, 7, or 11 days. The rates of graft rejection, tumor development at the graft site, and survival time for these immunosuppressed animals did not differ from those of immunologically intact recipients. By contrast, allogeneic skin was not rejected by animals treated with the same immunosuppressive manipulations. These experiments indicate that syngeneic skin-graft rejection, the "heterogenization phenomenon," is not of immunologic origin.

4513 AN ANEMIA-INDUCING VIRUS DERIVED FROM TUMORS CAUSED BY MURINE SARCOMA VIRUS-MOLONEY. (E.) Taylor, D. O. N. (California State Dept. Public Hlth., Berkeley), N. E. Cremer, L. S. Oshiro and E. H. Lennette. *J Nat Cancer Inst* 49(3):829-845, 1972.

Cells from rat tumors induced by Moloney sarcoma virus were explanted and cultured *in vitro*. When cell-free fluids from the fifteenth *in vitro* passage were injected into newborn Osborne-Mendel (O/M) rats, severe anemia developed. Subsequent rat-plasma passages also induced anemia in O/M rats, but sarcomas were no longer observed. The agent causing the anemia was filterable and ether labile. It was contained in material banding at a density of 1.14-1.18 in which large numbers of C-type virus particles were observed. The agent was neutralized by Moloney leukemia virus antiserum, indicating it was closely related to the murine leukemia viruses. Sequential hematologic studies and necropsies demonstrated that while this agent produced erythroblastic splenomegaly and anemia, as observed with the Harvey strain of murine sarcoma virus, Kirsten murine erythroblastosis virus, and Friend and Rauscher leukemia viruses, distinct differences occurred in regard to development of sarcomas, osteolytic lesions, cystic lesions, and host susceptibility. Thus, it appears that an anemia-inducing virus, distinct from other strains of virus in the murine leukemia-sarcoma complex, has been found as a result of *in vitro* cultivation.

4514 INCREASED SUSCEPTIBILITY OF CELLS FROM CANCER PATIENTS WITH XY-GONADAL DYSGENESIS TO SIMIAN PAPOVAVIRUS 40 TRANSFORMATION. (E.) Mukerjee, D. (U. Texas Med. Branch, Galveston), J. M. Bowen, J. M. Trujillo and A. Cork. *Cancer Res* 32:1518-1520, 1972.

Skin fibroblast cultures from two cancer patients with XY-gonadal dysgenesis were infected with SV40. Infected cells were subcultured for two to three weeks, and the numbers of transformed colonies were observed. The two XY-gonadal dysgenesis patients had mean transformation frequencies of $70.4 \pm 1.9/10^4$ cells and $73.5 \pm 0.7/10^4$ cells resp., while chromosomally normal subjects had mean transformation frequencies of $2.1-4.2/10^4$ cells. Thus, XY-

gonadal dysgenesis resembles disorders such as Fanconi's aplastic anemia and Klinefelter's syndrome, which are also associated with increased susceptibility to SV40 transformation *in vitro*.

4515 IMMUNOLOGIC EVIDENCE SUGGESTING A VIRAL ETIOLOGY OF HUMAN OSTEOSARCOMA. (E.) Reilly, C. A., Jr. (Argonne Natl. Lab., Ill.), D. J. Pritchard, B. O. Biskis and M. P. Finkel. *Cancer* 30(3):603-609, 1972.

Sera from osteosarcoma patients were used in an indirect immunofluorescence assay to detect sarcoma-specific antigen(s) in human osteosarcomas. Fifty-seven of 58 of these sera and two of 24 normal sera reacted with osteosarcoma tissue as demonstrated by the fluorescence of both cell membrane and cytoplasm. Human osteosarcoma sera also detected sarcoma-specific antigen(s) in six of seven sarcomas induced in hamsters inoculated at birth with cell-free extracts of human osteosarcomas. Hamster carcinomas, reticular tissue tumors, and normal tissues failed to react with human osteosarcoma sera. The presence of human sarcoma-specific antigen(s) in the sarcomas of six hamsters treated with human osteosarcoma extracts suggests that these tumors were induced by a human osteosarcoma virus.

4516 STRUCTURE AND FUNCTION OF THE POLYPEPTIDES IN SIMIAN VIRUS 40. II. TRANSCRIPTION OF SUBVIRAL DEOXYNUCLEOPROTEIN COMPLEXES *IN VITRO*. (E.) Huang, E.-S. (Dept. Bacteriol. U. North Carolina, Chapel Hill), M. Nonoyama and J. S. Pagano. *J Virol* 9(6):930-937, 1972.

Purified SV40 virions were dissociated in alkaline buffers at pH 10.5 into a soluble protein and a deoxynucleoprotein complex (DNP-I) containing the viral DNA and the four minor of the six structural viral polypeptides. DNP-I was in turn dissociated into soluble protein and DNP-II by equilibrium centrifugation in CsCl. DNP-II contained mainly the viral DNA and a small remnant of viral protein, apparently viral polypeptide no. 3, which was tightly bound to viral DNA. The DNA transcription *in vitro* of DNP-I and -II with *E. coli* DNA-dependent RNA polymerase was studied. The rate of transcription with DNP-I as template was 30% of the rate with SV40 DNA component I (supercoiled) as template; the transcription rate with DNP-II as template was 80% of the SV40 component I rate. In dimethyl sulfoxide gradients, the complementary RNA (cRNA) synthesized from DNP-I was one-third to one-half the size of the cRNA species from SV40 DNA component I and DNP-II. Competition experiments between the cRNA species of DNA component I, DNP-I and DNP-II showed that with DNP-I as template only half the SV40 genome sequences were transcribed with *E. coli* transcriptase, while with DNP-II as template, most of the DNA was transcribed. Template activity of DNP-I and -II with a highly active form II RNA polymerase from SV40-infected permissive monkey

kidney cells followed a similar pattern. The results indicate that structural nucleoproteins of SV40 bind nonrandomly to viral DNA and effect the transcription of some subset of its sequences *in vitro*.

4517 FURTHER STUDIES OF A SIMIAN VIRUS 40-LIKE VIRUS ISOLATED FROM HUMAN BRAIN. (E.) Weiner, L. P. (Johns Hopkins Sch. Med., Baltimore, Md.), R. M. Herndon, O. Narayan and R. T. Johnson. *J Virol* 10(1):147-149, 1972.

A viral agent isolated from the brain of a patient with progressive multifocal leukoencephalopathy was reisolated by growing on fetal human brain cells (HFB). Cytopathic effects (CPE), consisting of pyknosis and cell lysis, were seen in HFB inoculated with the virus. Indirect fluorescent antibody staining with monkey anti-SV40 serum demonstrated nuclear fluorescence. Under the electron microscope, infected HFB cells showed papovavirus-like particles morphologically indistinguishable from SV40-polyoma group viruses. The virus reisolated in HFB cells produced CPE in primary African green monkey kidney cells and BSC-1 cells. In these cells, as in HFB, the virus showed antigenic similarities to SV40.

4518 RESCUE OF ROUS SARCOMA VIRUS FROM ROUS SARCOMA VIRUS-TRANSFORMED MAMMALIAN CELLS. (E.) Coffin, J. M. (McArdle Lab., U. Wisconsin, Madison). *J Virol* 10(1):153-156, 1972.

R(B77) cells, from a line of rat embryo fibroblasts transformed by B77 avian sarcoma virus, were exposed to gamma radiation and added to chicken embryo fibroblasts treated with UV-inactivated Sendai virus. Rescue of Rous sarcoma virus (RSV) from fused R(B77) and chicken cells was monitored by observing focus formation. R(B77) yielded 10^{-2} to 10^{-3} foci/cell, while the D6 clone of R(B77) was twice as efficient at focus production as uncloned R(B77) cells. When chicken cells in the fusion procedure were pretreated with mitomycin C or gamma radiation to suppress cell division, the ability of B77 virus-infected chicken cells to act as infectious centers was greatly impaired, although rescue of RSV from these treated chicken cells was not affected. Fusion of R(B77) cells with chicken red blood also led to virus rescue, although with less efficiency than with embryo fibroblasts. Therefore, virus rescue from R(B77) cells was mediated by a factor contributed by the chicken cells.

4519 RELATIONSHIP AMONG TUMORIGENICITY, T ANTIGEN, AND VIRUS-SPECIFIC TRANSPLANTATION ANTIGEN IN ADENOVIRUS TYPE 12 TRANSFORMED AND TUMOR CELLS. (E.) Akagi, T. (Okayama U. Med. Sch., Japan) and K. Ogawa. *Gann* 63(3):307-312, 1972.

Three lines of adenovirus type 12-transformed hamster cells (Tr-P-3(a), Tr-P-4 and Tr-WE-1) and one line of cells from an adenovirus-induced hamster tumor (Ham T-4) were tested for tumorigenicity in hamsters and for T antigen and virus-specific transplantation antigen (VSTA), resp., in immuno-fluorescence tests and tumor-development inhibition tests. Tr-P-4 cells, which had both T and VSTA antigens, were the most tumorigenic of the four lines tested. Tr-We-1 cells lacked T and VSTA antigens but were highly tumorigenic. The other two lines had T antigen, showed slight VSTA antigenicity, and were tumorigenic.

- 4520 INHIBITION OF SYNTHESIS OF HERPES SIMPLEX VIRUS DEOXYRIBONUCLEIC ACID BY A CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBON. (E.) Goldberg, R. J. (Hershey Med. Ctr., Pennsylvania State U., Hershey), J. J. Docherty and F. Rapp. *Proc Soc Exp Biol Med* 140(3):1054-1058, 1972.

Rabbit kidney cells were infected with herpes simplex virus (HSV) type 2; an hour later, infected cultures were treated with 7,12-dimethylbenz(a)anthracene (DMBA) or anthracene. Treated infected cultures were pulsed with ^3H -thymidine and autoradiography was used to monitor ^3H -thymidine uptake by nuclear DNA, as a measure of DNA synthesis in infected DMBA-treated cells. Uptake of label in infected cells given no other treatment greatly exceeded that in uninfected cells; in infected and uninfected cultures, 58% and 3% of cells, resp., were labeled. Antihormones did not affect label uptake by HSV-infected cells, but DMBA treatment produced a marked reduction of ^3H -thymidine uptake by infected cells (28% of cells labeled when exposed to 20 $\mu\text{g}/\text{ml}$ DMBA). Test compounds were not cytotoxic for HSV-infected cells.

- 4521 ACTIVATING AND PROTECTIVE CAPACITIES OF A PURIFIED ELECTROPHORETIC FRACTION OF MURINE LEUKEMIA VIRUS FOR MURINE LEUKEMIA VIRUS INFECTIVITY. (E.) Fischinger, P. J. (Nat'l. Cancer Inst., Bethesda, Md.), J. Lange and W. Schäfer. *Proc Nat Acad Sci USA* 69(7):1900-1904, 1972.

Cultured Friend leukemia virus (FLV) was treated with sodium dodecyl sulfate and phenol; viral proteins were precipitated from the phenol phase and protein separation was performed by preparative polyacrylamide slab gel electrophoresis. The purified FLV fraction was mixed with various murine leukemia viruses (MuLV) and inoculated on mouse cells; in some cases viruses exposed to FLV fractions were later treated with MuLV-specific neutralizing antisera. Treatment with FLV fractions significantly enhanced infectivity of MuLV inocula, as measured by focus induction. FLV fractions lost this enhancing capacity after chloroform-methanol treatment. FLV fractions also directly protected treated MuLV from neutralization by specific antibody. FLV fractions enhanced infectivity and protected MuLV of the

following serological types: Gross virus, Friend virus and Moloney virus strain IC. However, the FLV fraction had its enhancing and protective effects only for MuLV which had been passaged through tissue culture; viruses from tumors were not influenced by FLV fractions. The only active fraction of FLV was a fraction of 14,000 daltons which seemed to consist of group-specific antigen I and an associated lipid moiety.

- 4522 HISTORY OF A RHESUS MONKEY ADENOCARCINOMA CONTAINING VIRUS PARTICLES RESEMBLING ONCOGENIC RNA VIRUSES. (E.) Mason, M. M. (Mason Res. Inst., Worcester, Mass.), A. E. Bogden, V. Ilievski, H. J. Esber, J. R. Baker and H. C. Chopra. *J Nat Cancer Inst* 48(5):1323-1331, 1972.

An eight yr old female rhesus monkey developed neoplastic growths near the left nipple, in the left axilla and over the seventh and eighth ribs. Biopsy of the growth located near the nipple showed necrosis; viable portions of the tumor had a trabecular arrangement. Most viable cells were undifferentiated. Subsequent biopsy specimens showed viable polyhedral cells arranged in cords with a suggestion of an acinar formation. The monkey was in continual estrus. Phenesterin therapy produced oncolysis, as indicated by regression in tumor size (54 and 44% regression in two tumors); after phenesterin was discontinued, tumor growth was resumed. Autopsy revealed a widely disseminated tumor which had invaded both breasts and probably originated primarily in the breast and secondarily in the ovary. Small tumor masses were found in the adrenals, pancreas, kidneys, liver and stomach. Large numbers of virus particles, resembling Mason-Pfizer virus, were seen in biopsy material from the primary breast tumor. Serum growth-hormone levels in the tumor-bearing monkey were in the low normal range. Serum-insulin levels were in the high normal range, and serum progesterone levels were normal.

- 4523 INDUCTION OF MURINE C-TYPE VIRUSES FROM CLONAL LINES OF VIRUS-FREE BALB/3T3 CELLS. (E.) Aaronson, S. A. (Nat'l. Cancer Inst., Bethesda, Md.), G. J. Todaro and E. M. Scolnick. *Science* 174(4005):157-159, 1971.

The spontaneous production of C-type virus, in response to bromodeoxyuridine (BrdU), by several clonal lines of mouse BALB/3T3 and BALB/3T12 cells was demonstrated using reverse transcriptase assay and an antibody that specifically inhibits the viral enzyme. Previously, the clonal lines had shown no evidence of C-type virus production. Virion-associated polymerase activity was detected in BALB/3T3 clone A31 the second day following BrdU treatment. Activity reached a maximum in three to four days, then declined until the enzyme was barely detectable by day 14. Enzyme activity was inhibited by viral reverse transcriptase specific antibody. All subclones of A31 also showed inducible enzyme activity. Evidence for the

presence of murine leukemia virus (MLV) was obtained by the XC plaque test following transmission of virus to NIH/3T3 cells. The findings support a model that allows for vertical transmission of viral genome from cell to progeny cell without its extracellular appearance.

4524 TUMOR INDUCTION IN SQUIRREL MONKEYS BY THE ST STRAIN OF FELINE SARCOMA VIRUS. (E.)

Rabin, H. (Nat'l. Ctr. Primate Biol., U. California, Davis), G. H. Theilen, P. S. Sarma, D. L. Dungworth, M. A. Nelson-Rees and R. W. Cooper. *J Nat Cancer Inst* 49(2):441-450, 1972.

The ST strain of feline sarcoma virus (ST-FeSV) induced large undifferentiated sarcomas in two newborn squirrel monkeys after latent periods of 14-15 days. At the site of inoculation, a 2-day-old squirrel monkey developed several tumor masses that regressed, and older squirrel monkeys developed, at inoculation sites, palpable nodules that also regressed. A single 41-day-old talapoin monkey was refractory for tumor induction. The two tumors studied in tissue culture had pleomorphic cells (including multinucleated cells) that grew both in suspension and on the substratum. Both cell lines had essentially normal karyotypes. No virions were seen on ultrastructural examination of cells from either original tumors or early passage cultured cells derived from them. ST-FeSV group-specific (gs) antigen was in cell cultures derived from one of these tumors, which released a cell-transforming and gs antigen-inducing virus for normal cultured feline cells. A viable cell inoculum, prepared from cultured cells derived from this squirrel monkey tumor, induced, in kittens, sarcomas containing cells with feline karyotype. In limited trials, a tumor extract, a first-passage tissue-culture fluid concentrate, and viable fifth-passage cultured cell inocula, all derived from this same tumor, failed to induce progressive tumors in squirrel monkeys. Cultured cells of the second squirrel monkey tumor induced by ST-FeSV did not contain gs antigens and failed to release a cell-transforming or gs antigen-inducing virus. Attempts to rescue the ST-FeSV genome from cells of the gs antigen-negative tumor *in vitro* by cocultivation with cat cells infected with feline leukemia virus were negative.

4525 STRUCTURAL PROTEINS OF ADENOVIRUS-ASSOCIATED VIRUS TYPE 3. (E.) Johnson, F. B. (Nat'l. Cancer Inst., Bethesda, Md.), H. L. Ozer and M. D. Hoggan. *J Virol* 8(6):860-863, 1971.

Adenovirus-associated virus (AAV) type 3H virions were isolated from infected KB cells, purified by CsCl gradient centrifugation and analyzed on SDS-polyacrylamide gels. Three major structural proteins were found with molecular weights of approximately 66,000 (VP1), 30,000 (VP2) and 92,000 (VP3). VP1 was the fastest migrating and most prominent component (80% of total virus protein). Estimates of the number of polypeptide units per virion indicated that AAV-3H contained

6×10^6 daltons of protein. Thus, each virion contained approximately 72 VP1, 8 VP2 and 7 VP3 polypeptides. A minor high-molecular-weight band (117,000) was seen infrequently in gels of SDS-dissociated AAV. Since the band was never seen in urea-dissociated preparations, it probably represented a polymer of one or more of the major peptides.

4526 GENETIC ANALYSIS OF SIMIAN VIRUS 40. IV. INHIBITED TRANSFORMATION OF BALB/3T3 CELLS BY A TEMPERATURE-SENSITIVE EARLY MUTANT. (E.) Robb, J. A. (Nat'l. Cancer Inst., Bethesda, Md.), H. S. Smith and C. D. Scher. *J Virol* 9(6):969-972, 1972.

BALB/3T3 clone A31 mouse cells were absorbed with virions of the temperature-sensitive *ts*101* mutant of SV40 (101 virus) at 33 and 38.5 C (permissive and restrictive temperatures, resp.) Transformation of cells and synthesis of SV40 tumor (T) antigen were observed. There was no difference between normal wild-type and 101 SV40 virion absorption on BALB/3T3 at 33 or 38.5 C. The ability of 101 virions to initiate T antigen synthesis in abortively and stably transformed cells was inhibited 8-20 times at 33 C and 400-500 times at 38.5 C. T antigen synthesis after 101 virion infection was temperature-sensitive. Both abortive and stable transformation of 3T3 cells by 101 virions were inhibited at both 33 and 38.5 C, but neither transformation was temperature-sensitive. Two clones of 101-transformed cells from a 33 C stable transformation assay released rescuable virus at 33, 38 and 40 C. All rescued viruses were similar to the original 101 mutant in temperature sensitivity.

4527 SYNTHESIS OF VIRAL RIBONUCLEIC ACID DURING RESTRICTED ADENOVIRUS INFECTION. (E.)

Fox, R. I. (Albert Einstein Coll. Med., Bronx, N.Y.) and S. G. Baum. *J Virol* 10(2):220-227, 1972.

The mechanism by which simian virus 40 converts the abortive adenovirus type 7 infection of monkey cells into an efficient lytic infection has been investigated. Analysis of ribonucleic acid (RNA) synthesis during unenhanced and enhanced infection of monkey cells has shown that adenovirus RNA synthesized in the abortive infection contains both "early" and "late" sequences. In hybridization competition experiments, early adenovirus RNA from human cells prevented the hybridization of only 20% of the adenovirus RNA transcribed in unenhanced infection. Further, the RNA from unenhanced cells was able to completely block the hybridization of RNA synthesized during enhanced infection. Finally, virus-associated RNA, which is a late RNA transcribed in lytic adenovirus infection, is also produced in the unenhanced infection. A marked deficiency in adenoviral capsid protein synthesis in the unenhanced infection is noted. It is concluded that RNA sequences, which are sufficient to code for the synthesis and assembly of structural proteins of adenovirus are transcribed but are not efficiently translated in the unenhanced adenovirus infection of monkey cells.

- 4528 ROUS VIRUS ABSORPTION BY CELLS NATURALLY RESISTANT TO IT: ELECTRON MICROSCOPE STUDY. (Rus.) Savost'yanov, G. A. (N. N. Petrov Res. Inst. Oncol., Leningrad, USSR), A. M. Dyad'kova, and O. K. Kuznetsov. *Vop Onkol* 18(3):52-56, 1972.

Rous sarcoma virus (RSV; D-5 strain) in culture fluid from infected chick embryo cells was concentrated by ultracentrifugation. Chick embryo cells passaged with various kinds of RSV (RAV-1, RAV-2, Schmidt-Rupin virus) were used as sensitized cells, and skin and muscle cultures from 6-12-week-old human embryos were used as resistant cells. After cells had been incubated from 15-180 min with the virus in an aqueous solution at 37 C, the cell suspension was concentrated by centrifugation, and the resulting deposit was prepared for electron microscope examination. RSV was absorbed by phagocytosis and pinocytosis by the sensitized cells (within 15-60 min) and by the resistant cells (in the first 30 min). The number of virus particles remained unchanged during the 3-hr observation period in the resistant cells, while in the sensitized cells the number of virus particles decreased rapidly within 2 hr since virus particles were incorporated in the infectious process and virus replication phase began. The virus absorbed by the resistant cells does not participate in the infectious process but can be ejected by the cell with the rest of the vacuoles and absorbed again. In the resistant cells, complicated interactions between the membranes of the virion and cell do not take place; the destruction of the virion membrane and the liberation from it of internal nucleoproteins and nucleic acids is inhibited. This explains the inherent resistance of the cells to RSV.

- 4529 INTRACELLULAR FORMS OF ADENOVIRUS DEOXYRIBONUCLEIC ACID. I. EVIDENCE FOR A DEOXYRIBONUCLEIC ACID-PROTEIN COMPLEX IN BABY HAMSTER KIDNEY CELLS INFECTED WITH ADENOVIRUS TYPE 12. (E.) Doerfler, W. (Rockefeller U., New York, N. Y.), U. Lundholm and M. Hirsch-Kauffmann. *J Virol* 9(2):297-308, 1972.

Baby hamster kidney cells (BHK-21) were abortively infected with ^3H -adenovirus 12 (Ad12). Total intracellular DNA from infected cells was extracted and analyzed by the dye-buoyant density method using propidium iodide. Between 2 and 34 hr after infection, 8.2-20.4% of ^3H -labeled intracellular DNA had a density in dye-buoyant gradients which was 0.043-0.085 g/cm³ greater than the density of ^{14}C -labeled Ad12 marker DNA from purified virions. This heavy density DNA (HP fraction) was not seen when viral DNA was extracted from infected cells under conditions in which viral endonuclease was inhibited by 2-mercaptoethanol. The HP fraction DNA did not occur when Ad12 was prevented from absorbing and entering BHK-12 cells. In DNA-DNA hybridization tests, the HP fraction DNA hybridized exclusively with viral DNA. DNA of the HP fraction sedimented at similar rates in neutral and alkaline sucrose gradients. When DNA in the HP fraction was observed under the electron microscope, only linear DNA molecules were seen. By 2 hr after infection of BHK-21 cells with Ad12, equal amounts of HP fraction DNA were found in cell nuclei and cytoplasm. These findings indicate that a protein of cellular origin is

bound in a complex with Ad12 viral DNA in the HP fraction. RNA may also be involved in the DNA-protein complex. HP fraction DNA is only partly sensitive to digestion with deoxyribonuclease.

- 4530 THE COMBINED ACTION OF RAUSCHER LEUKEMIA VIRUS AND LACTIC DEHYDROGENASE VIRUS ON MOUSE LYMPHATIC TISSUE. (E.) Proffitt, M. R. (Oak Ridge Natl. Lab., Tenn.), C. C. Congdon and R. L. Tyndall. *Int J Cancer* 9(1):193-211, 1972.

Specific pathogen-free BALB/c mice were inoculated with animal-passaged Rauscher leukemia virus (APRLV), tissue-culture-passaged RLV (TCRLV), or lactic dehydrogenase virus (LDV); the APRLV was contaminated by LDV. Mice given LDV-contaminated APRLV showed early changes in lymphatic tissues comparable to changes seen in mice given LDV alone. These changes included depletion of small lymphocytes in spleen follicles and proliferation of immunoblasts in mesenteric lymph nodes. Prominent erythroid hyperplasia in the spleen of mice given APRLV, a reaction typical of Rauscher disease, was not seen in mice given LDV alone. Mice given an animal passage of TCRLV (AP-TCRLV), which was relatively uncontaminated by LDV, showed the early erythroid hyperplasia of APRLV-treated mice, but none of the other responses seen in mice given APRLV or LDV. Immunoblast proliferation and lymphocyte depletion in thymus-dependent areas were characteristic of the response to APRLV or LDV, but were not seen in mice given AP-TCRLV. Some changes seen in mice given APRLV or LDV resembled changes associated with stress and mediated by corticosteroid hormones. When LDV was added to AP-TCRLV prior to inoculation, the Rauscher disease response of inoculated mice was enhanced, as measured by increases in spleen weight. Proliferation of lymphoid tissue germinal center cells also followed addition of LDV to AP-TCRLV inocula. The presence of LDV in AP-TCRLV inocula given two days before challenge with sheep erythrocytes decreased primary hemagglutinin titers in recipients to 2-3 logs below titers in mice given APRLV, LDV or AP-TCRLV without LDV added.

- 4531 CROSS PROTECTION *IN VIVO* AGAINST AVIAN SARCOMA VIRUS SUBGROUPS A, B AND C INDUCED BY ROUS-ASSOCIATED VIRUSES. (E.) Meyers, P. (U. Miami Sch. Med., Fla.), M. M. Sigel and H. T. Holden. *J Nat Cancer Inst* 49(1):173-182, 1972.

Chickens were immunized with three biweekly injections of 10⁶ infectious U of Rous-associated virus (RAV), subgroups A, B or C; immunized birds were challenged six wk later with 100 focus-forming U of Schmidt-Ruppin Rous sarcoma virus (RSV) (subgroup B), RSV(RAV-1) (subgroup A), or Prague RSV (subgroup C). Tumor incidence was reduced on day nine after challenge in chickens immunized with RAV-1 (subgroup A); tumor incidence was reduced 94% in chickens challenged with subgroup A virus, 70% in chickens challenged

with subgroup B virus, and 60% in chickens challenged with subgroup C virus. The protective effect of immunization with A virus against challenge with A or B viruses persisted, but the initially less effective protection against subgroup C virus challenge became still less evident. Similar results were seen in chickens immunized with RAV-6 (subgroup B) and challenged with viruses of the three subgroups. Immunization with the B virus protected well against challenge with B or C viruses, but not against challenge with A virus. Immunization with RAV-49 (subgroup C) protected well against challenge with B and C viruses but only slightly against challenge with A viruses. This cross protection effect was not dependent on humoral antiviral neutralizing antibody, since resistant birds had antibodies only to the immunizing virus. The cross-protective effect was thought to be mediated by cellular immunity against common viral antigens or common virus-induced antigens.

4532 FELINE FIBROSARCOMA VIRUS: QUANTITATIVE FOCUS ASSAY, FOCUS MORPHOLOGY AND EVIDENCE FOR A "HELPER VIRUS". (E.) McDonald, R. (Rush-Presbyterian-St. Luke's Med. Ctr., Chicago, Ill.), L. G. Wolfe and F. Deinhardt. *Int J Cancer* 9(1):57-65, 1972.

Feline muscle, embryo and tongue tissue cultures, and marmoset kidney, skin and muscle cultures, were inoculated with Snyder-Theilen feline sarcoma virus (FeSV) or Gardner FeSV; infected cultures were overlaid with agar and re-fed three to five days later with liquid media. FeSV in infected cultures was assayed by focus formation. Higher titers of FeSV of both strains were found in feline cells than in marmoset cells (e.g., titers of 4,129 compared with 929 focus-forming U/ml). Snyder-Theilen FeSV grown in feline or marmoset cells, and Gardner FeSV grown in feline cells, generally induced foci of two morphological types foci consisting of round cells and foci consisting of a loose meshwork of round and fusiform cells. These different morphological types of foci were also seen in two morphological types of clone of FeSV-infected cells. Thermal stability experiments suggested that the morphological differences between foci were virus-dependent. When feline cell cultures were inoculated with Snyder-Theilen FeSV beyond the end point of focus induction, transformation by subsequent challenge inocula of this FeSV was inhibited. This indicated a ten- to 100-fold excess of interfering helper virus in this system.

4533 ERYTHROID NATURE OF THE RESPONSE TO FRIEND LEUKEMIA VIRUS INFECTION IN MICE. (E.) Stephenson, J. R. (U. Toronto, Fac. Med., Ontario, Canada), A. A. Axelrad and D. L. McLeod. *J Nat Cancer Inst* 48(2):531-539, 1972.

SIM/Mc and C3H/Bi mice were infected with a "polycythemic strain" of Friend virus (FV); prior to FV in-

fection, the mice had been subjected to ex-hypoxia to suppress hemoglobin synthesis. FV infection returned hemoglobin synthesis to normal in the plethoric mice. Blood erythrocyte concentration was increased in FV-infected SIM mice but was relatively unaffected in FV-infected C3H/Bi mice. FV increased the number of circulating nucleated cells in blood of both strains of mouse; increases were threefold in SIM and sevenfold in C3H/Bi mice. FV-transformed, tumor colony-forming cells were detected in the blood of C3H/Bi mice. Heme synthesis was increased in blood of FV-infected mice. This increase in heme synthesis was found to be due not only to erythrocyte activity, but also to intensive heme synthesis in a population of nucleated cells having a modal sedimentation velocity identical to that of FV-transformed cells but twice that of erythrocytes.

4534 STIMULATION OF DNA SYNTHESIS AND ENHANCEMENT OF MURINE SARCOMA VIRUS REPLICATION IN MOUSE EMBRYO CELLS BY SV40. (E.) Baker, R. S. U. (Sch. Med., Perth, Australia), P. J. Simons and B. J. Rankin. *J Gen Viro* 14:115-117, 1972.

The effect of wild-type simian virus (SV40) on DNA synthesis in cultured BALB/c mouse embryo cells is reported. The cultured cells were passed every three days at a concentration of 3×10^4 cells/cm² in Eagle's Minimum Essential Medium supplemented with 10% inactivated calf serum. Passage eight cells in an amitotic phase of negligible growth were infected with SV40 or murine sarcoma virus-Harvey (MSV-H), or with both SV40 and MSV-H. After 24-hour incubation in ³H-thymidine, the cells were processed for autoradiography and the proportion of cells synthesizing DNA was determined. Infection with SV40 resulted in a rapid increase in the number of cells incorporating ³H-thymidine and a concomitant increase in cell numbers. Sixty percent of infected cells were synthesizing DNA within 48 hr; none showed altered morphology. Cells infected with MSV-H alone did not undergo morphologic transformation, DNA synthesis or subsequent cell replication. Cultures infected with both SV40 and MSV-H showed extensive transformation to densely staining spindle cells. Fluids were collected from all cultures two and four days after infection and were tested for MSV-H by plaque assay. Among control cultures and cultures infected with SV40 or MSV-H alone, only four-day fluid from MSV-H-infected cells contained MSV-H (0.25×10^2 focus-forming units/ml). MSV-H titers in fluids from two- and four-day SV40 plus MSV-H cultures were 1.2×10^2 and 3.4×10^2 focus-forming units/ml, resp. These results indicate that MSV-H requires host cell DNA synthesis for successful infection of a cell, and that this is provided by SV40 infection.

4535 ISOLATION OF TEMPERATURE-SENSITIVE MUTANTS OF MURINE LEUKEMIA VIRUS. (E.) Stephenson, J. R. (Nat'l. Cancer Inst., Bethesda, Md.). R. K. Reynolds and S. A. Aaronson. *Virology* 48(3):749-756, 1972.

Kirsten murine leukemia viruses (KiMuLV) growing in NIH/3T3 mouse cells were mutagenized by treatment with 5-bromodeoxyuridine (BrdU) or *N*-methyl-*N'*-nitro-*N*-nitrosoguanidine (NTG). A total of 407 NTG-mutagenized KiMuLV-infected clones, and 410 BrdU-treated infected clones, were screened by a microtiter technique for the presence of temperature-sensitive (ts) mutants. Twenty-eight of the NTG-treated clones and 13 of the BrdU-treated clones harbored potential ts mutants, as evidenced by inability to induce syncytia on rat tumor cells (XC) at 31 C (a nonpermissive temperature). Of the 41 potential ts mutant clones, nine (two from BrdU- and seven from NTG-treated clones) were subsequently shown to be ts mutants. Each of the nine ts mutants was investigated to quantitate rates of spontaneous reversion at a permissive temperature. The reversion rates for each of the ts mutants were very low.

- 4536 RESCUE OF EPSTEIN-BARR VIRUS FROM SOMATIC CELL HYBRIDS OF BURKITT LYMPHOBLASTOID CELLS. (E.) Glaser, R. (Milton S. Hershey Med. Ctr., Pennsylvania St. U., Hershey) and F. Rapp. *J Virol* 10(2):288-296, 1972.

A Burkitt lymphoblastoid cell line, P3J-HR-1, was fused to a human sternal marrow cell line, D98/AH-2, using inactivated Sendai virus. The D98/HR-1 hybrid cells were larger than either parental line and grew in multilayered foci. Testing of somatic cell hybrids by direct and indirect immunofluorescence showed no evidence of virus-specific antigens. However, both virus-specific markers and virus particles could be induced by exposing hybrid cells to 5-iododeoxyuridine. These data indicated that the Epstein-Barr virus genome can be transferred from a lymphoblastoid cell to another cell type during cell hybridization, that the viral genome can persist in hybrids for a long period of time, and that virus synthesis can be induced in the heterokaryons.

- 4537 TRANSFORMATION OF GUINEA PIG EMBRYO CELLS BY A MURINE SARCOMA VIRUS. (E.) Rhim, J. S. (Microbiol. Assoc., Bethesda, Md.), C. F. Demoise, F. G. Duh and H. Y. Cho. *Virology* 48(3):841-843, 1972.

Cultured guinea pig embryo cells were infected with the Kirsten murine sarcoma virus (Ki-MSV). Foci of morphologically transformed cells began to appear 15-20 days after infection. Transformed cells continuously released virus, and cell-free preparations from these cells were able to produce similar altered foci in NIH Swiss mouse, rat and guinea pig embryo cells. The transformed cells also contained high titers of gs antigen characteristic of the murine sarcoma-leukemia virus group. Attempts to transform guinea pig embryo cells with the Moloney and Harvey isolates of MSV or with the Theilen strain of feline sarcoma virus were unsuccessful.

- 4538 HERPESVIRUS SAIMIRI IN MARMOSET-MOUSE HYBRID CELL LINES. (E.) Periman, P. (Natl. Cancer Inst., Bethesda, Md.), S. Tyrrell and A. S. Rabson. *J Nat Cancer Inst* 49(2):387-393, 1972.

Marmoset-mouse hybrid cell lines were derived from fusion of marmoset lymphoid cells (MLC-1 line) with 8-azaguanine-resistant murine adenocarcinoma cells (RAG line) by use of Sendai virus and growth in aminopterin-containing medium. Cytogenetic studies of the hybrid lines showed the cells contained both mouse and marmoset chromosomes. Whereas the MLC-1 cells released small amounts of virus into the supernatants and between 0.1 and 1% of these cells released *Herpesvirus saimiri* on contact with vero cells, the hybrid cells released no virus into the supernatants and between 0.01 and 0.09% of these cells released virus on contact with vero monolayers. In the hybrid cell lines the absence of virus in the supernatants and decreased number of cells plating as infectious centers suggest either that the mouse components inhibit the expression of the *H. saimiri* genome, or that replication depends on MLC-1 genes which have been lost, or that the virus itself was lost from many of the hybrid cells. The number of cells yielding virus decreased as the hybrid lines were grown in medium free of aminopterin. This was associated with loss of marmoset chromosomes, which suggests the virus in the MLC-1 cells may be in some way closely associated with the chromosomes.

- 4539 ISOLATION AND CHARACTERIZATION OF SIMIAN VIRUS 40 RIBONUCLEIC ACID. (E.) Weinberg, R. A. (Weizmann Inst. Sci., Rehovot, Israel), S. O. Warmaar and E. Winocour. *J Virol* 10(2):193-201, 1972.

Deoxyribonucleic acid-ribonucleic acid (RNA) hybridization in formamide was used to isolate simian virus 40-specific RNA. Early in the lytic cycle, a 19S viral RNA species was observed. Late in the lytic cycle, 16S and 19S viral species were found. The 16S and 19S species of viral RNA were localized in the cytoplasm. High-molecular-weight heterogeneous RNA, containing viral sequences, was isolated from the nuclear fraction of infected cells late in the lytic cycle. This RNA may contain nonviral sequences linked to viral sequences. The formamide hybridization technique can be used to isolate intact late lytic viral RNA which is at least 99% pure.

- 4540 TEMPERATURE-DEPENDENT TRANSFORMATION OF CELLS INFECTED WITH A MUTANT OF BRYAN ROUS SARCOMA VIRUS. (E.) Bader, J. P. (Natl. Cancer Inst., Bethesda, Md.). *J Virol* 10(2):267-276, 1972.

Chick embryo cells infected with a mutant (Ta) of the Bryan high-titer strain of Rous sarcoma virus (RSV-BH) are morphologically transformed at 36 C but appear similar to uninfected cells at 41 C. When cells infected with RSV-BH-Ta are switched from

1 to 36 C, morphological changes characteristic of transformation are observable within 10 min. The transformation is reversible; cells shifted from 36 to 41 C have been observed to lose their transformed morphology within 1 hr. The transformation after a shift in temperature is unaffected by inhibition of deoxyribonucleic acid (DNA), ribonucleic acid (RNA), or protein synthesis, demonstrating that the proteins involved in the morphological change are already present. Transformed cells infected with RSV-BH or RSV-BH-Ta take up hexose and synthesize hyaluronic acid at higher rates than uninfected cells or RSV-BH-Ta-infected cells grown at 41 C. However, inhibition of either protein or RNA synthesis, but not DNA synthesis, prevented the induction of increased hexose uptake and hyaluronic acid synthesis after a shift of RSV-BH-Ta-infected cells from 41 to 36 C. Therefore, these biochemical changes are secondary to a more basic change responsible for morphological transformation.

541 STRAND ORIENTATION OF SIMIAN VIRUS 40 TRANSCRIPTION IN PRODUCTIVELY INFECTED CELLS. (E.) Lindstrom, D. M. (Salk Inst. Biol. Stud., San Diego, Calif.) and R. Dulbecco. *Proc Nat Acad Sci USA* 69(6): 517-520, 1972.

SC-1 cells were infected with SV40. Eight days after infection, SV40 DNA was extracted from infected cells and annealed with highly asymmetric complementary RNA (cRNA) synthesized from SV40 DNA by an RNA polymerase of *E. coli*. The results indicated that early and late SV40 RNA's were transcribed *in vivo* from opposite strands of the SV40 DNA molecule, that cRNA, synthesized by *E. coli*, was transcribed from the same strand as the early SV40 RNA, and that this cRNA was complementary to the late SV40 RNA.

542 GENETIC ANALYSIS OF SIMIAN VIRUS 40. III. CHARACTERIZATION OF A TEMPERATURE-SENSITIVE MUTANT BLOCKED AT AN EARLY STAGE OF PRODUCTIVE INFECTION IN MONKEY CELLS. (E.) Robb, J. A. (Natl. Inst. Arthritis Metab. Dis., Bethesda, Md.) and R. G. Martin. *J Virol* 9(6):956-968, 1972.

CV-1 cells, a cloned subline of CV-1 monkey cells, were inoculated with the *ts*101* (101) temperature-sensitive mutant of SV40. 101 virions adsorbed as efficiently as nonmutant wild-type SV40 to inoculated cells at restrictive (40-41 C) as well as at permissive (30-33 C) temperatures. 101 virions also penetrated cells normally at restrictive temperatures (i.e., they lost sensitivity to neutralizing antibody after adsorption to cells). At restrictive temperatures, the 101 virions were unable to induce cellular DNA synthesis or synthesis of viral DNA and the viral antigen. SV40-specific tumor antigen synthesis and SV40 U-antigen synthesis were also inhibited in 101 cells at the restrictive temperature. First cycle tumor- and viral-antigen synthesis after infection of cells with 101 DNA were normal at the restrictive temperature, but the resulting progeny virus were

as temperature-sensitive as their 101 parents. 101 virions did not complement or inhibit other temperature-sensitive SV40 mutants or wild-type virions. The affected protein in 101 virions may be a regulatory structural protein, perhaps a core protein, that interacts with the DNA of the virions.

4543 STUDIES OF THE MECHANISM OF ENHANCEMENT OF HUMAN ADENOVIRUS INFECTION IN MONKEY CELLS BY SIMIAN VIRUS 40. (E.) Baum, S. G. (Albert Einstein Coll. Med., Bronx, N.Y.), M. S. Howitz and J. V. Maizel, Jr. *J Virol* 10(2):211-219, 1972.

The defect which prevents human adenovirus replication in monkey cells and the mechanism whereby this restriction is overcome by coinfection with simian virus 40 (SV40) have been studied. Adenovirus capsid proteins are not synthesized efficiently in monkey cells in the absence of SV40. Adenovirus "enhancement" by SV40 was found to be the product of increased efficiency of replication by a small percentage of cells. This enhancement effect apparently occurred only when SV40 and adenovirus infected the same cells. These findings suggest that the replicative block occurs prior to virion assembly, possibly at the post-transcriptional level.

4544 RAT LEUKEMIA DERIVED 9H VIRUS (9HV). II. RESPONSE OF RATS TO LOW DOSES OF VIRUS. (E.) Bergs, V. V. (U. Miami Sch. Med., Florida), T. M. Scotti and M. Bergs. *Proc Soc Exp Biol Med* 139(2):535-539, 1972.

Studies of the growth pattern of 9H virus (9HV) in the liver of W/FU rats revealed that i.p. inoculation of newborn rats, free of maternal antibody to 9HV, with low doses of this virus resulted in a gradual increase of viral progeny (assayed by hemagglutinin inhibition tests on W/FU embryo cells) that reached its peak by day 10. This was followed by a decrease in virus titer accompanied by a gradual increase of serum antibody titer to the virus. Intracellular inclusions in liver cells were noted at day 6. Viral hepatitis, including cytopathic changes and inflammatory cells, and definite peliosis hepatis became evident at day 8 to 10. The thymus and spleen of these animals showed atrophy grossly and histologically. Rats inoculated with 9HV components (9HV-A and 9HV-B) showed a similar pattern of response, except that peliosis hepatis was not conspicuous in rats inoculated with 9HV-B. Intracerebral inoculation of low doses of 9HV resulted in virus multiplication in both brain and liver and in the development of hepatitis and peliosis hepatis. No significant brain lesions were apparent in these animals, indicating cytotropism of this virus in regard to its cytopathic effect in the intact rat. Weanling rats free of antibody to 9HV and inoculated with high doses of the virus failed to develop any disease, indicating an age-dependent resistance to 9HV.

- 4545 INFECTIOUS MONONUCLEOSIS AND ACUTE LEUKEMIA. (Sp.) Sackmann Muriel, F. (Children's Hosp. Buenos Aires, Argentina) and J. A. Penalver. *Sangre* 16(4):403-410, 1971.

Two cases of infectious mononucleosis (IM) and acute leukemia (AL) occurring in the same patient are reported. Both diseases were diagnosed simultaneously in a 2-year-old child and 10 month-old infant; IM was also ascertained in an 8-year-old child during prednisone and vincristine treatment of a relapse of AL. In reviewing published information on 11 related cases, no evidence of a time relationship between the occurrence of the two diseases could be found. Acute leukemia does not seem to alter the immunological response to IM and a common etiological agent for the two diseases appears unlikely.

- 4546 SEQUENCE HETEROGENEITY IN CLOSED SIMIAN VIRUS 40 DEOXYRIBONUCLEIC ACID. (E.) Tai, H. T. (Norman W. Church Lab. Chem. Biol., California Inst. Tech., Pasadena), C. A. Smith, P. A. Sharp and J. Vinograd. *J. Virol* 9(1):317-325, 1972.

Singly nicked closed circular SV40 DNA was denatured in NaOH, and the heteroduplex molecules of viral DNA formed by the self-annealing of the denatured DNA were observed by formamide-protein film electron microscopy. DNA was prepared from SV40 grown at high and low multiplicities of infection (HM and LM DNA, resp.) Undenatured DNA showed a narrow length distribution and otherwise appeared homogeneous in size. Observations of heteroduplexes in LM DNA indicated that 2.5% of LM DNA molecules contained deletions which, together with DNA sequence substitutions, caused single-stranded loops to appear in the DNA. No detectable substitution loops were seen in LM DNA. Undenatured HM DNA, however, showed a high frequency of heteroduplexes containing deletions or substitutions (11-13% of molecules with deletions and 7-12% with substitutions). Deletions and substitutions appeared to occur in separate molecules. Length measurements indicated that the molecules were from true sequence substitutions, and not from adjacent or overlapping deletions. More than 80% of heteroduplexes with substitutions were shorter than native SV40 DNA; substituted sequences in these DNA's ranged from 5-50% of the SV40 length (mean = 20% of SV40 length).

- 4547 SURFACE CHANGES OF HUMAN CELLS PRODUCTIVELY INFECTED WITH HUMAN ADENOVIRUSES. (E.) Salzberg, S. (St. Louis U. Sch. Med., Missouri) and H. J. Raskas. *Virology* 48(3):631-637, 1972.

Productive infection of human embryonic kidney (HEK) cells with a group C adenovirus (type 2) resulted in surface changes that were detected as increased agglutination in the presence of concanavalin A (Con A). Agglutination increased as the infection progressed, with maximum response to Con A occurring by 18 hr. Treatment with cytosine arabinoside either for the entire infection or beginning 8 hr

after infection prevented the surface alterations. In contrast to the agglutination produced by adenovirus 2, infection with a group A adenovirus (type 12) did not cause a changed response to Con A. However, infection with two cytotoxic mutants derived from adenovirus 12 resulted in membrane changes detectable by Con A. These findings demonstrate that specific viral gene functions are required for the surface changes occurring during productive infection of adenoviruses. Since the cytotoxic mutants are nononcogenic, the ability to produce surface changes during productive infection seems to be unrelated to the oncogenicity of the virus.

- 4548 GENETIC RELATEDNESS OF TYPE 1 AND TYPE 2 HERPES SIMPLEX VIRUSES. (E.) Kieff, E. (Dept. Biol. Sci., U. Chicago, Ill.), B. Hoyer, S. Bachenheimer and B. Roizman. *J Virol* 9(5):738-745, 1972.

The extent of homology between herpes simplex virus 1 and 2 (HSV-1 and HSV-2) DNA was measured by determining the relative rate of hybridization of ³H- or ¹⁴C-thymidine-labeled HSV-1 and HSV-2 DNA to excess unlabeled HSV-1 or HSV-2 DNA immobilized on filters (liquid filter annealing) or in solution (liquid annealing). Approximately 40% of HSV-1 and HSV-2 DNA was homologous at hybridization temperatures 25 C below the melting temperature (T_m) of HSV DNA (liquid-filter annealing). Lowering the temperature to 34 C below the T_m increased the extent of homology to 46% (liquid annealing). The extent of base-pairing in HSV-1-HSV-2 heteroduplex DNA was determined by thermal chromatography on hydroxyapatite. Heteroduplexes of HSV-1 and HSV-2 DNA eluted in a single peak whose midpoint (Te₅₀) was 10 C below that of the homoduplex. Conspicuously absent were heteroduplexes that eluted at more than 15 C below the Te₅₀ of the homoduplex. The data suggest the existence of a variable region of HSV DNA (54%) with very little, if any, homology and an invariable region (46%) with relatively good (85%) matching of base pairs.

- 4549 EVIDENCE FOR A NEW BIOSYNTHETIC PATHWAY OF SPHINGOMYELIN IN SV40 TRANSFORMED MOUSE CELLS. (E.) Diringer, H. (Max-Planck Inst. Virus Res., Tübingen, West Germany), W. D. Marggraf, M. A. Koch and F. A. Anderer. *Biochem Biophys Res Commun* 47(6):1345-1352, 1972.

Sphingomyelin metabolism was studied in replicating SV40-transformed mouse fibroblasts by ³²P-orthophosphate plus ³H-choline pulse-chase experiments. Cells were pulse labeled with both substances for 24 hr and then chased. At given times during the chase, cell aliquots were taken and the lipids were extracted. The individual phospholipids were separated by two-dimensional thin-layer chromatography. The proportion of ³²P to ³H incorporated into both lecithin and sphingomyelin was constant at all times, indicating that the radioactivity was probably incorporated into these two lipids as ³²P-phosphoryl-³H-choline. The kinetics of incorporation, however,

differed between the two lipids. The peak of radioactivity in the lecithin fraction was reached within four hr after the beginning of the chase and thereafter declined slightly, whereas the peak radioactivity in the sphingomyelin fraction was not reached until 20 hr after the start of the chase. Further analysis of the labeling kinetics of the two phospholipids suggested that sphingomyelin was synthesized by transfer of phosphorocholine from lecithin to free or N-acylated sphingosine. It was concluded that previously described biosynthetic pathways, in which sphingomyelin was formed either by transfer of phosphorocholine from CDP-choline to N-acylsphingosine or by the direct acylation of sphingosylphosphorylcholine, were of only minor importance in the present system.

- 4550 PROPERTIES OF A MURINE SARCOMA VIRUS ISOLATED FROM A TUMOR ARISING IN AN NZW/NZB F₁ HYBRID MOUSE. I. ISOLATION AND PATHOLOGY OF TUMORS INDUCED IN RODENTS. (E.) Gazdar, A. F. (Natl. Cancer Inst., Bethesda, Md.), H. C. Chopra and P. S. Sarma. *Int J Cancer* 9(1):219-233, 1972.

A spontaneous sarcoma developed by a New Zealand white x New Zealand black (B/W) F₁ mouse was studied; the tumor arose s.c. in the left flank and consisted of elongated spindle-shaped cells. It could not be passaged more than three times *in vivo* in B/W or BALB/c mice. A sarcoma virus was isolated from transplanted sarcoma tissue and inoculated i.m. into mice, rats, hamsters and Mastomys. Virus inoculation produced a high incidence of sarcomas in these species; virus-induced tumors sometimes regressed in mice, but did not regress in other species. Virus-induced tumors could be transplanted into recipients of the four species. Transplanted tumors regressed in many cases in mice and hamsters. Virus-induced mouse tumors were sarcomas comprised of spindle cells and many inflammatory cells and showing a prominent angiomatous component. Splenomegaly developed in 80% of virus-inoculated B/W mice; spleens of these mice showed destruction of normal architecture and replacement of normal cells by angiomatous tissue; fibrous and inflammatory changes were also seen in mouse spleens. Lymphoid tissues of tumor-bearing mice also showed striking changes. Virus-induced hamster tumors consisted of undifferentiated polygonal cells, while tumors of rats and Mastomys consisted of thin-walled blood vessels infiltrated with polymorphonuclear leukocytes. Under the electron microscope, both virus-induced and transplanted sarcomas showed many C-type virus particles which resembled murine leukemia-sarcoma viruses. In complement fixation tests with murine leukemia-sarcoma group-specific (gs) antisera and tumor homogenates, the murine leukemia-sarcoma virus gs antigen was demonstrated.

- 4551 ISOLATION AND CHARACTERIZATION OF A PROTEIN THAT STIMULATES DNA SYNTHESIS FROM AVIAN MYELOBLASTOSIS VIRUS. (E.) Leis, J. P. (Albert

Einstein Coll. Med., Bronx, N.Y.) and J. Hurwitz. *Proc Nat Acad Sci USA* 69(8):2331-2335, 1972.

A heat-labile, nondialyzable factor, which stimulates viral RNA dependent DNA polymerase, was isolated during the purification of the avian myeloblastosis virus enzyme. Polymerase activity was purified by ammonium sulfate precipitation followed by two elutions from phosphocellulose columns. The protein factor, which was eluted at a low salt concentration from the second column, was inactivated by heating at 100 C for four min or by pronase treatment, but was not affected by incubation with nuclease S1. The protein stimulated the rate of AMV RNA-primed DNA synthesis by up to eight-fold when added to the purified AMV polymerase fraction. It also stimulated AMV polymerase-directed repair of ³H-labeled λ DNA which had 32% of its total nucleotides removed with exonuclease III. The factor was specific in this system for the purified AMV polymerase and was not able to stimulate other bacterial, mammalian or viral polymerases. It was also specific for DNA synthesis primed with AMV-RNA only. In the presence of stimulatory protein, the AMV polymerase was able to initiate synthesis from single-strand breaks in native DNA.

- 4552 CELL SURFACE GLYCOSYL TRANSFERASES AND ACCEPTORS IN NORMAL AND RNA- AND DNA-VIRUS TRANSFORMED FIBROBLASTS. (E.) Bosmann, H. B. (U. Rochester Sch. Med. Dent., N.Y.). *Biochem Biophys Res Commun* 48(3):523-529, 1972.

Glycosyl transferases and transferase acceptors have been demonstrated on the membrane surface of normal 3T3 mouse fibroblasts and on 3T3 cells transformed by murine sarcoma virus (MSV), polyoma virus (PY) and Rous sarcoma virus (RSV). The presence of enzyme and acceptor was determined by the ability of cells to stimulate the transfer of monosaccharide from isotopically labeled nucleotide diphosphate monosaccharide to acid insoluble material. All three transformed cell lines, when confluent, had enzyme and/or acceptor sites in levels two to four times those present in confluent 3T3 cultures. However, in cells from sparse cultures, the reaction was essentially the same in both the normal and transformed cells. Using exogenous acceptors, elevated surface levels of some glycoprotein: glycosyl transferases were demonstrated in the transformed cells. These results are consistent with the hypothesis that glycosyl transferases may function as bridge or combination molecules in cell-cell adhesion phenomena and contact inhibition.

- 4553 INTERFERON INDUCERS: ENHANCEMENT OF VIRAL ONCOGENESIS IN MICE AND RATS. (E.) Gazdar, A. F. (Natl. Cancer Inst., Bethesda, Md.), A. D. Steinberg, G. F. Spahn and S. Baron. *Proc Soc Exp Biol Med* 139(4):1132-1137, 1972.

Pretreatment with several interferon inducers en-

hanced virus-induced sarcomas and leukemias in mice and rats. Pretreatment with a single s.c. dose of polyI·polyC or polyA·polyU, a single oral dose of tilorone, a single i.v. dose of Newcastle disease virus (NDV) or a single i.p. dose of pyran copolymer 24 hr prior to i.m. inoculation of murine sarcoma virus (MSV) significantly enhanced tumor induction in weanling AL/N mice and suckling Osborne-Mendel rats. The enhancement was manifested by a shorter latent period to tumor appearance, higher incidence of tumors, larger mean tumor size, and longer regression time as compared with control animals injected with MSV alone. Injection of polyI·polyC simultaneously with MSV also enhanced tumor induction. However, injection either 48 hr prior to or 24 hr after MSV inoculation had no effect on the tumors. The enhancing effect of polyI·polyC was strain dependent. Pretreatment enhanced tumor induction in AL/N mice, (BALB/c x AL/N) F₁ mice, NZW mice and A/J mice but had no effect in BALB/c or A/He mice. Sex differences were not seen in polyI·polyC enhancement and the effect on MSV tumors did not correlate with the H-2 type or the allotypes of the Fv-1 locus, which controls the sensitivity to murine leukemia viruses. No correlation was observed between polyI·polyC-mediated tumor enhancement and the induced levels of circulating interferon. Pretreatment of AL/N mice with potent interferon preparations 18 hr prior to MSV inoculation enhanced tumor development but had no effect on mean tumor size or tumor regression time. Pretreatment of BALB/c and C3H mice with a high dose of interferon or with polyI·polyC enhanced Rauscher leukemia virus (RLV)-induced splenomegaly, but lower doses of interferon, tilorone and NDV had no significant effect. Pretreatment with statolon s.c. had no effect on MSV tumor induction in AL/N or BALB/c mice. There was no correlation between the enhancement of humoral immunity by polyI·polyC and its enhancement of MSV-induced tumors.

- 4554 DNA COPIES OF VIRAL RNA IN RAT CELLS TRANSFORMED BY ROUS SARCOMA VIRUS (RSV). (E.) Harel, L. (Inst. Sci. Res. Cancer, Villejuif, France), J. Harel and G. Frezouls. *Biochem Biophys Res Commun* 48(4):796-801, 1972.

DNA preparations from Rous sarcoma virus (RSV)-transformed XC-cells and from normal rat liver cells were tested for the presence of copies of the RSV genome by hybridization to ³²P-labeled viral 70S RNA. At least 50% of the input ³²P-labeled 70S viral RNA annealed with DNA from the transformed XC-cells, while only two to three percent annealed with DNA from normal rat liver cells. The amount of viral RNA annealing to XC-cell DNA indicated that XC-cells contain one or two viral genome copies per tumor cell genome. These results are consistent with the provirus theory of viral oncogenesis.

- 4555 VIRAL AND CELLULAR ANTIGENS OF MURINE LEUKEMIAS AND MYELOMAS. SEROLOGICAL ANALYSIS BY IMMUNOELECTRON MICROSCOPY. (E.) Aoki, T.

(Sloan-Kettering Inst. Cancer Res., New York, N.Y.) and T. Takahashi. *J Exp Med* 135(3):443-457, 1972.

Immunoelectron microscope studies were used to detect H-2, θ , Ly-A and Ly-B antigens on two mouse leukemia cells: the E δ G2 leukemia induced by Gross virus and carrying the Gross cell surface antigen (GCSA), and the spontaneous AKR leukemic K36 ascites cells, also positive for GCSA. H-2^b, θ -C3H and Ly-A.2 antigens were seen on the E δ G2 cell surface; Ly-B.2 was not demonstrable. One eighth of budding and extracellular murine leukemia virus (MuLV) virions in these cells showed θ -C3H antigen; H-2^b, Ly-A.2 and Ly-B.2 were not detected on any virions in E δ G2 cells. H-2^k and Ly-B.1 antigens were detected on K36 cell surfaces; θ -AKR and Ly-A.2 antigens were not detectable. MuLV virions in K36 cells showed H-2^k antigens on their envelopes in 25% of cases. θ -AKR, Ly-A.2 and Ly-B.1 antigens were lacking on MuLV virions in K36 cells. In related studies, an additional viral envelope antigens was detected on virions produced by the mouse myeloma MOPC-70A cells in tests for the differentiation alloantigen (PC). Based on immunoelectron microscopic analysis of the antigen, MOPC-70A myeloma virus is a distinct MuLV subtype.

- 4556 MORPHOLOGY OF SIMIAN FOAMY VIRUSES, WITH PARTICULAR REFERENCE TO VIRUS ISOLATED FROM SPONTANEOUS TUMOR OF A RHESUS MONKEY. (E.) Chopra, H. C. (Nat. Inst. Neurol. Dis. Stroke, Laurel, Md.), J. J. Hooks, M. J. Walling and C. J. Gibbs, Jr. *J Nat Cancer Inst* 48(2):451-463, 1972.

Simian foamy virus (SFV) types 1-7 propagated in vero green monkey kidney cells and human embryo kidney cells were observed under the electron microscope. The seven serotypes were compared with one another and with the Mason-Pfizer monkey virus (C(M-PMV)). Cell cultures inoculated with SFV developed cytopathic changes characterized by the formation of syncytia and dilation of endoplasmic reticulum. The different strains differed slightly in their size and surface projections. In all cases, however, virions consisted of an outer envelope with projections and a ring-shaped inner component. The internal component appeared in the cytoplasm and by budding process became enveloped by the cell membrane. In contrast, the C(M-PMV) virus lacked surface projections and consisted of an inner dense nuclei. The foamy virus types were also antigenically distinct from C(M-PMV): none was neutralized by anti-C(M-PMV) sera and no C(M-PMV) antigens were detected in SFV-infected cells by immunofluorescence testing. A potential oncogenic role is indicated for the foamy viruses in view of their morphologic resemblance to known oncogenic RNA viruses.

- 4557 THE ISOLATION AND CHARACTERIZATION OF PLASMA MEMBRANE FROM CULTURED CELLS. IV. THE CARBOHYDRATE COMPOSITION OF MEMBRANES ISOLATED FROM ONCOGENIC RNA VIRUS-CONVERTED CHICK EMBRYO

FIBROBLASTS. (E.) Perdue, J. F. (McArdle Lab. Cancer Res., U. Wisconsin, Madison), R. Kletzien and V. L. Wray. *Biochem Biophys Acta* 266(2):505-510, 1972.

Cell membrane fractions were isolated by density gradient centrifugation of homogenates of cultured chick embryo fibroblasts converted by avian sarcoma viruses, morph^f Fujinami virus and a mutant of this virus, morph^r Fujinami virus. Membrane fractions were concentrated in sucrose at a density of 1.058 ± 0.001 (A' band of morph^f-converted cells) and 1.074 ± 0.004 (A' band of morph^r-converted cells). The membranes in the B' band from cells converted by either virus were both concentrated at density of 1.11. Estimates of sialic acid content in the membrane fractions were 75 nmoles/mg protein in the A' band from morph^f-converted cells and 64 nmoles/mg protein in the A' band from morph^r-converted cells. Sialic acid levels were 50% higher in uninfected cells. Neutral sugar levels in the A' and B' band membranes from morph^f-converted cells were 235 and 152 $\mu\text{g}/\text{mg}$ protein, the same as recently reported for uninfected cells. The morph^r-converted cells had 40% more neutral sugar (331 $\mu\text{g}/\text{mg}$ protein) in the A' band than did uninfected cells. This value was similar to that reported for RBA-virus-transformed cells. An analysis of the amino sugar content (0.13-0.19 $\mu\text{g}/\text{moles}/\text{mg}$ protein) of the cell membranes in the A' and B' bands from uninfected fibroblasts and fibroblasts infected with leukosis virus (RAV-49), or infected and converted by sarcoma virus RBA and morph^f and morph^r Fujinami, did not establish compositional differences which could be related to morphological cell shape or virus conversion. The most consistent finding was the decrease in sialic acid content of membranes from the cells converted by the oncogenic viruses (RBA, morph^f and morph^r Fujinami). Since this decrease also did not correlate with cell shape and was not observed in leukemia virus-infected cells, it represents a fundamental alteration in membrane chemistry paralleling a loss of the fibroblasts' controls of growth and multiplication.

4558 PATTERNS OF GLUCOSE METABOLISM IN NORMAL AND VIRUS-TRANSFORMED CHICK CELLS IN TISSUE CULTURE. (E.) Bissell, M. J. (Dept. Molec. Biol., U. California, Berkeley), C. Hatie and H. Rubin. *J Nat Cancer Inst* 49(2):555-565, 1972.

Chick embryo cells, normal and transformed by Bryan, Schmidt-Ruppin or Rous-associated sarcoma viruses (RSV), were grown at cell densities ranging from "sparse" (6×10^5 cells/60 mm dish) to "dense" (5.5×10^6 cells/dish); glucose uptake, formation of lactic acid, and formation of CO_2 , were observed in cultures. When ^{14}C -glucose was added to normal cells at less than limiting concentrations ($<0.5 \text{ mM}$), the ratio of lactate to glucose was always higher in dense than in sparse cultures. Although the absolute rate of lactate production decreased as cells became more crowded, the ratio of lactate produced per glucose used increased. In normal cells, CO_2 production and CO_2 : glucose ratio decreased with increasing cell density. Thus the lactate: CO_2 ratio increased with increasing

cell density (i.e., more glucose was channeled through the glycolytic than through the aerobic pathways). The phosphogluconate pathway also became more prominent in denser cultures. However, population *per se*, rather than cell growth rate, appeared to be responsible for changes in the pattern of carbon flow. The rate of glycogen synthesis/mg protein decreased at higher densities in normal cells. RSV-transformed cells were also affected by population density, but to a lesser degree than normal cells. Regardless of population density, however, the amount of lactate produced and the lactate: CO_2 ratio were always higher in transformed cultures than in normal cultures.

4559 IMMUNODEPRESSIVE EFFECT OF RAUSCHER LEUKEMIA VIRUS ON ANTINUCLEAR ANTIBODY FORMATION IN NEW ZEALAND BLACK MICE. (E.) Siegel, B. V. (U. Oregon Med. Sch., Portland), M. Brown and J. I. Morton. *J Nat Cancer Inst* 48(1):159-163, 1972.

Five-hundredths ml of 10^{-1} , 10^{-2} or 10^{-3} dilution of a second NZB mouse passage of Rauscher leukemia virus (RLV) were inoculated i.p. into baby NZB mice; the influence of RLV infection on anti-nuclear antibody (ANA) development in fresh plasma of infected mice was observed using indirect immunofluorescence. Inoculation with a 10^{-2} dilution of RLV at five days of age depressed total positive ANA reactions to 50-80% of those of controls. The incidence of strongly positive ANA responses in RLV-infected mice generally remained under 50% of that seen in controls. Of 12 virus-inoculated mice surviving 30 days postinoculation, 11 showed leukemic development, peripheral blood smears appearing erythroleukemic in these mice. Virus-infected mice which survived eventually developed ANA responses comparable to, but not exceeding, those of controls. In another experiment, the effect of virus dose was examined in connection with RLV depression of ANA response. Mice received injections of 10^{-1} (high dose) or 10^{-3} (low dose) RLV, while controls received a 10^{-1} concentration of normal NZB spleen extract. Fifty-nine percent of controls showed strong ANA responses during the first month of life, in contrast to 28 and 27%, resp., of mice given low and high doses of RLV. In related experiments, 1.5- and 5-month-old NZB mice showing strongly positive ANA responses were tested for ANA before and at intervals after RLV infection. No diminution in persistence of strong immunofluorescence reactivity was seen in 22 days postinjection. Inoculation of BALB/c and C57BL/6 mice, all negative for ANA, with a 10^{-1} dose of RLV did not cause conversion to positive ANA reactivity.

4560 ACUTE LYMPHOBLASTIC LEUKEMIA: VIRUS-LIKE PARTICLES IN LYMPHATIC CELL INCLUSIONS FROM BONE MARROW AND PERIPHERAL BLOOD. (E.) Sun, C. N. (V. A. Hosp., Little Rock, Ark.), G. E. Byrne and H. Pinkerton. *Exp Pathol (Jena)* 6(1):72-79, 1972.

Intracellular virus-like particles in preparations made directly from leukemic bone marrow are reported. Light and electron microscopic observations of bone marrow obtained from a five-year old girl with acute lymphoblastic leukemia showed abnormal inclusions, 0.5-2 microns in diameter, in the lymphoblasts and mature lymphocytes during routine examination of the first bone marrow aspirate. The number of inclusions varied from two to twelve per cell. They were PAS-positive, and negative with Feulgen, Sudan Black B, Oil Red O and peroxidase methods. Similar inclusions were noted in the lymphocytes seen in the peripheral smears. Electron microscopy (EM) of the bone marrow was performed on the preleukemic phase and at intervals of one, four and twelve weeks after the onset of the leukemic phase. Tissue cultures were started from two of the aspirates and cultures for mycoplasma were negative. Ovoid inclusions corresponding to those observed by light microscopy were noted in the EM studies. Often they were composed of a single limiting membrane, enclosing a dense population of "doughnut type" virus-like particles approximately 400 Å in diameter. In many of the inclusions whorled membranes were present. The morphology of these virus-like particles is similar to the "immature" virus particles observed in murine leukemia, and to virus-like bodies reported in some human lymphomas.

- 4561 THE ROLE OF EPITHELIAL RETICULAR CELLS OF THE THYMUS IN GROSS VIRUS-INDUCED LEUKEMOGENESIS IN THE RAT. (It.) Cali, A. (Inst. Anat. Path. Histol. U. Naples, Italy), R. Vecchione, L. Coscia-Porrazzi and L. Palombini. *Tumori* 57(4):237-246, 1971.

Thymic tissue obtained from 7-10 day-old W/Fu rats was inoculated i.m. after 25 days of culture in the thigh of 40-50 day-old male W/Fu rats which had been thymectomized at birth and inoculated with Gross virus at 3-4 days-of-age. Each rat received a graft (interior part of thigh) containing 2×10^4 cells obtained from a pool of 12 thymuses. The rats were then divided into two groups: 11 rats received Gross virus inoculum in addition to the thymic graft and six rats received no virus and served as controls. Two of the six control rats developed normal thymic tissue islets at the grafting site 4 to 5 months after inoculation, whereas five of the 11 virus-treated rats developed lymphoma at the thymic tissue inoculation site 6 to 8 months after treatment. Inoculation of acellular filtrate of this neoplastic tissue to other rats produced lymphoma indicating that this fluid included Gross virus. The long latency period in the development of lymphoma under the experimental conditions suggests that development of neoplasia is strictly dependent on a preceding restoration of morphologically normal thymus.

- 4562 THE TRANSFORMATION OF BHK 21 HAMSTER CELLS BY SIMIAN VIRUS 40. Wiblin, C. N. (Imp. Cancer Res. Fund, London, England) and I. A.

MacPherson. *Int J Cancer* 10(1):296-309, 1972.

Cells of the C13 clone of baby hamster kidney 21/13 (BHK 21/13) cells were exposed to SV40 at multiplicities of infection ranging from 10^0 - 10^4 plaque forming U/cell. Judging by the efficiency of plating in culture and by SV40 T antigen production, C13 cells were refractory to SV40 transformation and infection. When African green monkey kidney (BS-C-1) cells were infected with SV40 and fused with C13 cells, C13 cells were transformed. Typical SV40 cytopathic effects appeared, colony formation in the cells increased 50-fold over that seen in C13 cells not exposed to SV40-infected BS-C-1 cells, and SV40 T antigen was detected. One transformed C13 alone (C13/SV) was selected for further study. C13/SV cells showed several of the properties of BHK 21 cells transformed by viruses other than SV40. After 350 generations in culture, C13/SV cells induced metastasizing tumors in hamsters; cell lines derived from these metastases were designated C13/SV-M. Metastases of C13/SV-induced tumors were apparently the result of dissemination of the cells rather than of release of infectious SV40. C13/SV-M and C13/Sv cells had similar growth properties *in vitro*. C13/SV-M cells showed properties associated with similar growth properties *in vitro*. C13/SV-M cells showed properties associated with surface alterations in transformed cells. SV40 transplantation antigen may have been masked or absent in C13/SV-M cells.

- 4563 THE RELATIONSHIP BETWEEN THE SOLUBLE ANTIGENS AND THE VIRION OF ADENOVIRUS TYPE 3. VI. FURTHER CHARACTERIZATION OF ANTIGENIC SITES AVAILABLE AT THE SURFACE OF VIRIONS. (E.) Norrby, E. (Karolinska Inst. Sch. Med., Stockholm, Sweden) and G. Wadell. *Virology* 48(3):757-765, 1972.

Adenovirus type 3 was investigated in absorption experiments in which adenovirus 3 rabbit hyperimmune sera against soluble virus components and virions were exhaustively absorbed in the presence of sheep anti-rabbit serum. After absorption with adenovirus 3 antigens, antisera were reacted with adenovirus 3 virions in hemagglutinin-inhibition (HI) tests. These tests demonstrated the presence of antigenic sites at the surface of virions of adenovirus 3 which were not carried by spontaneously occurring soluble 3 components. When antibodies against adenovirus 3 vertex capsomers (represented by an antipenton serum absorbed with purified fibers) or against adenovirus 3 fibers were tested for neutralization of virus activity, efficient neutralization occurred only when both kinds of antibodies (antipenton and antidodecon) were present in reactions, or when anti-rabbit serum was added. Cross reactions between surface antigens of eight adenovirus types (3, 4, 11, 16, 9, 15, 2 and 6) representing all of Rosen's subgroups were investigated in HI tests with purified virions and soluble hemagglutinin in the presence of rabbit hyperimmune sera against soluble components and virions. Cross reactions were found only at low serum dilutions; they occurred predominantly among subgroup members, though some inter-

group reactions were seen. The reactions were due to vertex capsomer-associated subgroup-specific antigen(s). One antiserum against adenovirus type 11 dodecons displayed some neutralization of type 3 virions in the presence of anti-rabbit serum.

- 4564 STUDIES ON TYPE-H VIRUS-LIKE PARTICLES IN HAMSTER: THEIR ROLE IN ONCOGENESIS. (E.) Cesarini, J. P. (Temple U. Hlth. Sci. Ctr., Philadelphia, Pa.) and C. De Micco. *Int J Cancer* 10:174-185, 1972.

Cells from continuous hamster lines, transformed hamster cell clones, transplantable hamster tumor cell lines and primary hamster tumor cell cultures were examined under the electron microscope for the H virus-like particle (H VLP). H VLP was absent in normal hamster tissues and hamster embryos. Primary virus-induced hamster tumors and transplanted tumors were also free of H VLP in all cases but one. H VLP was found in cell lines obtained from an SV40-induced and in cell lines from the BHK 21/13 line, a line of cells transformed by Rous sarcoma virus (RSV) and by polyoma virus. H VLP were seen in association with morphologically different A-type virus-like particles in a BHK 21/13 clone transformed by RSV and then by UV-irradiated polyoma. H VLP was present in swollen cisternae of the rough endoplasmic reticulum but never in cell nuclei.

- 4565 VARIATIONS IN SARCOMA AND LEUKEMIA VIRUS ACTIVITY IN SOMATIC CELL HYBRIDS. (E.) Long, C. (Flow Labs., Inc., Rockville, Md.), G. Gelloff and R. V. Gilden. *Int J Cancer* 10(2):310-319, 1972.

Eight hybrid clones were grown from the fusion of two parental lines: a 3T6 mouse embryo line deficient in hypoxanthine-guanine phosphoribosyl transferase (HGPRT), resistant to 6-thioguanine, and infected with Rauscher leukemia virus (RLV); and a hamster cell line lacking thymidine kinase and carrying defective murine sarcoma virus (MSV) genome. The mouse parent line (TG-8) shed LV and the MSV genome was rescued from the hamster parent line (HT-1) by co-cultivation with an LV-shedding mouse line. The hybrid clones differed morphologically from both parents, being more elongated and refractile. All clones were positive for MuLV group specific (gs) antigen and all lacked hamster leukemia virus gs antigen. Five clones produced equal amounts of sarcoma and leukemia virus; however, two clones produced 100-fold excesses of virus. An eighth clone, which was morphologically like the TG-8 parent, produced leukemia virus but not sarcoma virus. Sarcoma virus could not be rescued from this clone by fusion with RLV-shedding mouse cells. All clones had HGPRT adenosine kinase of hamster origin. Six clones also possessed adenosine kinase of murine origin.

- 4566 MATURATION OF INFECTIOUS SIMIAN VIRUS 40 IN THE PRESENCE OF ETHIDIUM BROMIDE. (E.) Kletmann, W. (Wistar Inst., Philadelphia, Pa.), K. Kato and H. Koprowski. *J Gen Virol* 15:35-44, 1972.

DNA synthesis in SV40-infected and uninfected African green monkey cells was measured in cultures containing or lacking ethidium bromide (EB). Virus DNA synthesis and mitochondrial DNA (M-DNA) synthesis were observed by submitting extracted virus and M-DNA to isopycnic CsCl-EB gradient centrifugation to separate the closed-circular (component I) and nicked-circular (component II) portions of virus and M-DNA. EB increased total DNA synthesis and nuclear DNA synthesis in uninfected cells. In uninfected cells, 4 µg/ml EB removed component I M-DNA from the CsCl-EB gradients. In SV40-infected cells, neither 4 nor 8 µg/ml EB affected nuclear DNA synthesis. Component II M-DNA was reduced by 4 mg/ml EB. Production of SV40 progeny virus was not affected by EB, nor was the infectivity of SV40.

- 4567 COMPARED ACTION OF A POLYOMA-VIRUS-SPECIFIC INHIBITOR ON THE FORMATION OF POLYOMA CAPSID ANTIGEN AND OF POLYOMA TUMOR ANTIGEN. (E.) Meyer, G. (C.R.A.C.M., Marseille, France), R. Cramer and H. Yoshikura. *Int J Cancer* 10:128-133, 1972.

A virus-specific inhibitor protein factor was extracted from polyoma virus-infected baby hamster kidney cells by sonication and centrifugation. The inhibitor was added to mouse embryo cells one hr after they were infected with polyoma virus. Immunofluorescence was used to test for the formation of polyoma virus capsid antigen and tumor (T) antigen. By 48 hr after infection, capsid antigen appearance was reduced by more than 90% in inhibitor-treated infected cells as compared with infected cells not treated with inhibitor. The inhibitor did not affect the kinetics of polyoma T antigen appearance in infected cells.

- 4568 ULTRASTRUCTURAL LOCALIZATION OF CONCANAVALIN A RECEPTORS IN NORMAL AND SV40-TRANSFORMED HAMSTER AND RAT CELLS. (E.) Bretton, R. (Inst. Sci. Res. Cancer, Villejuif, France), R. Wicker and W. Bernhard. *Int J Cancer* 10(2):397-410, 1972.

Normal and SV40-transformed hamster cells were cultured and treated with concanavalin A (Con A) and horseradish peroxidase, and the distribution of Con A receptor sites on cell surfaces was observed by examining peroxidase reactions under the electron microscope. All normal and transformed cells treated with Con A-peroxidase showed strong surface reactions. Normal hamster cells showed a continuous layer of electron-dense material indicating that the Con A receptor areas were evenly distributed over the cell coat. SV40-transformed cells showed a more patchy and uneven distribution of Con A

receptor sites. The distinction between evenly and unevenly distributed Con A receptor sites on the cell surfaces was detectable even after 108-112 passages of normal or transformed cells. No differences between the distribution of Con A receptor sites could be discerned between normal or SV40-transformed rat cells.

- 4569 TYPE C VIRUSES IN THE PANCREAS OF NORMAL C57BL MICE. (E.) Della Torre, G. (Natl. Inst. Study Cure Tumors, Milan, Italy) and G. Della Porta. *Cancer Res* 32:1595-1597, 1972.

Pancreases and thymuses from normal C57BL mice, normal C3Hf mice, and normal AKR mice were examined under the electron microscope for the presence of type C viruses. C-type virus particles were found in 20 of 22 pancreases from C57BL mice aged more than 3 wk; few particles were seen in younger C57BL mice. In the older mice, the particles were seen budding from membranes of intracytoplasmic vacuoles and cisternae of endoplasmic reticulum in pancreatic acinar cells. Thymuses of C57BL mice, both newborn and >3 wk old, also harbored C-type particles, but in smaller numbers than the pancreases. No type C particles were found in the pancreases of C3Hf or AKR mice. In the thymus of these strains, type C particle distribution was essentially similar to that in C57BL mice.

- 4570 POLYPEPTIDES OF AVIAN RNA TUMOR VIRUSES. IV. COMPONENTS OF THE VIRAL ENVELOPE. (E.) Bolognesi, D. P. (Max-Planck Inst., Tübingen, Germany), H. Bauer, H. Gelderblom and G. Hüper. *Virology* 47:551-566, 1972.

Avian myeloblastosis virus (AMV), recovered from myeloblasts from the blood of leukemic chickens, was concentrated by ultracentrifugation and fractionated by sucrose density centrifugation. The virus-containing band was then centrifuged on a sucrose gradient. Viruses were split by sedimentation through NP40 and DTT and further density gradient centrifugation. The fraction banding at 1.19 g/cm³ consisted mainly of rosette-like structures (300 Å in diameter) having the dimensions of projections on the outer surface of the virus. The rosettes represented 60% of viral carbohydrate and 7% of viral protein. When rosettes were treated with SDS and DTT and electrophoresed on acrylamide gels, two major proteins (viral glycoproteins) appeared with molecular wts of 37,000 daltons (the GI protein) and 115,000 daltons (GII). GII could be isolated without SDS treatment and resembled the knob-like portion of the complete rosette. GI and GII specifically absorbed neutralizing sera and precipitated with these sera in immunodiffusion tests. In other serum absorption tests, rosettes appeared to possess material which specifically absorbs a neutralizing antibody against a virus from subgroup B. This suggested that biologically acute Ve antigen was present in rosettes. When rosettes were tested in gel

diffusion using nonneutralizing rabbit antisera, a precipitation line was seen. The corresponding antigen was apparently not identical with any of the four complement-fixing antigens of AMV. The rosettes possessed at least two antigenic specificities, one residing in GI, one in GII. It was concluded that the surface projections of AMV, associated with rosette structures, represented the viral type-specific antigens.

- 4571 RIBONUCLEASE-SENSITIVE ENDOGENOUS DNA POLYMERASE ACTIVITY AND DNA-DIRECTED POLYMERASE IN HUMAN TISSUE CULTURE CELL LINES. (E.) Srivastava, B. I. S. (Roswell Park Mem. Inst., Buffalo, N.Y.) and J. Minowada. *Cancer Res* 32(11):2481-2486, 1972.

The 37,000 X g supernatant ("soluble") activity, the chromatin-associated DNA-directed DNA polymerase activity, and the soluble RNase-sensitive endogenous DNA polymerase activity were examined in two fibroblast cell lines (WI-38 and WI-38VA13), in 13 lymphoid cell lines originated from normal persons or from acute lymphocytic leukemia, acute myelocytic leukemia, Burkitt lymphoma, or multiple myeloma patients, and also in cells obtained directly from patients with acute lymphocytic leukemia, acute myelocytic leukemia, multiple myeloma, or lymphosarcoma. RNase-sensitive endogenous DNA polymerase activity, which was 1/1000 to 1/10 of DNA-directed soluble DNA polymerase activity, was lowest in WI-38 cells and highest in lymphoblasts from acute lymphocytic leukemia patients. The soluble and chromatin-associated DNA-directed DNA polymerase activity of WI-38V13 cells, compared to that of WI-38 cells, and the activity of acute myelocytic leukemia, Burkitt lymphoma, and multiple myeloma cells, compared to that of normal cells, were two to ten times higher; in contrast, the activity of cells of acute lymphocytic leukemia or lymphosarcoma origin was one-third to one-half that of normal cells.

- 4572 ONCOGENICITY OF FELINE FIBROSARCOMA VIRUSES IN MARMOSET MONKEYS: PATHOLOGIC, VIROLOGIC, AND IMMUNOLOGIC FINDINGS. (E.) Wolfe, L. G. (Rush-Presbyterian-St. Luke's Med. Ctr., Chicago, Ill.), R. D. Smith, J. Hoekstra, B. Marczyńska, R. K. Smith, R. McDonald, R. L. Northrop and F. Deinhardt. *J Nat Cancer Inst* 49(2):519-539, 1972.

Seventy-five marmosets were injected i.p. and/or i.m. with cell-free concentrates of cat tumors induced by Snyder-Thelen or Gardner-Arnstein feline sarcoma virus (ST- and GA-FeSV). A total of 53 intraabdominal or injection-site sarcomas developed in 19 marmosets inoculated neonatally or up to eight yr of age. ST-FeSV induced undifferentiated sarcomas while GA-FeSV induced well-differentiated fibrosarcomas. Pulmonary and regional lymph node metastases were seen in 20% of inoculated marmosets. Ten marmoset-to-marmoset passages, with tumors induced by either virus, were accomplished; all marmosets inoculated with intact tumor cells developed tumors, usually composed

of recipients' cells. Primary sarcomas showed group-specific (gs) antigen but lacked C-type virus particles, while cell lines established *in vitro* from these tumors and transplanted tumors contained infectious virions. One of 14 cell-free extracts from marmoset tumors induced foci in cat embryo cells *in vitro*. Virus produced by cultured marmoset tumors was oncogenic in marmosets and in cats. Gs antibodies were present in sera of 17 of 50 tumor-bearing marmosets.

- 4573 EFFECT OF MAMMARY TUMOR VIRUS INFECTION ON *IN VIVO* OXIDATION OF GLUCOSE-1-¹⁴C AND GLUCOSE-6-¹⁴C IN C3H MICE. (E.) Burki, H. R. (Northwestern U. Med. Sch., Chicago, Ill.) and G. T. Okita. *Cancer Res* 31(12):1955-1961, 1971.

A two-part study was conducted to compare the rate of *in vivo* oxidation of glucose-1-¹⁴C and glucose-6-¹⁴C in C3H tumor-free and C3Hf (factor-free) virgin female mice of different ages, and to determine the effect of the presence of small foci of mammary tumor tissue on the *in vivo* metabolism of glucose-¹⁴C. Although no differences were observed between young mice of the two strains, C3H virgins older than 40 wk oxidized glucose-6-¹⁴C to ¹⁴CO₂ at a faster rate than C3Hf virgins of the same age. In addition, C3H mice older than 40 wk had significantly lower body wt than the C3Hf controls. No age-dependent interstrain differences in the rate of glucose-1-¹⁴C oxidation were observed. Injection s.c. of an homogenate of a spontaneous mammary tumor which arose in a C3H mouse resulted in a significant reduction in body wt and an increase in glucose-6-¹⁴C oxidation in C3Hf but not C3H virgins. The tumor nodules grew progressively in the C3Hf but not in the C3H mice. These results imply that degradation of glucose by the glycolysis-Krebs cycle pathway, but not by the pentose shunt, was increased in aging and in tumor-bearing C3H virgin mice.

- 4574 LEUKEMIA VIRUS-INDUCED IMMUNOSUPPRESSION. VIII. RAPID DEPRESSION OF *IN VITRO* LEUCOCYTE MIGRATION AFTER INFECTION OF MICE WITH FRIEND LEUKEMIA VIRUS. (E.) Friedman, H. (Einstein Med. Ctr., Philadelphia, Pa.) and W. S. Ceglowski. *J Immunol* 107(6):1673-1681, 1971.

BALB/c mice were inoculated i.p. with a 10⁻¹ dilution preparation of Friend leukemia virus (FLV); at various times after inoculation, mice were killed and spleen, lymph node, thymus and bone marrow cells were placed in capillary tubes to test their migratory capacities. Excellent migration was seen with spleen cells of uninfected mice, while migration of spleen cells of infected mice was markedly inhibited by three to five days postinoculation. Normal spleen cells showed areas of migration of 16.3 ± 3.9 mm², while spleen cells from FLV-infected mice showed areas of 10.1 ± 2.5 mm² on day three and 4.2 ± 1.1 to <2.0 mm² six to 20 days postinfection. No inhibition of migration was seen in spleen cells of FLV-infected mice one

day postinfection. Spleen cell migration inhibition was less pronounced in mice infected with FLV at dilutions of 10⁻² or 10⁻³. Lymph node and marrow cells migration was not as affected by FLV infection as was spleen cells; migration of these cells was not inhibited until two or three wk postinfection. Thymus cells showed no migration inhibition until four wk postinfection. No migration-inhibiting factor was detected in culture supernatants of spleen cells from infected mice sensitized with allogeneic mouse skin grafts or tubercle bacilli and challenged *in vitro* with the appropriate antigen. Similar cultures from uninfected mice released a lymphoid cell migration-inhibiting factor.

- 4575 SENSITIVITY OF EPSTEIN-BARR VIRUS (EBV) PRODUCER AND NON-PRODUCER HUMAN LYMPHOBLASTOID LINES TO SUPERINFECTION WITH EB-VIRUS. (E.) Klein, G. (Karolinska Inst., Stockholm, Sweden), L. Dombos and B. Gothoskar. *Int J Cancer* 10:44-57, 1972.

Twenty-nine human lymphoblastoid cell lines, including lines from Burkitt's lymphoma, nasopharyngeal carcinoma, infectious mononucleosis and normal blood, were exposed to Epstein-Barr virus (EBV) and virus absorption by cells and the production of early antigen (EA) by exposed cells were observed. EBV absorption was assessed by counting the numbers of direct membrane fluorescence-positive cells immediately after infection and by the direct radioimmune membrane labeling method. Eleven of the lymphoblastoid cell lines were "nonproducers", (i.e., produced little or no EA or EBV viral capsid antigen (VCA) in separate tests). Virus absorption and subsequent appearance of EA-positive cells were concordant in mice of the 11 nonproducer lines. Five nonproducer lines absorbed the most EBV (71-62% of virus-exposed cells positive for absorption); four of these five lines developed significant percentages of EA-positive cells after EBV infection. Four nonproducer lines which absorbed EBV remained EA negative. Eighteen cell lines were "producers" (i.e., produced much EA and VCA in separate tests). Four of these lines showed increased EA production and absorbed EBV readily. Of the 14 producer lines showing little or no increase in EA production, these five showed relatively good EBV absorption. One IgE-producing human myeloma cell line showed neither EBV absorption nor EA development.

- 4576 INHERITANCE OF SUSCEPTIBILITY TO FRIEND MOUSE LEUKEMIA VIRUS. VIII. EFFECT OF A SINGLE GENETIC LOCUS ON THE PATHOGENESIS OF THE LEUKEMIA. (E.) Okada, T. (Inst. Med. Sci., Tokyo, Japan), H. Sugano and K. Takizawa. *Int J Cancer* 10(2):382-390, 1972.

The effect of the Fv locus, which controls the early response to Friend leukemia virus (FLV), on the pathogenesis of FLV-induced leukemia was studied in two pairs of mouse strains (DDD and C57BL/6) which are congenic except for this locus. Rapid spleen enlargement and spleen focus formation, which are

characteristic of FLV infection, were seen in young mice with the Fv^S/Fv^S genotype (DDD and C57BL/6-Fv^S) but not in young mice with the Fv^r/Fv^r genotype (DDD-Fv^r and C57BL/6) following i.p. injection of virus. When the infected Fv^r/Fv^r mice were observed for 150 days, all of the DDD-Fv^r mice developed splenomegaly whereas none of the C57BL/6 mice did. Histologic observation of the DDD-Fv^r splenomegalic mice revealed erythroblastic ("Friend cells"), lymphatic or granulocytic leukemia, or myeloproliferative disorder with a prominent megakaryocytic proliferation. These results indicate that FLV is able to induce various types of leukemias in mice and that the early responses can be completely abrogated in mice with an Fv^r/Fv^r genotype. Genetic factors other than the Fv locus may be involved in the late-occurring FLV-induced leukemias.

- 4577 MAMMARY GLAND TUMORS IN SUBSTRAINS C57BL/M AND C57BL/He MICE. (E.) Heston, W. E. (Natl. Cancer Inst., Bethesda, Md.), G. Vlahakis and G. H. Smith. *J Nat Cancer Inst* 49(3):805-812, 1972.

A few spontaneous mammary tumors were observed in breeding female mice of substrains C57BL/M and C57BL/He; the incidence in C57BL/M was somewhat higher than in C57BL/He. This correlates with former observations that whereas C57BL/He is genetically resistant to the mammary tumor virus (MTV), C57BL/M is much more susceptible. Mammary tumors were induced with hypophyseal isografts without the introduction of MTV in both substrains and, as further correlation with their genetic susceptibility, the incidence in the C57BL/M females was somewhat higher than in the C57BL/He females. All the hypophyseal isograft-stimulated mammary tumors were adenocarcinomas. No morphologic evidence was obtained for the presence of "derepressed" MTV in these C57BL mammary tumors induced by hypophyseal isografts. In the primary spontaneous tumors extracellular particles and budding forms were observed. Some of these were classified as type-C particles but others were difficult to interpret. The possibility that some of these particles were type B remains open. In line with the genetic resistance and susceptibility of the two substrains, these extracellular particles were seen only in the spontaneous tumors of the C57BL/M substrain. The spontaneous tumors were intertransplantable between the two substrains, though the substrains have been separated since before 1936.

- 4578 MORPHOLOGY AND BIOLOGICAL PROPERTIES OF TRANSPLANTABLE TUMOURS INDUCED BY POLYOMA VIRUS. (E.) Jaszcz, W. (Med. Acad., Cracow, Poland). *Folia Biol* 20(1-2):67-91, 1972.
- 4579 SPONTANEOUS TUMORS IN HAMSTERS: INCIDENCE, MORPHOLOGY, TRANSPLANTATION, AND VIRUS STUDIES. (E.) Yabe, Y. (Okayama U. Med. Sch., Japan), N. Kataoka and H. Koyama. *Gann* 63(3):329-336, 1972.
- 4580 ELECTROPHORETIC ANALYSIS OF THE RNA FROM A MOUSE LEUKEMIA VIRUS. (E.) McClain, K.

(Dept. Path. Pediatrics, U. Chicago, Ill.) and W. H. Kirsten. *Cancer Res* 32:1470-1475, 1972.

- 4581 DIFFERENTIATION OF TYPE 1 AND TYPE 2 HERPES SIMPLEX VIRUS BY *IN VITRO* STIMULATION OF IMMUNE LYMPHOCYTES. (E.) Rosenberg, G. L. (Natl. Inst. Dent. Res., Bethesda, Md.) C. Wohlenberg, A. J. Nahmias and A. L. Notkins. *J Immunol* 109(2):413-414, 1972.
- 4582 EXPRESSION OF LACTATE AND MALATE DEHYDROGENASES IN TUMORS INDUCED BY SV40 AND 7,12-DIMETHYLBENZ(A)ANTHRACENE. (E.) Prasad, R. (Baylor Coll. Med., Houston, Tex.), N. Prasad and S. S. Tevethia. *Science* 178(4056):70-71, 1972.
- 4583 TRANSLATION OF REOVIRUS MESSENGER RNAs SYNTHESIZED *IN VITRO* INTO REOVIRUS POLYPEPTIDES BY SEVERAL MAMMALIAN CELL-FREE EXTRACTS. (E.) McDowell, M. J. (Duke U. Med. Ctr., Durham, N.C.), W. K. Joklik, L. Villa-Komaroff. *Proc Nat Acad Sci USA* 69(9):2649-2653, 1972.
- 4584 SPONTANEOUS DISSEMINATED SQUIRREL FIBROMA. (E.) Shively, J. N. (New York St. Veterinary Coll., Cornell U., Ithaca), K. K. Moe, A. Woolf and J. M. King. *J Nat Cancer Inst* 49(3):919-922, 1972.
- 4585 INHIBITION OF RNA-DIRECTED DNA POLYMERASE FROM RAUSCHER LEUKEMIA VIRUS BY THE 5'-TRIPHOSPHATE OF CYTOSINE ARABINOSIDE. (E.) Tuominen, F. W. (Oak Ridge Natl. Lab., Tenn.) and F. T. Kenney. *Biochem Biophys Res Commun* 48(6):1469-1475, 1972.
- 4586 INDUCTION OF DEOXYRIBONUCLEIC ACID SYNTHESIS AND THE ONCOGENICITY OF MAREK'S DISEASE VIRUS. (E.) Lee, L. F. (Regional Poultry Res. Lab., East Lansing, Mich.). *J Virol* 10(2):167-170, 1972.
- 4587 STUDIES ON THE GLYCOSPHINGOLIPIDS OF NORMAL AND VIRALLY TRANSFORMED 3T3 MOUSE FIBROBLASTS. (E.) Yogeewaran, G. (Dept. Biochem., U. Toronto, Canada), R. Sheinin, J. R. Wherrett and R. K. Murray. *J Biol Chem* 247(16):5146-5158, 1972.
- 4588 TOBACCO MOSAIC VIRUS - LIKE PARTICLES IN MAMMALIAN CELLS INOCULATED WITH TMV RIBONUCLEIC ACID. (E.) Chyle, M. (Charles U. Med. Sch., Prague, Czechoslovakia), P. Chyle, J. Korb and F. Patocka. *J Hyg Epidemiol Microbiol Immunol* 16(1):122-123, 1972.
- 4589 CHARACTERISTICS OF A VIRUS FOUND IN A ROUS MOUSE CELL LINE, SR-C3H-2127. (E.) Hino, S. (Inst. Med. Sci., U. Tokyo, Japan), N. Yamaguchi and T. Yamamoto. *Jap J Exp Med* 42(1):43-52, 1972.
- 4590 COMPARISON OF CHROMATOGRAPHIC PATTERNS OF LOW MOLECULAR WEIGHT RNA FROM BURKITT LYMPHOMA, INFECTIOUS MONONUCLEOSIS, EB-VIRUS TRANSFORMED, AND NORMAL HUMAN LYMPHOBLASTS. (E.) Fujioka, S. (Natl. Cancer Inst., Bethesda, Md.), S. O'Hopp, P. Gerber and R. C. Gallo. *Blood* 39(5):610-620, 1972.
- 4591 COMPARATIVE ULTRASTRUCTURAL STUDIES ON THE CORES OF HERPES SIMPLEX AND VARICELLA-ZOSTER

IRUSES. (E.) Nii, S. (Res. Inst. Microbial Dis., Osaka U., Japan). *Biken J* 14(4):425-430, 1971.

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594 LYMPHOCYTIC SARCOMA OF THE MOUSE ASSOCIATED WITH VIRUS-LIKE PARTICLES. (E.) Tokuzen, S. (Natl. Cancer Ctr. Res. Inst., Tokyo, Japan), W. Takahara and T. Sakai. *Gann* 63(3):313-316, 1972.

595 ESTABLISHMENT OF LYMPHOBLASTOID CELL LINES FROM PERIPHERAL BLOOD AND LYMPH NODE OF JAPANESE PATIENTS WITH VARIOUS DISEASES. (E.) Iyoshi, I. (Okayama U. Med. Sch., Japan), H. Masagawa, T. Tsubota, H. Masuji and K. Hiraki. *Immunol* 62(5):413-417, 1971.

96 CHARACTERIZATION OF AN ENDONUCLEASE ASSOCIATED WITH SIMIAN VIRUS 40 VIRIONS. (E.) Sowell, W. R. (Natl. Cancer Inst., Bethesda, Md.), Saral, R. G. Martin and H. L. Ozer. *J Virol* 10(3):400-416, 1972.

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100 EPITHELIAL FEATURES OF "NONPRODUCER" BALB/3T3 CELLS TRANSFORMED BY MURINE SARCOMA VIRUS. (E.) Ikawa, Y. (Natl. Cancer Inst., Bethesda, Md.), A. F. Gazdar and H. C. Chopra. *J Nat Cancer Inst* 49(5):1449-1453, 1972.

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D. Zarzycki, A. Liszkowa and M. Skrochowska. *Pol Med J* 11(1):176-184, 1972.

4603 A COMMON CHANGE OF ASPARTYL-tRNA IN POLYOMA- AND SV40-TRANSFORMED CELLS. (E.) Gallagher, R. E. (Natl. Cancer Inst., Bethesda, Md.), R. C. Ting and R. C. Gallo. *Biochim Biophys Acta* 272(4):568-582, 1972.

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4605 FACTORS RELATED TO THERAPEUTIC EFFICACY IN ADOPTIVE CHEMOIMMUNOTHERAPY OF A FRIEND VIRUS-INDUCED LYMPHOMA. (E.) Fass, L. (U. Washington Sch. Med., Seattle) and A. Fefer. *Cancer Res* 32(11):2427-2431, 1972.

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4608 REPLICATION OF FELINE C-TYPE VIRUS AT THE PLASMA MEMBRANE OF ERYTHROCYTES. (E.) Oshiro, L. S. (California State Dept. Public Hlth., Berkeley), D. O. M. Taylor, J. L. Riggs and E. H. Lennette. *J Nat Cancer Inst* 48(5):1419-1424, 1972.

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See also:

- * (Rev): 4305, 4309, 4311, 4312, 4320, 4332, 4334, 4335, 4337, 4339, 4343, 4347
- * (Chem): 4371, 4395, 4396, 4413
- * (Immun): 4611, 4614, 4618, 4621, 4623, 4630, 4631, 4645, 4647, 4651, 4654, 4660, 4663, 4665, 4672, 4676, 4680, 4685, 4687, 4691, 4694, 4710, 4735, 4750, 4763, 4771

4611 ANTIGENIC RELATIONSHIP BETWEEN THE HERPES-VIRUS OF INFECTIOUS BOVINE RHINOTRACHEITIS, MAREK'S DISEASE, AND BURKITT'S LYMPHOMA. (E.)

Evans, D. L. (M.D. Anderson Hosp. Tumor Inst., Houston, Texas), J. W. Barnett, J. M. Bowen and L. Dmochowski. *J Virol* 10(2):277-287, 1972.

Common herpesvirus (HV) antigens in infectious bovine rhinotracheitis (IBR), Marek's disease (MDV), and Burkitt's lymphoma (EBV) were found. Immunodiffusion tests in 0.7% agarose demonstrated a line of identity with the HV preparations by using specific antisera prepared against IBR, MDV, and EBV. These common antigens were found to consist of multiple components: i.e., at least two MDV antigens were identical to IBR and EBV components when subjected to immunoelectrophoresis in 0.7% agarose. Indirect immunofluorescence testing of EBV strain P₃HR-1 and IBR-infected embryonic bovine kidney cells, when antisera prepared against partially purified IBR, MDV, and EBV antigens, revealed identical activity of the three antisera as demonstrated by brilliant nuclear fluorescence in P₃HR-1 cells and evenly distributed cytoplasmic activity in 18-hr IBR-infected bovine kidney cell cultures. Initial physical-chemical studies of the partially purified antigens were carried out by differential centrifugation cycles (6,000, 25,000 and 100,000 X g), rate zonal centrifugation in 5 to 20% sucrose density gradients, and analysis by disc electrophoresis in 5 and 7% polyacrylamide gels. These studies revealed similar molecular weight (>1,000,000) and size characteristics and similar electrophoretic mobilities among the three partially purified HV antigens.

4612 COUNTERACTION OF THE BLOCKING OF CELL-MEDIATED TUMOR IMMUNITY BY INOCULATION OF UNBLOCKING SERA AND SPLENECTOMY: IMMUNOTHERAPEUTIC EFFECTS ON PRIMARY POLYOMA TUMORS IN RATS. (E.) Bansal, S. C. (Fred Hutchinson Cancer Res. Ctr., Seattle, Wash.) and H. O. Sjögren. *Int J Cancer* 9(3):490-509, 1972.

Polyoma virus-induced sarcoma cells were inoculated s.c. into rats two to eight days before injection of an "unblocking" serum prepared by i.p. inoculation of rats with *Bacillus Calmette-Guérin* and later challenge with polyoma tumor cells. The effect of unblocking serum on the antibody-associated blocking activity of sera from tumor-bearing rats was studied by observing the cytotoxicity of lymphocytes for tumor cells; blocking serum from tumor-bearing rats ordinarily depresses the cytotoxic response of circulating lymphocytes against tumor cells. Four of five rats given polyoma tumor cells and unblocking sera failed to develop detectable levels of serum blocking; tumor isografts in these rats grew progressively for 2 wk, then regressed completely. In a second experiment, kidney sarcomas were induced by polyoma virus inoculation; tumor-bearing rats were splenectomized and then treated with unblocking serum. Blocking activity of sera from tumor-bearing splenectomized rats decreased or disappeared as a result of treatment with unblocking sera. In related experiments, splenectomized, kidney polyoma tumor-bearing rats

were injected with unblocking serum or with normal rat serum. Serum blocking activity decreased in rats given unblocking serum but not in rats given normal serum. Sera of rats given no treatment or treated with normal sera had no cytotoxicity for polyoma tumor cells, but serum from rats given unblocking serum did show cytotoxicity. Kidney tumors in rats not given unblocking serum grew rapidly while tumor growth rate was considerably slower in five of eight rats given unblocking serum. In addition, the survival time of nine of 11 rats given unblocking serum was significantly prolonged relative to the survival time in rats not given unblocking serum.

4613 DIFFERENCES IN THE BINDING OF FLUORESCENT CONCAVALIN A TO THE SURFACE MEMBRANE OF NORMAL AND TRANSFORMED CELLS. (E.) Shoham J. (Weizmann Inst. Sci., Rehovot, Israel) and L. Sachs. *Proc Nat Acad Sci USA* 69(9):2479-2482, 1972.

The binding of fluorescein-conjugated Concanavalin A to the cell surface has been studied in normal and transformed cells in interphase and mitosis. Binding to the cell surface was in the form of an incomplete ring of fluorescence, and the binding was inhibited by α -methyl-D-mannopyranoside. All the cells were fluorescent when treated with 25-250 μ g/ml of fluorescent Concanavalin A. With 10 μ g, the cells were all fluorescent after 30 min of binding, but after 0.5-5 min with 10 μ g or 30 min with 1 or 2.5 μ g, transformed interphase cells showed a higher percentage of cells with surface fluorescence than did normal interphase cells. Trypsinized normal and transformed interphase cells showed the same fluorescence. Binding with 2.5 μ g at 4 C instead of at 24 C, gave a higher percentage of fluorescent cells with trypsinized than with untrypsinized transformed cells. Mitotic normal cells were similar to transformed interphase cells, whereas mitotic transformed cells were intermediate between normal and transformed interphase cells. The results indicate that the use of low concentrations of fluorescent Concanavalin A can show differences in surface fluorescence between normal and transformed, interphase and mitotic, and trypsinized and untrypsinized cells. It is suggested that the observed differences in fluorescence can be explained by differences in affinity of the lectin binding sites and/or differences in the clustering of sites.

4614 MEMBRANE IMMUNOFLOURESCENCE STUDIES ON CELLS PRODUCING RAT C-TYPE VIRUS PARTICLES. (E.) Pearson, G. (Natl. Cancer Inst., Bethesda, Md.), T. Orr, L. Redmon and V. Bergs. *Int J Cancer* 10:14-19, 1972.

Cells of the WF-1 rat line, a spontaneously transformed line which originated from embryos of W/Fu inbred rats and produced large amounts of rat C-type virus, were treated with antisera prepared by inoculating W/Fu rats with WF-1 cells. Membrane immunofluorescence was used to detect anti-WF-1

antibodies. Antisera gave positive reactions with 20-35% of WF-1 cells but did not react with normal embryonic W/Fu fibroblasts. Anti-WF-1 sera also reacted with R-35 and RMTL-8 cells, virus producing cell lines derived from rat mammary tumors. Anti-WF-1 sera did not react with nonvirus producing cell lines, and absorption of pooled reactive sera with normal W/Fu cells failed to remove antibodies against WF-1 cells.

- 4615 CELL-SPECIFIC ANTIGENS AND IMMUNOGLOBULIN SYNTHESIS OF MURINE MYELOMA CELLS AND THEIR VARIANTS. (E.) Hyman, R. (Salk Inst. Biol. Stud. San Diego, Calif.), P. Ralph and S. Sarkar. *J Nat Cancer Inst* 48 (1):173-184, 1972.

Immunoglobulin synthesis and secretion, surface antigens, and murine leukemia virus (MuLV) group-specific (gs) antigens were studied in seven myeloma tissue cultures from BALB/c (six lines) and C3H (one line) mouse tumors, and in nine variants of these myeloma cell lines. The amount of IgG secreted by myeloma cells relative to total protein synthesis was similar in all seven lines. For myelomas secreting IgG, the ratio of radioactivity in secreted L and H chain IgG was approximately 2; in two myelomas secreting IgA, an excess of H chains was secreted. Plasma cell surface antigens and histocompatibility antigen $H-2^d$ were present in BALB/c myelomas; $H-2^k$ was seen in the C3H myeloma line. Gross leukemia virus antigens were determined in myeloma lines with both mouse and rat anti-Gross virus antisera. All but one myeloma line showed MuLV gs antigen. Among myeloma cell line variants, those which did not synthesize immunoglobulins showed greatly reduced amounts of histocompatibility antigens and Gross virus antigens; variants not synthesizing immunoglobulins also lacked detectable plasma cell-specific antigens.

- 4616 CELLULAR IMMUNOABSORBENTS IN TRANSPLANTATION IMMUNITY: SPECIFIC *IN VITRO* DELETION AND RECOVERY OF MOUSE LYMPHOID CELLS SENSITIZED AGAINST ALLOGENEIC TUMORS. (E.) Berke, G. (Harvard Med. Sch., Boston, Mass.) and R. H. Levey. *J Exp Med* 135(4):972-984, 1972.

Mice of various strains were immunized against allogeneic tumors by i.p. injection of tumor cells; the tumors were the spindle-shaped sarcoma (SaI) of the A/J mouse, the EL4 leukosis of the C57BL/6 mouse, and the P815 mastocytoma of the DBA/2 mouse. Spleen cells were collected from innune mice and the lysis of tumor target cells *in vitro* by spleen cells was observed by measuring ^{51}Cr release from labeled target tumor cells. Degree of lysis of tumor cells by immune spleen cells was specific for each tumor; when labeled tumor cells were incubated with normal spleen cells, lysis was not increased over that of tumor cells not mixed with any spleen cells. The lytic capacity of sensitized spleen cells previously incubated on mouse embryo fibroblast monolayers and then removed was studied. BALB/c anti-EL4 spleen cells

incubated on C57BL/6 embryo monolayers (syngeneic with EL4) were only slightly cytotoxic to EL4 tumor cells; BALB/c anti-EL4 spleen cells not incubated with mouse monolayer were fully cytotoxic to the tumor cells. BALB/c anti-EL4 spleen cells incubated with fibroblasts from other mouse strains showed unimpaired cytotoxicity for EL4 cells. Similar results were obtained with C57BL/6 anti-SaI spleen cells and C57BL/6 anti-P815 spleen cells. Upon incubation of cytotoxic spleen cells with specific mouse embryo fibroblasts, specifically sensitized cytotoxic cells were selectively absorbed onto monolayers and remained adherent after other spleen cells were removed. Adherent cytotoxic cells could be removed from monolayers by trypsinization and separation on discontinuous albumin gradient. These recovered cells were cytolytic for tumor cells. Sensitized spleen cells neutralized tumor growth *in vivo* when injected into mice; tumor growth-inhibiting capacity of spleen cells was depleted by incubation of spleen cells on mouse embryo fibroblast monolayers. Cytolytic spleen cells recovered from such monolayers retained their ability to inhibit tumor growth *in vivo*.

- 4617 ANTIBODIES PRODUCED BY IMMUNIZATION OF GOATS WITH 40S RIBOSOMAL SUBUNITS FROM NOVIKOFF HEPATOMA ASCITES CELLS. (E.) Busch, R. K. (Baylor Coll. Med., Houston, Texas), W. H. Spohn, Y. Daskal and H. Busch. *Proc Soc Exp Biol Med* 140(3):1030-1033, 1972.

The 40S and 60S ribosomal subunits were separated from the Novikoff ascites hepatoma by sucrose gradient centrifugation; antisera against these subunits were prepared by inoculation of goats. Goat sera from animals inoculated with 40S subunits produced marked agglutination when mixed *in vitro* with Novikoff ascites hepatoma target cells. Antisera to 60S subunits also agglutinated Novikoff target cells. Antisera to 60S subunits agglutinated Walker tumor ascites cells, but antiserum to 40S subunits did not. Both 40S and 60S subunit antisera gave positive immunofluorescence reactions with Novikoff cells. When mixed with Novikoff cells and inoculated i.p. into rats, antisera to 40S subunits delayed tumor growth more than antisera to 60S subunits. However, combined anti-40S and -60S sera suppressed tumor growth more effectively than either antiserum alone.

- 4618 AUTOGENOUS IMMUNITY TO ENDOGENOUS RNA TUMOR VIRUS ANTIGENS IN MICE WITH A LOW NATURAL INCIDENCE OF LYMPHOMA. (E.) Hanna, M. G., Jr. (Oak Ridge Natl. Lab., Tennessee), R. W. Tennant, J. M. Yukas, N. K. Clapp, B. L. Batzing and M. J. Snodgrass. *Cancer Res* 32(10):2226-2234, 1972.

The immune reactivity to endogenous (wild-type) RNA tumor virus-related antigen(s) was evaluated in RF mice, a strain with a low natural incidence of lymphoma. The purposes were to determine whether maintained humoral immunity could be detected and to evaluate the response with respect to the immune-

mediated pathogenesis of glomerulosclerosis and incidence of tumors of lymphatic origin. Measurements of detectable murine leukemia virus antigen in the thymus and spleen were correlated with the development of immune competence, glomerulosclerosis, and the incidence of lymphoid neoplasia. Also, the specificity of the antibody that lodged in the kidney was determined by elution and indirect immunofluorescence with Gross virus-infected cells. A marked decrease in detectable murine leukemia virus antigen in thymus and spleen was found to correlate with development of immunological competence of the spleen as assayed by *de novo* germinal-center formation, antigen localization, and immune elimination from serum, which in turn correlated with occurrence of glomerulosclerosis. The antibody in the kidney was determined to be specific for Gross virus antigen(s). The role of this autogenous immunity may be considered to be beneficial in the RF mouse, as data correlating natural lymphoid neoplasia with severity of immune-complex glomerulosclerosis indicates that an inverse relationship is established in aged animals.

- 4619 CELL-MEDIATED TUMOR IMMUNITY MEASURED *IN VITRO* AND *IN VIVO* WITH SOLUBLE TUMOR-SPECIFIC ANTIGENS. (E.) Meltzer, M. S. (Natl. Cancer Inst., Bethesda, Md.), J. J. Oppenheim, B. H. Littman, E. J. Leonard and H. J. Rapp. *J Nat Cancer Inst* 49(3):727-734, 1972.

Tumor-specific cellular immunity to lines of diethylnitrosamine-induced guinea pig hepatomas was demonstrated *in vitro* by macrophage migration inhibition and lymphocyte transformation, with water-soluble tumor antigens as the eliciting immunogens. Antigens from the ascites form of line-1 and line-10 tumors were extracted with 3 M KCl and partially purified by ammonium sulfate precipitation. Peritoneal exudate cells from strain-2 guinea pigs immune to one or the other of the tumor cell lines were used for the *in vitro* studies; a lymphocyte-rich subpopulation was used for lymphocyte transformation. Cellular responses to the solubilized tumor antigens were tumor line specific and dose dependent in both lymphocyte transformation and macrophage migration inhibition assays.

- 4620 ANTIGENIC CHANGES ON THE SURFACE OF LYMPHOCYTES FROM PATIENTS WITH CHRONIC LYMPHOCYTIC LEUKEMIA. (E.) Bentwich, Z. (Hebrew U.-Hadassah Med. Sch., Jerusalem, Israel), D. W. Weiss, D. Sulitzeanu, E. Kedar, G. Izak, I. Cohen and O. Eyal. *Cancer Res* 32:1375-1383, 1972.

Rabbit antisera were prepared against white blood cells (WBC) from blood of patients with chronic lymphocytic leukemia (CLL) and against normal human lymphocytes. The cytotoxicity of these antisera against CLL WBC, normal WBC, lymphocytes from patients with nonleukemia neoplastic or nonneoplastic conditions, and lymphocytes of normal new-

borns was observed. After absorption with normal adult WBC, antisera showed marked cytotoxic activity against all CLL WBC target cells and against some newborn lymphocytes; no activity against the other target cells was seen. Differences in cytotoxic activity of absorbed anti-CLL WBC sera for normal lymphocytes and CLL WBC apparently reflected differences inherent in normal and leukemic cell surfaces rather than absorption of serum proteins onto leukemia cell surfaces.

- 4621 IMMUNE RESPONSE TO GROSS VIRUS-INDUCED LYMPHOMA. III. CHARACTERISTICS OF THE CELLULAR IMMUNE RESPONSE. (E.) de Landazuri, M. O. (Natl. Cancer Inst., Bethesda, Md.) and R. B. Herberman. *J Nat Cancer Inst* 49(1):147-154, 1972.

W/Fu rats were inoculated s.c. with 10^8 cells of a W/Fu rat transplantable, Gross virus-induced lymphoma and studied for the development of cellular immunity. Spleens, regional and distal lymph nodes, thymuses, peripheral blood, bone marrow and peritoneal cells were collected from immunized rats and mixed with ^{51}Cr -labeled lymphoma target cells to investigate cellular cytotoxicity induced in these lymphoid cell populations. Cellular immunity, assayed as lysis of target cells by lymphoid cells, was first detected in regional lymph node cells four days after immunization. Cytotoxicity developed later in peripheral blood lymphocytes, spleen cells and peritoneal cells. Distal lymph nodes, thymus and bone marrow cells showed little or no cytotoxicity. Reactive cells reached peak cytotoxicity levels 6-14 days after immunization; cytotoxicity declined rapidly thereafter. Comparison of the activity of lymphoid cell populations at attacker: target cell ratios from 200:1 to 10:1 showed that blood lymphocytes were the most reactive at high ratios and also the most effective at low ratios. Purification of lymphoid cells increased cytotoxic effects, but the differences in reactivity among different lymphoid cell populations could not be entirely explained by the percent of lymphocytes in preparations. Cytotoxic immune lymphoid cells retained their cytotoxicity after 4000 R of X-irradiation.

- 4622 DETECTION OF HUMAN LEUKAEMIA ASSOCIATED ANTIGENS IN LEUKAEMIC SERUM AND NORMAL EMBRYOS. (E.) Harris, R. (Roy. Infirm., Manchester, England), D. Viza, R. Todd, J. Phillips, R. Sugar, R. F. Jennison, G. Marriott and M. H. Gleeson. *Nature* 233(5321):556-557, 1971.

A double diffusion technique (DD) and crossover electrophoresis (COE) were used to detect leukemia-associated antigens (LAA) in sera from 50 leukemic patients. With a suitably absorbed xenogenic antiserum, FXP prepared against material extracted from acute myeloblastic leukemia cells, circulating LAA were observed in sera from about one-third of the patients. Positive reactions were obtained with 15 of 50 patients' sera tested by the COE technique

and with two of 50 specimens tested by the DD method. Five of six fetal sera were positive by both methods. Negative results were obtained with all 22 sera samples from healthy volunteers. Common oncogenic viruses may be involved in producing LAA, and hitherto unsuspected etiological heterogeneity may exist within the framework of current histological classification. More sensitive techniques and stronger antisera now being investigated may detect a larger number of positive reactions. It is not yet clear to what extent quantitative and qualitative phenomena are involved.

4623 CELLULAR REACTIONS AGAINST BURKITT LYMPHOMA CELLS. II. EFFECTOR CELLS OBTAINED BY ALLOGENEIC STIMULATION IN MIXED LEUKOCYTE CULTURES. (E.) Golub, S. H. (Karolinska Inst., Stockholm, Sweden), J. F. Hewetson, E. A. J. Svedmyr and S. Singh. *Int J Cancer* 10:150-156, 1972.

Peripheral blood leukocytes from healthy humans were stimulated by incubation with Burkitt lymphoma cells or allogeneic human leukocytes; the ratio of healthy leukocytes to stimulator lymphoid cells was 2:1. Cells surviving incubation with stimulator lymphoid cells were tested for effector cell activity. Potential effector cells were incubated with the Burkitt lymphoma cells used for stimulation or with other cells, and colony inhibition (CI) in these incubation mixtures was observed. Optimal effector cell activity against the Burkitt lymphoma cells used to stimulate effector cells was obtained when leukocytes were incubated with stimulator cells for 4-7 days. When effector:target cell ratios were relatively low (e.g., 10:1 as opposed to 100:1) CI activity was largely specific for target cells of the same lines used to stimulate effector cells. When normal leukocytes were stimulated with non-Burkitt lymphoma leukocytes, CI activity of resulting effector cells was strongly restricted to target cells of the same lines used for stimulation. Stimulation with Burkitt lymphoma cells, on the other hand, produced effector cells having CI activity which was cross-reactive with other Burkitt lymphoma cells.

4624 IMMUNOLOGICAL STUDY OF POLYPS OF THE COLON. (E.) Burtin, P. (Inst. Res. Cancer, Villejuif, France), E. Martin, M. C. Sabine and J. von Kleist. *J Nat Cancer Inst* 48(1):25-32, 1972.

Indirect immunofluorescence reactions with rabbit antisera against normal human colonic mucosa, cytoplasmic antigen, plasma membrane antigen and gastrointestinal cancer carcinoembryonic antigen (CEA) were performed against samples of 25 colonic polyps. Some polyps were polyposis- or colon cancer-associated, others were solitary and not associated with cancer. Polyps were classified into three groups according to their degree of differentiation. In immunofluorescence tests, normal cytoplasmic antigen reactions were strongly reduced

or absent in some polyps, but were at nearly normal levels in others. Cytoplasmic antigen fluorescence was reduced mainly in relatively undifferentiated polyps. Membrane fluorescence corresponding to the colonic membrane antigen was decreased or lacking in tested polyps. CEA reactions were seen in all polyps but were stronger in well-differentiated polyps than in undifferentiated polyps. A precipitation reaction was also seen between a monospecific anti-CEA antiserum and the perchloric extract of a pool of benign polyps. CEA was not seen in tests with normal colonic mucosa but was seen in hemorrhoidal mucosa samples and in samples of other noncancerous mucosa.

4625 ABSENCE OF CIRCULATING ANTIBODIES TO CARCINOEMBRYONIC ANTIGEN IN PATIENTS WITH GASTROINTESTINAL MALIGNANCIES. (E.) Lo Gerfo, P. (Coll. Phys. Surg., Columbia U. New York, N.Y.), F. P. Herter and S. J. Bennett. *Int J Cancer* 9(2):344-348, 1972.

In an attempt to demonstrate patient antibody activity against carcinoembryonic antigen (CEA), antigen-antibody complexes were labeled with ^{125}I and absorbed with zirconyl phosphate gel (Z-gel). The 265 subjects tested included 110 with nonmetastatic colon carcinoma, 122 with other gastrointestinal, breast and pulmonary neoplasms, 20 pregnant women, and 13 healthy volunteers. Sera from 25 of the subjects were also analyzed by Sepharose 6 B column chromatography. Antibody activity directed against CEA could not be detected with either technique. The possibility that CEA-anti-CEA complexes exist and prevent the detection of free antibodies cannot be ruled out, though this situation is reported to occur only in patients with metastatic carcinoma. It is also possible that the specific site of the human antibodies was destroyed during the labeling procedure.

4626 EARLY APPEARANCE OF SERUM α -FETOPROTEIN DURING HEPATOCARCINOGENESIS AS A FUNCTION OF AGE OF RATS AND EXTENT OF TREATMENT WITH 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE. (E.) Kroes, R. (Natl. Cancer Inst., Bethesda, Md.), G. M. Williams and J. H. Weisburger. *Cancer Res* 32:1526-1532, 1972.

Male rats (aged 6-12 weeks, 9 or 15 months) were fed a diet supplemented with 0.06% 3'-methyl-4-dimethylaminoazobenzene (3'-MDAB) for 5, 10 or 20 weeks. Beginning at week 3 of 3'-MDAB feeding, rats were bled and serum was separated and assayed for α -fetoprotein (AFP). Sera from all animals contained AFP by week 3 and remained AFP-positive during 3'-MDAB feeding. When 3'-MDAB was stopped after 5 or 10 weeks, sera remained positive for another 1 or 2 weeks before becoming negative. Sera of rats given 3'-MDAB for only 5 weeks remained AFP-negative for 30 weeks after carcinogen feeding. In some rats fed 3'-MDAB for 10 weeks, sera became AFP-negative by week 13 and 14, after which it

gradually returned to AFP-positive. Serum remained positive without relapse for 19 weeks in one rat given 3'-MDAB for ten wks; this rat had developed a large liver tumor. Age did not affect appearance of AFP, although older rats showed positive serum AFP only at week 4 of the 3'-MDAB diet, a week later than younger rats. Older rats remained AFP-negative after 3'-MDAB feeding longer than younger rats.

4627 RADIOIMMUNOASSAY OF ALPHA-FETOPROTEIN IN PRIMARY AND SECONDARY CANCER OF THE LIVER.

(E.) Ruoslahti, E. (Dept. Serology Bacteriol., U. Helsinki, Finland), M. Seppälä, P. Vuopio, E. Saksela and P. Peltokallio. *J Nat Cancer Inst* 49(3):623-630, 1972.

The serum alpha-fetoprotein (AFP) concentration was determined by radioimmunoassay in 14 primary liver cancers and 17 secondary liver cancers. With this method, unlike any previous one, AFP could be quantitated in all the samples. The AFP levels in 10 of the 14 patients (71%) were one thousand times or more (3.5-840 µg/ml) above the normal serum level. Two sera had intermediate values (100 and 200 ng/ml) and two had normal AFP concentrations (9 and 16 ng/ml). A normal AFP level thus does not exclude the possibility of primary liver cancer. No correlation was found between the AFP level and the degree of malignancy of the tumor. Of the 17 patients with secondary liver cancer, three had an AFP concentration above the normal range. In these, the elevation was moderate, ranging from 60-400 ng/ml.

4628 IMMUNOLOGIC INDUCTION OF MALIGNANT LYMPHOMA: GENETIC FACTORS IN THE GRAFT-VERSUS-HOST MODEL. (E.) Gleichmann, E. (New England Med. Ctr. Hosp., Boston, Mass.), H. Gleichmann and R. S. Schwartz. *J Nat Cancer Inst* 49(3):793-804, 1972.

The development of malignant lymphomas was studied in 47 different donor-recipient pairs undergoing a chronic graft-versus-host reaction, which was induced in F₁ hybrid mice by the injection of parental spleen cells. None of the H-2 compatible combinations developed lymphomas. The development of neoplasms in H-2 incompatible pairs was inhibited by maneuvers designed to diminish the immunologic response of the graft against the host. Whether lymphomas developed in a given donor-recipient pair appeared to depend on: a) a major antigenic (H-2) difference between donor and recipient; b) the inherent (genetic?) ability of the donor's immunocytes to respond to the recipient's antigens; and c) a factor in the recipient, which probably determines susceptibility to oncogenic viruses.

4629 TUMORIGENICITY AND ISOIMMUNIZING PROPERTIES OF C3H MOUSE CELLS UNDERGOING "SPONTANEOUS" MALIGNANT CONVERSION *IN VITRO*. (E.) Kieler, J.

(Fibiger Lab., Copenhagen, Denmark), C. Radzikowski, J. Moore and K. Ulrich. *J Nat Cancer Inst* 48(2): 393-405, 1972.

Three C3H mouse cell lines, derived from embryo, spleen and lung, showed spontaneous malignant transformation *in vitro*. Cells of these transformed lines were injected into C3H and other mice to test for tumorigenicity and to determine whether such injections immunized against transplants of the same cells. The cytotoxicity *in vitro* of sera and lymphoid cells from mice injected with transformed cells was also observed. Transformed cells were tumorigenic; newborn mice were more susceptible than adults. Transformed cells developed isoimmunizing properties, as evidenced by *in vivo* transplantation immunity tests and by *in vitro* cytotoxicity tests with sera and lymphoid cells. Earle's L-929 mouse fibroblasts, the three cell lines which transformed spontaneously plus another such line, and four tumors derived from these cell cultures induced immune cross-reactions in C3H mice in transplantation experiments. Cross-reactions were also seen between the three principal cell lines studied and their corresponding antisera *in vitro*. There was no evidence that the development of common antigenic properties was due to murine leukemia virus, mammary tumor virus, or mycoplasma. Tumors derived from the three cell lines were transplantable into allogeneic hosts, even when hosts were immunized with normal C3H cells, indicating that the appearance of "tumor-associated" isoantigens was followed by the loss or dilution of normal H-2 antigens.

4630 ANTIBODIES TO EPSTEIN-BARR VIRUS (EBV) IN AMERICAN PATIENTS WITH BURKITT'S LYMPHOMA. (E.) Levine, P. H. (Natl. Cancer Inst., Bethesda, Md.), G. T. O'Connor and C. W. Berard. *Cancer* 30(3):610-615, 1972.

Twenty-nine American patients with lymphomas histologically indistinguishable from African Burkitt's lymphoma were studied for antibody to the EBV. Antibody titers were higher in the American Burkitt patients than age-matched normal controls or patients with acute lymphocytic leukemia (ALL), but they were not as high as the African Burkitt patients. All cases with typical histologic features and adequate pathologic material (including imprints) were positive for antibody to EBV. The young American Burkitt patients (less than 8 yr old) had particularly high titers with a geometric mean titer of 1:425 compared to 1:11 for the matched ALL group and 1:4 for the normal controls. These studies indicate that American Burkitt patients, like those in Africa, have elevated EBV antibody levels and provide another similar parameter suggesting that American and African Burkitt's lymphoma are the same disease.

4631 GROUP- AND TYPE-SPECIFIC ANTIGENS IN MOUSE LEUKAEMIA INDUCED BY FRIEND, MAZURENKO

D RAUSCHER VIRUSES. (E.) Mazurenko, N. P. (Acad. d. Sci., Moscow, USSR) and V. E. Gurtsevich. *oplasma* 19(4):277-282, 1972.

Leukemias of different morphological types were induced in CC57Br mice by i.p. injections of zurenko, Friend of Rauscher virus preparations. Tumor-specific antigen (GSA) in organs of leukemic mice was determined by microprecipitation in agar using rabbit antisera and type-specific antigen (TSA) by immunofluorescence. GSA was found in liver, spleen, thymus, lymph nodes, lungs, kidneys and plasma of all mice with virus-induced leukemias, regardless of the morphological form those leukemias took. No GSA was found in cardiac muscle or brain tissue. TSA was found in spleen, thymus and lymph nodes of all leukemic mice. GSA first appeared in Friend virus-infected mouse plasma on day 8 postinfection; TSA was first observed in spleen and bone marrow of these mice on the 7-8 days postinfection. Plasma GSA and spleen TSA appeared simultaneously on day 7 in mice infected with Rauscher virus.

32 GIANT FOLLICULAR LYMPHOCYTOMA OF THE SPLEEN: STUDY ON IMMUNOGLOBULIN FORMATION AND DISPERBANCE IN IT CAUSED BY NEOPLASMS. (Ger.) Ott, H. (Klinik Hosp., Stuttgart, West Germany). *Med Welt* (50):1996-1997, 1971.

Structural changes in the spleen of a 65-year-old man with Brill-Symmers disease are described. Splenectomy caused no change in serum proteins and the immunoglobulin levels remained within normal limits. The conditions under which malignant follicular lymphomas would cause a deficiency in the humoral immune system are discussed. The presence of germinal centers (germinocytes and germinoblasts) as controlling factors for follicular structure is stressed and the question is raised whether the absence of germinocytes and germinoblasts, which are responsible for the development of plasma cells and gammaglobulin, will cause hypo- and agammaglobulinemia. It is stressed that localized follicular lymphoma frequently changes to lymphatic leukemia, which is accompanied by a decrease in gammaglobulins. It is also postulated that in cases of acquired agammaglobulinemia, which is accompanied by a hypertrophy of germinal centers and lymphoid tissue, a blocking of plasma cells and immunoglobulins occurs in the thymus-independent immune system.

3 RESPONSE OF SYNGENEIC MURINE LYMPHOMATA TO IMMUNOTHERAPY IN RELATION TO THE ANTIGENICITY OF THE TUMOUR. (E.) Parr, I. (Chester Beatty Res. Inst., Surry, England). *Brit J Cancer* 26(3):181-182, 1972.

Responses of four murine lymphomata, transplanted to their syngeneic hosts and differing widely in their biological properties such as tendency to metastasize and "strength" of tumor specific antigen, to immuno-

therapy, were investigated. Following the injection of a known number of tumor cells, the mice were treated either by administration of irradiated tumor cells, living BCG or both. In general, the response to BCG alone was small even in the most responsive tumors, irradiated cells were more effective and the best results were obtained by a combination of the two procedures. "Cures" were only obtained with the most antigenic of the tumors tested and then only when the live tumor cells were inoculated i.p. The effect of these treatments on the rate of growth of tumor when the cells were given s.c. was small but the rate at which metastatic spread occurred from the s.c. site was slowed and for one of these tumors this was quite marked.

4634 LUNG CARCINOMA OF SHEEP (JAAGSIEKTE). III. LYMPH NODE, BLOOD, AND IMMUNOGLOBULIN. (E.) Hod, I. (Hebrew U., Rehovot, Israel), K. Perk, T. A. Nobel and U. Klopfer. *J Nat Cancer Inst* 48(2):487-507, 1972.

Tumor, lymph nodes and serum samples from 12 adult sheep with pulmonary carcinoma (jaagsiekte) were examined chemically and under the electron microscope. Normal lymph node architecture in sheep with jaagsiekte was deranged; lymphocyte depletion was marked (especially in mediastinal nodes), germinocytes were depleted, and plasmacytosis was seen as was reticulocytosis. In electrophoretic studies of serum proteins of sheep with jaagsiekte, a rise in β_1 and in total γ globulin fractions was seen, accompanying a rise in total proteins. Fast-moving serum lipoproteins were decreased in tumor-bearing sheep, while slow-moving lipoproteins were increased. Ultracentrifuge and immunoelectrophoretic studies suggested that the hyperglobulinemia in jaagsiekte sheep occurred mainly in the 7S IgG fraction. In immunofluorescence tests, few tumor cells reacted positively against normal sheep sera and sera from tumor-bearing sheep. Even fewer tumor cells reacted positively against fluorescein isothiocyanate-tagged antisheep globulin anti-serum applied directly to tumor cells. In gel diffusion tests, precipitation lines between sheep sera and tumor cell extracts were not seen.

4635 IDENTITY OF THE SOLUBLE EVB-ASSOCIATED ANTIGENS OF HUMAN LYMPHOID CELL LINES. (E.) Reedman, B. M. (Queensland Inst. Med. Res., Brisbane, Australia), J. H. Pope and D. J. Moss. *Int J Cancer* 9(1):172-181, 1972.

Lymphoid cell lines from patients with acute myeloid leukemia (QIMR-WIL), Burkitt lymphoma (QIMR-GOR and Raji), infectious mononucleosis (QIMR-STE) and thymus cells transformed by Epstein-Barr virus (EBV) (TFT-1) were reacted in immunodiffusion (ID) tests against human sera from different sources. All lymphoid cell lines except Raji contained EBV. Two precipitation lines, S and F, were seen in ID tests of QIMR-WIL cells. With soluble antigen, the S line occurred but not the F line. Gamma globulin produced both lines

when tested against the QIMR-WIL cells; this suggested that the two lines were due to antigen-antibody reactions. The S line, which was produced with soluble antigens from TFT-1, Raji, QIMR-STE and QIMR-GOR as well as QIMR-WIL cells, appeared to be associated with EBV. Furthermore, the capacity of soluble antigens to produce the S line was related to the complement fixing (CF) activity of the antigen. Crude antigens prepared from HeLa cells, fetal thymus fibroblasts and melanoma cells gave weak reactions with some sera but were not identical to the S line. Ninety-five percent of sera negative in immunofluorescence (IF) tests with QIMR-WIL antigen were also negative in CF tests. The S line reaction was rare in sera lacking IF and CF antibody, but the F line reaction was common in such sera. The CF and ID antigens were thought to be at least partially identical. When QIMR-WIL antigen was fractionated and reacted against five sera, the distribution and concentration of the antigen responsible for the S line reaction was similar to that of a heat-resistant soluble CF antigen.

- 4636 EFFECT OF IMMUNOSUPPRESSION OF THE DEVELOPMENT OF THE ADJUVANT-INDUCED GRANULOMA IN MICE. (E.) Krueger, G. R. F. (Natl. Cancer Inst., Bethesda, Md.). *Path Microbiol* 37(6):436-448, 1971.

Female C₃H/HeN, BALB/c, C57Bl and Swiss mice were sensitized with complete Freund's adjuvant (CFA) and immunosuppressed with thymectomy, azathioprine or antilymphocyte serum (ALS). The development of granulomas following sensitization was studied and correlated with cutaneous delayed hypersensitivity. Only slight differences between mouse strains were observed. Thymectomy caused a significant decrease in lymphocytes and foamy phagocytes at the site of inflammation. Granulocytes and activated mesenchymal cells predominated. Cellular response at a second site of sensitization was the same. Lymphocyte reduction was less marked following azathioprine treatment, especially after a second sensitization. Lymphoid cells and small basophilic reticulum cells predominated. ALS treatment produced a moderate to marked depression of lymphocyte infiltration in both the first and second CFA sensitizations. Plasmacytoid cells increased after the second sensitization. All the immunosuppressive treatments caused a reduction in the number of draining lymph nodes in small lymphocytes. Secondary follicles increased in thymectomized mice, decreased in azathioprine-treated mice and were unchanged in ALS-treated mice. Medullary cord plasma cells were numerous in thymectomized mice, decreased in azathioprine-treated mice and absent in ALS-treated mice. The incidence of immature plasmacytes was inversely proportional to the number of medullary cord plasma cells. Thymectomy and ALS had the greatest effects on delayed hypersensitivity; azathioprine produced a less specific cellular response. Immunosuppression did not increase dissemination of granulomatous lesions.

- 4637 STUDIES OF CARCINO-FETAL PROTEINS. III. DEVELOPMENT OF A RADIOIMMUNOASSAY FOR α -FETOPROTEIN. DEMONSTRATION OF α -FETOPROTEIN IN

SERUM OF HEALTHY HUMAN ADULTS. (E.) Ruoslahti, E. (U. Central Hosp., Helsinki, Finland) and M. Seppala. *Int J Cancer* 8:374-383, 1971.

A new radioimmunoassay for serum α -fetoprotein (α -FP) is described. α -FP was iodinated and ¹²⁵I-labeled α -FP was extracted and reacted with anti- α -FP antisera. Standard curves for the inhibition of binding of labeled α -FP by antibody were obtained and the inhibition of this activity by normal and hepatoma patients' sera was tested. The sensitivity limit of the radioimmunoassay was 250 pg of α -FP/ml serum, while that of the older immunodiffusion test for α -FP was 10 μ g α -FP/ml serum. Hepatoma sera were α -FP-positive in immunodiffusion at dilutions of 1:80; these sera were positive at dilutions of up to 1:200,000 in the new assay. The new assay completely covered the thousandfold concentration gap between α -FP levels in normal human serum and levels detectable by immunodiffusion. Evidence yielded by the radioimmunoassay for the presence of α -FP in normal human sera was as follows. Normal sera at dilutions of 1:5 inhibited the binding of labeled α -FP by antibody. This inhibition could be abolished by treating normal sera with anti- α -FP immunoadsorbent. Elution of these immunoadsorbents at pH 2.5 revealed that they had bound α -FP activity from normal sera. Finally, after fractionation of normal sera by electrofocusing the activity inhibiting the radioimmunoassay was present in a fraction having the isoelectric point of fetal α -FP.

- 4638 SOME ASPECTS OF THE IMMUNE DEFENSE AGAINST CANCER. II. *IN VITRO* STUDIES ON HUMAN TUMORS. (E.) Hellström, I. (U. Washington Med. Sch., Seattle) and K. E. Hellström. *Cancer* 28(5):1269-1271, 1971.

Studies of lymphocyte-mediated antitumor reactions in human subjects are summarized. Peripheral blood lymphocytes from patients with growing neuroblastomas inhibited cultivated neuroblastoma cells; inhibition occurred with both autochthonous cells and neuroblastic cells from other patients, indicating that neuroblastomas possess common tumor-associated antigens. Sera from the neuroblastoma patients blocked destruction of cultured neuroblastoma cells by immunologically active lymphocytes. Lymphocytes from patients with other types of tumors were able to destroy cultivated autochthonous tumor cells of the respective types. Morphologically similar tumors were found to cross react. Normal cells from the tumor patients were not destroyed by lymphocytes affecting the neoplastic cells, indicating antigenic differences between normal and tumor cells from the same patient. A correlation exists between progressive tumor growth *in vivo* and blocking serum activity *in vitro*; 67 of 81 patients with growing tumors had blocking sera, while sera from only three of 19 symptom-free patients were blocking. Sera from patients in remission were able to reverse blocking activity of sera from other patients with the same type tumor. Further experiments may determine the possibility of immunologic prevention of tumors.

- 639 STUDIES ON BLASTIC TRANSFORMATION OF LYMPHOCYTE CULTURES IN CHRONIC LYMPHOCYTIC LEUKEMIA. (Pol.) Pluzanska, A. (Acad. Med., Lodz, Poland), Kulesza, E. Krykowski, H. Koeppe and H. Jaworska. *Rad Lek* 24(21):2017-2022, 1971.

PHA-stimulated blastic transformation in 3- and 5-day-old lymphocyte cultures obtained from 35 patients with chronic lymphocytic leukemia (10 mild, group I; 16 moderately severe, group II; 9 severe, group III) was much lower (0-21.5%, mean 6.42%, on day 3; 2.2-29.5%, mean 9.5%, on day 5) than in cultures from 20 healthy controls (62-80%, mean 70.5%). There was no significant correlation with severity of disease (6.7%, 6.5% and 5.9% on day 3 in groups I, II and III, res.), although complete absence of transformed cells was seen more frequently in group III, and no correlation with treatment or alpha₂ or gamma globulin levels. There seemed to be a slight correlation between degree of depression and duration of disease (4.7% in those with > 3 years duration) and degree of leukocytosis (3% in those with > 100,000/mm³ as compared with 8.2% in those with < 10,000/mm³). It is suggested that blastic transformation in 3-day cultures has no prognostic value.

- 40 IMMUNOLOGICAL STUDY OF CEREBRAL TUMORS *IN VITRO*. (Fr.) Febvre, H. (Sainte-Anne Hosp. Paris, France), R. Maunoury and J. P. Constans. *Neuro-chirurgie* 17(3):203-207, 1971.

Immunological reactions of normal human embryonic liver and brain cells, human embryonic cells transformed *in vitro* by Rous sarcoma virus (RSV), cell lines from human glioblastomas and astrocytomas, and three lines of tumor cells of extracerebral origin were compared by immunofluorescence, mixed agglutination tests, and the delayed hypersensitivity test. Tumor cells isolated from primary brain tumors and human embryonic cells transformed by RSV displayed positive immunofluorescence reaction with human serum, while all normal human cell lines and lines derived from extracerebral tumors gave negative results. The results from mixed agglutination tests were the same. In patients who had undergone surgery for primary brain tumors and had been hyperimmunized with their own tumor, strong intradermal reactions were produced by antigens prepared from malignant glial tumors and embryonic cells transformed *in vitro* by RSV; antigens from extracerebral tumors gave weak reactions.

- 1 LYMPHOCYTE TRANSFORMATION IN IMMUNOPROLIFERATIVE DISORDERS. (E.) Catovsky, D. (Royal Brompton Med. Sch., London, England), P. J. L. Holt and D. A. G. Galton. *Brit J Cancer* 26(3):154-163, 1972.

Lymphocyte transformation with phytohemagglutinin (PHA) studied in 30 patients with immunoproliferative

disorders (lymphoproliferative and plasma cell disorders). Lymphocyte transformation at three days was reduced in the lymphoproliferative disorders (chronic lymphocytic leukemia (CLL), well-differentiated (lymphocytic) follicular lymphoma (FLL) and Waldenström's macroglobulinemia (WM)), and normal in the plasma cell disorders (myelomatosis, primary systemic amyloidosis, α-chain disease and benign monoclonal gammopathy) and in idiopathic cold hemagglutinin disease. A case of plasma-cell leukemia with increased numbers of abnormal cells in the circulation also showed reduced transformation. It is suggested that the presence in the circulation of abnormal lymphocytes (or plasma cells) accounts for the results in CLL and FLL, WM and plasma-cell leukemia. In WM a correlation was found between the activity of the disease (expressed by the levels of IgM paraprotein) and the degree of blast transformation. The long-term (28 days) *in vitro* survival of lymphocytes using subconcentrations of PHA was also studied in seven patients. The cell populations (PHA-non-responsive) of CLL and FLL, but not of WM, had a good *in vitro* survival, resembling in this respect the normal PHA-responsive population of lymphocytes, but they remained PHA-non-responsive after four weeks' culture. It is speculated that in CLL the long survival *in vitro* of the PHA-non-responsive (leukemic) population corresponds to their long life-span *in vivo*.

- 4642 EVOLUTION OF CELL-MEDIATED ANTITUMOR IMMUNITY IN MICE BEARING A SYNGENEIC CHEMICALLY INDUCED TUMOR: INFLUENCE OF TUMOR GROWTH, SURGICAL REMOVAL AND TREATMENT WITH IRRADIATED TUMOR CELLS. (E.) Belehradsky, J., Jr. (Gustave-Roussy Inst., Villejuif, France), G. Barski and M. Thonier. *Int J Cancer* 9:461-469, 1972.

Male C57BL/6 mice were given an immunizing injection s.c. of living cells of an undifferentiated, 3-methylcholanthrene-induced sarcoma (TBL CL2). Peritoneal cells (PC) were taken from immunized mice at various times after immunization and incubated with TBL CL2 cells; the inhibition of colony growth (CGI) *in vitro* by PC was observed. PC harvested seven days after inoculation of tumor cells showed strong CGI activity; the average number of colonies in TBL CL2 cultures was reduced 95% by these PC. No CGI was seen for PC taken 23 days after tumor inoculation. Mice entered an "eclipse" stage after an initial induction of immunological activity for their PC. This eclipse state lasted until mice were killed at day 60 after immunization. However, when TBL CL2-induced tumors were excised 39 days after tumor inoculation, CGI activity for PC was restored by 68-75 days after tumor resection. When mice whose tumors had been removed were given injections of X-irradiated TBL CL2 cells (9,000 R), CGI activity was restored by seven days after the injection of the irradiated cells. An *in vivo* study of tumor graft rejection showed a parallelism with CGI tests. Grafts were rejected in mice bearing TBL CL2 tumors for ten days and having immunologically active PC; grafts were not rejected in tumor-bearing mice whose PC were immunologically "eclipsed".

- 4643 IMMUNE REACTIVITY OF LEUKEMIA PATIENTS TO AUTOLOGOUS BLAST CELLS. (E.) Levanthal, B. G. (Natl. Cancer Inst., Bethesda, Md.), R. H. Halterman, E. B. Rosenberg and R. B. Herberman. *Cancer Res* 32:1820-1825, 1972.

Twenty patients with acute leukemia were studied by three assays, the mixed leukocyte culture, lymphocyte cytotoxicity assay, and skin tests, for evidence of immune reactivity against their own leukemic blast cells. All but one showed a positive response in at least one assay, with mixed leukocyte culture positive in 17 of 20, lymphocyte cytotoxicity assay positive in 8 of 16, and skin test positive in 13 of 18 patients at some point in the course of their disease. The skin test seemed to correlate with disease state. It was positive 14 of 18 times when performed in remission and only 3 of 8 times in relapse. Positive reactions in the mixed leukocyte culture tended to be most common 10 to 20 days after chemotherapy had been discontinued. The tests did not correlate well with one another. Presumably, they measure different phases of the immune response with differing sensitivity to such variables as chemotherapy. These studies indicate that immune reactivity of patients to their own leukemia cells does exist and can be assayed as an important new measure of the effect of therapy on the patient.

- 4644 SERUM α -FETOPROTEIN AS A BIOCHEMICAL MARKER FOR HEPATOCELLULAR CARCINOMA. (E.) McIntire, K. R. (Natl. Cancer Inst., Bethesda, Md.), C. L. Vogel, G. L. Princler and I. R. Patel. *Cancer Res* 32:1941-1946, 1972.

The demonstration of α -fetoprotein (α FP) has proven value in the diagnosis of hepatocellular carcinoma, but little is known of the dynamics of this protein during the course of the disease. A sensitive, quantitative test has been used to measure α FP serum levels in 90 Ugandan patients with histologically proven hepatocellular carcinoma. By the standard double diffusion immunological test, 71% of the patients were α FP positive. The quantitative values were spread over a wide range from 0.5 to 4000 μ g/ml, with a median value of 71 μ g/ml. Forty-one patients (26 before treatment and 15 during chemotherapy) were followed with serial serum α FP determinations. There was a remarkable stability in the level for each patient, which levels showed little fluctuation during the time they were followed, regardless of the initial level. The only consistent change was a slight tendency for the serum α FP to rise as the disease progressed. A striking difference was noted in four patients receiving partial hepatectomy who showed a rapid decline in serum α FP and became negative postoperatively.

- 4645 EFFECT OF HOST STRAIN AND H-2 TYPE ON SPONTANEOUS REGRESSION OF MURINE LEUKEMIA. (E.) Dietz, M. (Michigan Cancer Fdn., Detroit) and M. A. Rich. *Int J Cancer* 10:99-104, 1972.

Mice of 14 different strains, representing six different H-2 antigenic types, were inoculated i.p. with either of two Friend leukemia viruses, one of which induced leukemias which often regressed (RFV) and one of which was conventional (CFV). The leukemia incidence and the latent period of leukemia development were observed. For each mouse strain the responses to RFV and to CFV were similar in regard to latent period. Mice with the H-2^d and H-2^b alleles were most susceptible to CFV leukemogenesis; mice with the H-2^k and H-2^a alleles showed an intermediate susceptibility to CFV, and mice with the H-2^b allele were resistant. Leukemia regressed in ten of 12 mouse strains susceptible to RFV. Leukemias regressed in RFV-inoculated mice homozygous for all the H-2 types save H-2^b. Regression of leukemias in CFV-inoculated mice was most often seen in mice homozygous for the H-2^k allele. In general, those strains which were more refractory to leukemia induction by RFV and CFV showed the highest incidences of regression. It was concluded that the H-2 locus was not a determinant of leukemia regression.

- 4646 INTERACTION OF PHYTOHEMAGGLUTININ AND CONCAVALIN A WITH TRANSPLANTABLE MOUSE LYMPHOMAS OF DIFFERING MALIGNANT POTENTIAL. (E.) Dent, P. B. (Dept. Pediat. Biochem., McMaster U., Hamilton, Canada) and B. L. Hillcoat. *J Nat Cancer Inst* 49(2):373-377, 1972.

The effects of phytohemagglutinin (PHA) and concanavalin A (con A) on DNA synthesis and agglutination in three mouse lymphoma lines with differing degrees of malignancy were investigated. The Gross virus-induced A Ascites lymphoma was the most highly malignant, the mean survival time of female C3H/HeJ mice being 8.8 ± 2 days after i.p. injection of 5×10^6 cells. Injection of the same number of LS₂ transplantable lymphoma cells resulted in a mean survival time of 15.7 ± 0.7 days. None of the mice injected with LM₄ transplantable lymphoma cells died. *In vitro* agglutination tests showed that all three lines gave the same response in con A or PHA. However, differences were seen in the effect of the agglutinins on DNA synthesis as measured by the rate of ³H-thymidine incorporation. While con A inhibited DNA synthesis in all three tumor lines to the same extent, PHA inhibited DNA synthesis in A Ascites cells to a greater extent than in the LS₂ and LM₄ lines. In spite of the differential effects of PHA on DNA synthesis, no significant differences were observed in binding of ¹²⁵I-labeled PHA to the tumor cell membranes.

- 4647 COMPLEMENT-FIXING ANTIGENS OF HERPES SIMPLEX VIRUS TYPES 1 AND 2: REACTIVITY OF CAPSID, ENVELOPE, AND SOLUBLE ANTIGENS. (E.) Martin, M. L. (Ctr. Dis. Control, Atlanta, Ga.), E. L. Palmer and R. E. Kissling. *Infect Immun* 5(2):248-254, 1972.

Capsid complement-fixing (CF) antigens were prepared

from herpes simplex virus (HSV) types 1 and 2 by dissociating the viral envelope from the virus particle by detergent treatment; envelope CF antigen was prepared by treating HSV of both types with ether and high pH. Soluble HSV CF antigens were prepared in culture fluids of untreated HSV-infected rabbit or monkey cells. Antigens of the three types from the two HSV serotypes were reacted in CF tests against anti-capsid antigen, anti-envelope antigen or anti-soluble antigen guinea pig or rabbit antisera prepared against HSV-type 1 or -type 2 antigens. HSV-type 1 and -type 2 capsid antigens were highly cross-reactive in CF with antisera against capsid antigen; cross-reactivity was also seen for envelope and soluble antigens. In some cases, however, antisera to an antigenic component of HSV-type 1 reacted more strongly with HSV-type 1 antigen than with HSV-type 2 antigens. Soluble antigens of both HSV serotypes cross-reacted with antisera produced against crude HSV in infected animals; antibody titers of 1:32 to 1:64 were seen. However, sera from humans infected with crude HSV had low soluble antigen antibody titers ($\leq 1:8$). The HSV CF antigens did not react with anti-varicella virus antiserum, but did react with anti-herpes virus type B antiserum. In sera from normal human donors, titers of antibody to HSV reference egg antigen and to HSV capsid antigen were higher than titers to HSV envelope antigen, which in turn were higher than titers to HSV soluble antigen.

648 RADIOIMMUNE ASSAY OF CARCINOEMBRYONIC ANTIGEN. (E.) Egan, M. L. (City Hope Natl. Med. Ctr., Duarte, Calif.), J. T. Lautenschleger, E. E. Coligan and C. W. Todd. *Immunochem* 9:289-299, 1972.

A modified radioimmune assay for carcinoembryonic antigen (CEA) is described; the assay is based on the double antibody technique. Three γ -emitters are used; ^{125}I to follow CEA precipitation, ^{131}I to monitor the precipitation of goat anti-CEA antiserum, and ^{22}Na as a volume marker for residual supernate. A computer program has been developed to facilitate calculation of assay data. The assay has been shown to be capable of measuring CEA in amounts as low as 3-70 ng.

649 FACILITATION OF POLYOMA TUMOR GROWTH IN RATS BY BLOCKING SERA AND TUMOR ELUATE. (E.) Mansal, S. C. (Fred Hutchinson Cancer Ctr., Seattle, Wash.), R. Hargreaves and H. O. Sjögren. *Int J Cancer* (1):97-108, 1972.

Intraperitoneal inoculation of rats with blocking material in the form of serum from rats bearing polyoma virus-induced PW13 tumors or eluates of polyoma tumor tissue enhanced growth of PW13 isografts. Eluates of a 3-methylcholanthrene (MCA)-induced tumor and eluates of normal kidney tissues from PW13-bearing rats did not facilitate tumor growth. In related experiments, blocking serum and tumor and normal kidney eluates were tested for ability to abrogate the cyto-

toxicity of polyoma tumor-bearing rats' lymphocytes for polyoma tumor target cells *in vitro*. Eluates from polyoma tumor tissue blocked lymphocyte cytotoxicity, but MCA tumor eluates and normal kidney eluates from polyoma tumor-bearing rats had no detectable blocking activity. Blocking serum also abolished lymphocyte cytotoxicity for polyoma tumor target cells. Blocking activity of polyoma tumor eluates was detectable in sera of recipients for three days after administration of eluates. There were no differences in levels of cell-mediated cytotoxicity of lymphocytes for target tumor cells between rats given blocking serum and rats given polyoma tumor eluates.

4650 DETECTION OF CELLULAR IMMUNITY TO TUMOR ANTIGENS OF A GUINEA PIG HEPATOMA BY INHIBITION OF MACROPHAGE MIGRATION. (E.) Churchill, W. H. (Natl. Cancer Inst., Bethesda, Md.), B. Zbar, J. A. Belli and J. R. David. *J Nat Cancer Inst* 48(2):541-549, 1972.

Hepatomas were induced in guinea pigs by diethylnitrosamine in drinking water; cells of these tumors (line-1 cells) were mixed, to a proportion of 10% line-1 cells, with peritoneal exudate cells from guinea pigs which had been immunized against line-1 tumors by multiple injections of tumor cells. Macrophage migration was inhibited in mixtures of line-1 cells and immune peritoneal exudate cells; migration from such mixtures was 41% the rate of migration of immune cells alone. Migration in mixtures of line-1 tumor cells and unimmunized animals' peritoneal exudate cells was 107% the migration rate for immune peritoneal exudate cells alone. Normal spleen cells and peritoneal exudate from guinea pigs with the line-7 tumor did not affect macrophage migration when mixed with line-1 cells. Lymphocytes, purified from peritoneal exudate cells harvested from guinea pigs immunized against line-1 tumors, produced macrophage migration inhibition factor in response to tumor cell antigens. Pretreatment of line-1 cells with trypsin did not alter their inhibitory effect on macrophage migration. Cells treated by X-irradiation (5000 R) or stored in liquid nitrogen after slow freezing also retained their ability to inhibit macrophage migration.

4651 ANTIGENIC COMPARISON OF BOVINE TYPE C VIRUS WITH MURINE AND FELINE LEUKEMIA VIRUSES. (E.) Ferrer, J. F. (Sch. Vet. Med., U. Pennsylvania, Kennett Square). *Cancer Res* 32:1871-1877, 1972.

Bovine Serum 27-125 (spontaneous regression case of leukemia), which contains antibodies to a type C virus found in bovine cultures [New Bolton Center (NBC) cell lines], did not react in immunofluorescence tests with rat cells transformed by and releasing abundant quantities of murine leukemia viruses. In addition, these rat cells did not remove the immunofluorescence activity of Serum 27-125 for virus-containing NBC cells. Negative results were also obtained when three rat antisera containing antibodies to most, if not all,

the known antigens of the murine leukemia-sarcoma viruses, including the group-specific (*gs*) antigens, were tested by immunofluorescence on NBC cultures showing relatively high proportions of cells with the bovine virus immunofluorescence antigen. Two anti-feline leukemia virus sera, with strong anti-*gs* antigen activity, also failed to react with the NBC cultures. Repeated absorption with large numbers of disrupted NBC cells did not remove the immunofluorescence activity of one of the anti-feline leukemia virus sera for *gs-3* antigen contained in a rat lymphoma. Immunodiffusion experiments with the anti-murine leukemia virus and anti-feline leukemia virus sera also failed to reveal the *gs* antigens in Tween-ether-treated and concentrated preparations of cells and/or pellets of culture fluids from the virus-producing NBC cell lines. These preparations did not remove the anti-*gs*-precipitating activity of an anti-murine leukemia virus serum either. The results of both immunofluorescence and immunodiffusion studies indicate that the type C virus of the NBC cell lines is an indigenous bovine virus which is antigenically unrelated to the known mammalian type C viruses. These findings suggest the possibility that leukemia in cattle and perhaps in other species may be caused by a family of type C viruses different from that of the presently known leukemia viruses.

- 4652 DEMONSTRATION OF CELLULAR IMMUNITY TO TUMOR-SPECIFIC ANTIGENS OF MALIGNANT MELANOMA IN HAMSTERS BY INHIBITION OF MACROPHAGE MIGRATION. (E.) Henderson, W. R. (U. California Sch. Med., San Francisco), K. Fukuyama, W. L. Epstein and L. E. Spittler. *J Invest Derm* 58(4):229-232, 1972.

Delayed hypersensitivity of Golden Syrian hamsters to melanoma-specific tumor antigens was demonstrated by a technique employing the inhibition of macrophage migration *in vitro*. Migration of peritoneal exudate cells from animals immunized by injection with cell-free inocula of hamster melanoma was inhibited when these cells were incubated with cultured melanoma cells. In contrast, the migration of peritoneal exudate cells from normal nonimmunized controls was unaffected when incubated with melanoma cells. A decreased migration rate was also observed with peritoneal exudate cells from animals, inoculated with melanoma supernatant, who never developed tumors and with peritoneal exudate cells from animals who had had their tumors removed 3, 9 and 16 days before testing.

- 4653 IMMUNOGENICITY OF LEUKEMIA L1210 CELLS AFTER NEURAMINIDASE TREATMENT. (E.) Bekesi, J. G. (Roswell Park Mem. Inst., Buffalo, N.Y.), G. St. Arneault and J. F. Holland. *J Nat Cancer Inst* 49(1):107-118, 1972.

L1210 DBA/2 mouse leukemia cells were incubated with various concentrations of neuraminidase from *Vibrio cholerae* before being used to immunize mice with i.p. injections. The release of sialic acid from

neuraminidase-treated L1210 cells, and the immunity conferred on mice by these cells to challenge injections of L1210 cells, were observed. Tumor cells not treated with neuraminidase, and tumor cells treated with neuraminidase in concentrations of 10 IU or less, released negligible sialic acid, and did not protect mice against L1210 cell challenge; all challenged mice treated with these cells died. Neuraminidase concentrations of 20-50 IU/2.5 x 10⁷ L1210 cells/ml incubation medium caused rapid sialic acid release and optimal protection; in mice immunized with these cells, oncogenicity was lost and immunized mice survived challenge with 10⁵ L1210 cells (100,000 times the LD₅₀ for this tumor). Incubation of L1210 cells with more than 75 IU neuraminidase caused loss of oncogenicity but also abolished the immunogenicity of the cells, as evidenced by decreasing resistance to challenge among immunized mice. Treatment with neuraminidase caused a significant release of protein-bound sialic acid, e.g., *N*-acetylneuraminic acid and *N*-glycolylneuraminic acid. Radioactive glycoprotein was also released. Neuraminidase other than that from *V. cholerae* did not eliminate the oncogenicity of L1210 cells.

- 4654 IMMUNOFLUORESCENCE TESTS FOR ANTIBODIES TO EPSTEIN-BARR VIRUS WITH SERA OF LOWER PRIMATES. (E.) Dunkel, V. C. (Natl. Cancer Inst., Bethesda, Md.), T. W. Pry, G. Henle and W. Henle. *J Nat Cancer Inst* 49(2):435-440, 1972.

Sera from seven species of old-world monkeys, two species of new-world monkeys and one species of Prosimian were tested by indirect immunofluorescence for antibodies against Epstein-Barr virus (EBV) and EBV-antigens. Using acetone-fixed P3HR-1 and EB-3 cells, no immunofluorescence was observed with sera from the Prosimian and two new-world monkeys (owl and squirrel). Sera from all species of old-world monkeys tested gave positive reactions with anti-monkey γ -globulin conjugate. However, differences in reactivity were observed when these same sera were tested with antihuman IgG conjugate, the greatest differences occurring with sera from talapoin and African green monkeys. No differences in reactivity between the two conjugates were observed when they were tested on EB-3 cells with human sera from patients with EBV-related diseases and other malignancies and from normal controls. Thus, the variation with primate sera was apparently not the result of limited reactivity of the sera with the antihuman IgG conjugate.

- 4655 TUMOR-SPECIFIC VACCINE CONTAINING MYCOBACTERIUM BOVIS AND TUMOR CELLS: SAFETY AND EFFICACY. (E.) Bartlett, G. L. (Natl. Cancer Inst., Bethesda, Md.) and B. Zbar. *J Nat Cancer Inst* 48(6):1709-1726, 1972.

Guinea pigs were injected with line-10 hepatocellular carcinoma cells and resultant papules were excised; other animals were given irradiated

12,000 rads) line-10 cells, mixed irradiated line-0 cells and bacillus Calmette-Guerin (BCG) or mixed viable line-10 cells and BCG. Twenty-one days later, guinea pigs were challenged with 10^6 viable line-10 cells and immunity to challenge was observed. In delayed cutaneous hypersensitivity tests, only animals immunized with the irradiated tumor cells and BCG evidenced a hypersensitivity reaction. Tumor growth at the challenge site was retarded only in animals given vaccines of viable line-10 cells plus BCG. This vaccine produced regression of palpable malignant tumor in animals challenged with 10^5 line-10 tumor cells; the vaccine did not produce tumor regression, however, when challenge inocula contained 10^7 cells. Five animals immunized with line-10 cells plus BCG showed relapse into tumors after regression or tumor stasis. Relapse tumors were antigenically similar to the original tumors against which guinea pigs were protected by the line-10-BCG vaccine. Guinea pigs were not protected against tumor challenge by irradiated line-10 cells alone or by viable line-10 cells emulsified in Freund's complete adjuvant. Vaccines containing viable line-10 cells and BCG sometimes caused tumors in guinea pigs with tumors at a distant site. Repeated injections of vaccine or a larger proportion of line-10 cells in vaccines did not improve the therapeutic effect of vaccines.

4656 A FACTOR THAT CAN BE USED TO REGULATE AN *IN VITRO* PRIMARY IMMUNE RESPONSE. (E.) Watson, J. (Salk Inst. Biol. Stud., San Diego, Calif.) and M. Roman. *Proc Nat Acad Sci USA* 69(3):594-598, 1972.

A factor that supports stimulation of primary immune response against erythrocyte antigens in deficient mice did not support an *in vitro* primary immune response) fetal bovine serum (FBS)(5%) cultures in Eagle's medium was isolated from culture supernatants of mouse spleen cells infected with Rauscher leukemia virus. The factor was precipitated, dialysed with buffer and collected in fractions (Sephadex G-100) indicated as components I and II. Secondary but not primary immune responses, *in vitro*, were induced in spleen cell cultures supplemented with deficient FBS. The survival of spleen cell types in culture with normal FBS was identical with that in deficient FBS. However, when culture medium without serum was incubated 24 hr with the leukemia virus-infected cell lines (JLS-V5, ML-1, ML-2), an *in vitro* primary immune response was stimulated in the spleen cell cultures with deficient FBS. After fractionation, most activity was found associated with component I (m.w.~100,000). The kinetics of induction of the primary immune response with deficient FBS cultures and various component I concentrations were studied. The immune response *in vitro* with 25 and 100 μ g of component I was identical to the response in cultures using normal FBS. Decreased concentration of component I caused an increase in the lag period before proliferation of PFC (plaque-forming cells). The number of PFC decreased at the peak of the response but remained constant during the proliferative phase for all concentrations of component I. The rate of appearance of PFC de-

creased in the absence of component I. Some specific properties of component I are its antigen-dependent *in vitro* primary response, its ability to restore a lost activity only (does not stimulate response when added to normal FBS spleen cell cultures), its inability to substitute for FBS in stimulating primary immune response *in vitro* and its inability to affect *in vitro* secondary immune response in spleen cultures with deficient FBS.

4657 DELAYED CUTANEOUS SENSITIVITY REACTIONS TO EXTRACTS OF AUTOLOGOUS MALIGNANT MELANOMA: A SECOND LOOK. (E.) Bluming, A. Z. (Natl. Cancer Inst., Bethesda, Md.), C. L. Vogel, J. L. Ziegler and J. W. M. Kiryabwire. *J Nat Cancer Inst* 48(1):17-24, 1972.

Skin tests for delayed cutaneous sensitivity reactions were performed on 16 patients with malignant melanoma (seven men; nine women); skin test antigens included autologous tumor extract (ATE), normal autologous skin extract (ASE), tuberculin, streptokinase-streptodornase, mumps and dermatophyton. Eleven skin tests were positive with ATE as antigen; 1 mg/ml of ATE was the critical dose, some ATE-positive patients failing to respond to smaller amounts of ATE. Tests with ASE were performed in nine of the 11 ATE-positive patients and were positive in six patients. Again, 1 mg/ml of ASE was the critical dose. The three ATE-positive, ASE-negative patients were not different from other ATE-positive patients in any respect. Only one ATE-negative patient was ASE-positive. All patients, ATE-positive as well as ATE-negative, reacted to at least one of the other recall antigens used. No correlation was seen between ATE sensitivity and sex, age, duration of malignant melanoma symptoms, primary tumor site, regional lymph node involvement, presence of distant metastases, vitiligo or duration of remission. Four ATE-positive patients converted to ATE-negative and two patients converted from ATE-negative to ATE-positive.

4658 DEVELOPMENT OF NEOPLASIA AND KARYOTYPE ANALYSIS IN MICE WITH GRAFT-VERSUS-HOST REACTION. (E.) Hays, E. F. (Ctr. Hlth. Sciences, U. California, Los Angeles). *Cancer Res* 32(2):276-279, 1972.

The effect of graft-versus-host (GVH) reactions on lymphoma development in CBA/H-T6T6 x SJL/J hybrid (TSF₁) mice was studied. Mouse strains used were SJL/J, a strain with a high incidence of reticulum cell sarcoma (RCS); CBA/H-T6T6, a strain with a double marker chromosome; and C3H/HeJ, a strain with a high incidence of mammary carcinoma in females and hepatomas prevalent in males. TSF₁ littermates were injected with 8-30 x 10^6 adult SJL/J spleen cells or with an equivalent amount of cell-free extract of spleen at 8-59 days of age. A 57% mortality rate from acute GVH reactions was found in mice receiving 10, 5, and 3 x 10^6 SJL/J spleen cells at three-week intervals, starting

at 44 days of age. TSF₁ 3- to 7-day-old mice inoculated with $10-20 \times 10^6$ C3H spleen cells showed no GVH reactions. The chromosomes of four TSF₁ mice with acute GVH reactions from RCS were studied; the spleens showed 47 host (marked) and 62 donor (unmasked) metaphases. Aneuploid cells of host origin were found in all tumor-bearing animals but were not present in any animals with acute GVH reactions.

- 4659 VARICELLA-ZOSTER INFECTION IN PATIENTS WITH CANCER. (E.) Schimpff, S. (Baltimore Cancer Res. Ctr., Md.), A. Serpick, B. Stoler, B. Rumack, H. Mellin, J. M. Joseph and J. Block. *Ann Intern Med* 76:241-254, 1972.

Over a 24-month period, among 419 patients with cancer, zoster occurred in 25% of patients with Hodgkin's disease, 8.7% of other lymphoma patients, but in only 1.2% of patients with acute leukemia and 1.8% of patients with solid tumors. A disseminated or generalized form of zoster occurred in 12 of the 37 patients with zoster; these patients were more frequently DNCB-negative, but they were not necessarily receiving continuing cancer chemotherapy. Localization of zoster was frequently related to a site of prior radiation therapy. Recurrence of zoster occurred in eight patients. Patients with advanced Hodgkin's disease, cutaneous anergy, and recent nodal radiotherapy were inordinately predisposed to zoster. Absent varicella-zoster complement fixation titers in exposed patients with lymphoma but not leukemia also predisposed to zoster development. Zoster was an exogenously acquired reinfection in many patients, with a prolonged incubation period. No exposed staff member developed clinical infection, and only two had an antibody rise.

- 4660 RADIOIODINE-LABELED ANTIBODY TEST FOR THE DETECTION OF MEMBRANE ANTIGENS ASSOCIATED WITH EPSTEIN-BARR VIRUS. (E.) Hewetson, J. F., Karolinska Inst., Stockholm, Sweden), B. Gothoskar and G. Klein. *J Nat Cancer Inst* 48(1):87-94, 1972.

A direct, single-label, radioiodinated, antiglobulin technique was used, with viable target cells derived from lymphoblastoid cell lines carrying Epstein-Barr virus (EBV), to detect and measure antibodies against the EBV-determined membrane antigen (MA) complex. The blockings of radioiodinated immunoglobulin binding (RIB) was compared with that of direct membrane immunofluorescence (MIF) for a representative assortment of anti-MA-reactive and control sera. The overall correlation was good between the blocking indices obtained by the two methods (correlation coefficient: 0.76), and the RIB test was approximately four times more sensitive than the MIF test. The RIB test not only gave consistently higher titers but could also detect low concentrations of anti-MA antibodies in certain sera that were negative by the MIF test. Also the RIB test eliminated the laborious reading of the MIF tests.

- 4661 INDUCTION OF RESISTANCE AGAINST EHRlich CARCINOMA BY TUMOR CELLS SENSITIZED WITH IMMUNIZED RABBIT SERUM. (E.) Kato, N. (Fac. Pharm. Sci., U. Tokyo, Japan), S. Ito and D. Mizuno. *Gann* 63(2):173-179, 1972.

Strain ddy mice were injected i.p. with mixtures of Ehrlich ascites carcinoma cells and an anti-Ehrlich carcinoma antiserum prepared in rabbits by inoculation with Ehrlich cells. Injection of Ehrlich cells sensitized with the immune rabbit serum induced resistance to Ehrlich tumor mortality; 80% of mice given sensitized tumor cells survived 30 days post-injection. The survivors were challenged with Ehrlich cells and the LD₅₀ for this challenge was calculated and compared with the LD₅₀ for Ehrlich cells in unimmunized mice. The LD₅₀ for immunized, Ehrlich-resistant survivors was 1.2×10^6 cells/mouse while the LD₅₀ for unimmunized mice was 2.2×10^2 cells/mouse. Survivors of the sensitized Ehrlich cell regimen were also resistant to challenge with sarcoma 180 cells. Similarly, survivors of injections of sarcoma 180 cells sensitized with a sarcoma 180-resistant rabbit antiserum were resistant to challenge with Ehrlich carcinoma cells. Resistant mouse sera prepared from mice surviving sensitized Ehrlich cell regimens were not cytotoxic *in vitro* for Ehrlich cells, but did suppress Ehrlich growth *in vivo*.

- 4662 SELECTIVE SUPPRESSION OF HUMORAL AND CELLULAR IMMUNITY WITH CYTOSINE ARABINOSIDE. (E.) Griswold, D. E. (Roger Williams Gen. Hosp., Providence, R.I.), G. H. Heppner and P. Calabresi. *Cancer Res* 32(2):298-301, 1972.

Tail skin from C57BL mice was grafted onto the backs of C3H/HeJ mice; recipient mice were treated daily with 20 or 40 mg/kg cytosine arabinoside (ara-C) on either days one through five or days six through ten after grafting. Ara-C administered on days one through five did not affect rejection of allografts. Treatment on days six through ten prolonged graft retention by 2.2 days in recipients given 20 mg/kg ara-C and by 4.5 days in recipients given 40 mg/kg ara-C. In C3H/HeJ mice immunized with sheep red blood cells (SRBC), the production of 19S and 7S hemolysin plaque-forming cells (hpfc) in response to SRBC was inhibited by early or late administration of ara-C. However, ara-C administered on days seven through ten after SRBC was less effective in inhibiting hpfc production than ara-C administered on days one through four after immunization. These findings suggest that treatment with ara-C might be valuable in situations in which cell-mediated immune reactions are balanced in opposition to humoral blocking reactions.

- 4663 EVOLUTION OF COMPLEMENT-FIXING ANTIBODY TITERS WITH THE DEVELOPMENT OF BURKITT'S LYMPHOMA. (E.) Sohler, R. (Nat'l. Inst. Hlth. Med. Res., Lyons, France) and G. De-The. *Int J Cancer* 9(3):524-528, 1972.

ra from 29 African Burkitt's lymphoma patients were tested for complement fixing activity (CF) in reactions with a soluble CF antigen from a leukemia-derived, virus-producing lymphoblastoid cell line (IMR-WIL). Burkitt's lymphoma in the patient serum was either in regression or in a controlled state, or the disease was progressing. Patients with controlled or regressing tumors showed relatively low geometric mean titers (GMT) of CF antibody in their sera (mean GMT = 12.35). Patients with progressing tumors showed relatively high CF antibody GMT (mean = 10). In seven of 16 cases, CF antibody titers decreased as tumors regressed; in five of 10 cases CF titers increased as Burkitt's lymphoma progressed.

4 RADIOIMMUNOASSAY OF CARCINOEMBRYONIC ANTIGEN IN EXTRACTS OF HUMAN COLON AND STOMACH. J. Martin, F. (Sch. Med., Dijon, France) and M. S. Stin. *Int J Cancer* 9(3):641-647, 1972.

Carcinoembryonic antigen (CEA) was quantitated by a radioimmunoassay in perchloric extracts of cancerous and noncancerous human colonic and gastric tissues. Sera used in the assay were prepared in rabbits immunized with colonic tumor extracts or purified CEA. CEA content in primary colonic and rectal adenocarcinomas ranged from 8.9-233 mg/g perchloric extract. Liver metastases from large intestinal cancers contained 100 and 228 mg/g CEA, while gastric carcinomas contained less than 0.1-3.0 mg/g CEA. CEA was found in samples of colonic mucosa from noncancerous patients (1.5-8.0 mg/g, but was not seen in extracts of noncancerous gastric mucosa. CEA content in gut extracts from two fetuses was 2.8 and 2.0 mg/g. Comparison of the curves of inhibition of CEA binding to anti-CEA sera obtained using doubling concentrations of purified CEA or perchloric extracts of cancerous colon showed that inhibition was due to antigens with identical immunological reactivities.

5 INCIDENCE OF GROUP-SPECIFIC (gs) ANTIGENS OF TYPE C TUMOR VIRUSES IN SPONTANEOUS NEOPLASMS OF BALB/cCr MICE. (E.) Peters, R. L. (Microbiol. Assoc., Walkersville, Md.), G. J. Spahn, J. Rabstein, H. C. Turner and R. J. Huebner. *J Cancer* 10(2):290-295, 1972.

The incidence of species-specific gs antigen of the type C RNA tumor viruses in the spleen and tumor tissues of BALB/cCr mice with spontaneous neoplasms was determined by the complement fixation (CF) test. The incidence of gs antigen in the diseased spleens of mice with histologically diagnosed leukemia or lymphosarcoma and reticulum cell neoplasms was significantly ($P < 0.05$) higher than that for spleens of age-matched normal animals. Malignancies of CF-positive spleens did not differ histologically. The incidence of gs antigen in spleens of non-neoplastic mice with mammary tumors was the same as in spleens from normal controls. The incidence of gs antigen in the spleens of mice with tumors of mesenchymal or epithelial cell origin (other than mammary) was slightly, but not significantly,

elevated compared with normal controls. A high rate of gs antigen was detected in cell lines derived from both gs-positive and gs-negative donor tumors. Of four gs-negative cell lines, two were from gs negative and two were from gs-positive donor tumors.

4666 THE RESPONSE OF IMMUNOLOGICALLY RECONSTITUTED MICE TO ALLOGENEIC SKIN OR TUMOUR GRAFTS. (E.) Weston, B. J. (Inst. Cancer Res., London, England), C. Cheers, R. L. Carter, E. Leuchars, V. J. Wallis and A. J. S. Davies. *Int J Cancer* 9(1):66-75, 1972.

CBA/H mice were thymectomized two wk before exposure to 850 R X-irradiation; three hr postirradiation, syngeneic bone marrow cells were injected and ten days later allogeneic neonatal thymus lobes were implanted. Immunologically reconstituted mice were given intradermal inocula of EL4 C57BL mouse lymphoma, or skin grafts from syngeneic or C57BL mice. Cytological and histological changes in lymph nodes draining areas of tumor and skin grafts were studied. In mice given lymphoma, lymph nodes increased in wt 6.5 times by 9 to 13 days after inoculation; thereafter, lymph nodes decreased in wt. Smaller increases in lymph node wt were seen after syngeneic or allogeneic skin grafting. Three days after lymphoma inoculation, the lymph node was enlarged and blast cells were prominent. Germinal centers also became active and medullary cords were distended. Paracortical activity subsided 15 days after lymphoma inoculation. In mice given skin grafts, changes in lymph nodes appeared later and were less pronounced than in mice given tumor cells; paracortical hyperplasia first appeared seven days after skin grafting. Total mitotic activity in lymph nodes draining sites of lymphoma grafting increased for seven days after inoculation of tumor cells, and declined after 19 days postinoculation. Peak mitotic response after allogeneic skin grafting was less than after tumor grafting; two mitotic peaks appeared after allogeneic skin grafting, one at 9 days after grafting and the other 15 days after grafting. After the second peak, mitotic activity declined. Seven days after syngeneic skin grafting, there was a burst of mitosis, but this declined by nine days.

4667 IN VIVO ACTIVITY OF IN VITRO IMMUNIZED LYMPHOCYTES: I. TUMOR ALLOGRAFT REJECTION MEDIATED BY IN VITRO ACTIVATED MOUSE THYMOCYTES. (E.) Rouse, B. T. (Walter Eliza Hall Inst. Med. Res., Parkville, Victoria, Australia), H. Wagner and A. W. Harris. *J Immunol* 108(5):1353-1361, 1972.

Thymus cells of cortisone-treated CBA (H-2^k histocompatibility type) mice were cultured with BALB/c (H-2^d) or C57BL (H-2^b) mitomycin-treated spleen cells for six days. The cells were then tested for *in vitro* cytotoxicity by measuring their capacity to cause ⁵¹Cr release from labeled H-2^d and H-2^b tumor

cells. Cytotoxic lymphocytes (CL) generated by thymocytes immunized against H-2^d specifically lysed cells all H-2^d tumors tested when introduced into tumor cell cultures at ratios of 50:1. A mastocytoma cell line was most susceptible to CL lysis; 100% lysis was seen at a CL:mastocytoma cell ratio of 12:1. The *in vitro* lysis caused by CL was immunologically specific; CL immunized against H-2^d cells did not lyse a line of H-2^b thymic lymphoma cells. Tumor growth did not occur in lethally irradiated (800 R) CBA mice injected s.c. with 10⁵ mastocytoma cells and an equal number of CL at the same site. Intravenous injection of CL into lethally irradiated mice given mastocytoma cells s.c. also inhibited tumor growth, but not as efficiently. CL immunized against H-2^d were tested for capacity to protect against various tumors in CBA mice injected i.v. with 10⁶ syngeneic bone marrow cells. Protection was afforded by CL against all tumors of the H-2^d type; mastocytoma cells, which were most susceptible to lysis by CL *in vitro*, were rejected by fewer CL cells than cells of any other tumor. CL protection against tumor inoculation was immunologically specific; H-2^d-immunized thymocytes protected against H-2^d tumor cells at a ratio of 1:1, but did not protect against an H-2^k tumor, even at a ratio of 10:1.

4668 DISSECTION OF THE IMMUNOSUPPRESSIVE EFFECT OF THE Fc REGION OF TUMOR-ENHANCING IgG₂.

(E.) Cruse, J. M. (Dept. Biol., U. Mississippi, University), J. T. Forbes, G. Y. Gillespie, G. K. Lewis, R. W. Scales, B. R. Shivers, J. F. Fields, R. B. Hester, E. S. Watson and H. D. Whitten. *Z. Immunitaetsforsch* 143:43-58, 1972.

C3H_f/He (H-2^k) and TS (H-2^s) mice were immunized against a transplantable fibrosarcoma of C3H_f/He mice by repeated i.p. injections of tumor cells. Half-molecules of tumor-enhancing serum IgG₂ were prepared from antisera from immunized mice by reduction of the critical inter-H-chain disulfide bond using 2-mercaptoethanol and cysteine. Fab and Fc fragments of IgG₂ were obtained by digestive cleavage of IgG₂ with mercuripapain. TS mice were inoculated with half-molecules of tumor-enhancing IgG₂, whole IgG₂, or Fab or Fc fragments of IgG₂. Subsequently, the mice were injected with fibrosarcoma cells. Enhancement of tumor was achieved by Fab and Fc fragments and by whole- and half-molecules of IgG₂. Fc fragments were relatively more effective, and Fab fragments were relatively less effective, than half-molecules of IgG₂ as tumor enhancers.

4669 FURTHER DEFINITION BY CYTOTOXICITY TESTS OF CELL SURFACE ANTIGENS OF HUMAN SARCOMAS IN CULTURE. (E.) Bloom, E. T. (Sloan-Kettering Inst. Cancer Res., New York, N.Y.). *Cancer Res* 32(5):960-967, 1972.

Cells derived from 21 cultures of human sarcoma cells and from nine cultures of normal and neo-

plastic nonsarcomatous cells were reacted in cytotoxicity tests with 115 serum samples from sarcoma patients and nonsarcoma patients. Sera from sarcoma patients were cytotoxic to autochthonous sarcoma cells (the cytotoxicity depended on exogenous rabbit complement). Sarcoma cells were killed by 97% of sera from allogeneic sarcoma patients, 71% of sera from their family members, 80% of sera from patients with nonsarcomatous cancers, and 85% of sera from normal donors. Sera toxic to sarcoma cells were often nontoxic to nonsarcoma cells (including a line of skin fibroblasts from a sarcoma patient). Absorption of some sarcoma patients' sera with autochthonous or allogeneic sarcoma cells decreased cytotoxicity of sera for sarcoma cells, but did not affect their cytotoxicity for nonsarcoma cells. When sera from four patients with osteogenic sarcoma or Ewing's sarcoma were absorbed with the respective allogeneic sarcoma cells and tested for cytotoxicity, it appeared that these sarcoma cells shared at least one antigen, but that Ewing's sarcoma cells had less of this antigen, than did osteogenic sarcoma cells. Different sarcoma cell lines shared antigens which were not shared by nonsarcoma cells. This sensitivity of sarcoma cells to cytotoxic sera varied unpredictably with cell passage. The evidence was that antigens detected in this work were restricted to sarcoma.

4670 GENETIC CONTROL OF THE IMMUNE RESPONSE. THE EFFECT OF THYMECTOMY ON THE PRIMARY AND SECONDARY ANTIBODY RESPONSE OF MICE TO POLY-L (Tyr,Glu)-POLY-D, L-Ala--POLY-L-Lys. (E.)

Mitchell, G. F. (Stanford U. Sch. Med., Stanford, Calif.), F. C. Grumet and H. O. McDevitt. *J Exp Med* 135(1):126-134, 1972.

The effect of thymectomy on the genetically controlled murine immune response-1 (*Ir-1*) to the synthetic polypeptide poly-L(Tyr,Glu)-poly-D,L-Ala-poly-L-Lys [T,G)-A--L] was studied with both aqueous and adjuvant immunization regimens. Adult thymectomy (combined with irradiation and bone marrow transfusion) did not affect the aqueous antigen-induced (IgM) primary response of either high or low responder mice, but did abate the (IgG) secondary or tertiary response, a response which is restricted to the high responder strains. Adult thymectomy also blocked the normal high response to (T,G)-A--L in Freund's adjuvant in high responder mice and the high response to methylated bovine serum albumin (MBSA)-(T,G)-A--L in low responder mice. Neonatal thymectomy was also effective in blocking the response to (T,G)-A--L in Freund's adjuvant in high responder mice. These data are consistent with the concept that the *Ir-1* gene effect is mediated via thymus cell interaction with antigen and with "B"-cells during the time of induction of IgG antibody formation.

4671 ELUTION OF "BLOCKING FACTORS" FROM HUMAN TUMORS, CAPABLE OF ABROGATING TUMOR-CELL DESTRUCTION BY SPECIFICALLY IMMUNE LYMPHOCYTES. (E.)

Ögren, H. O. (Hutchinson Cancer Ctr. Seattle, Wash.), I. Hellström, S. C. Bansal, G. A. Warner and K. E. Hellström. *Int J Cancer* 9(2):274-283, 1972.

Tumor material was obtained surgically from patients with seminoma or osteogenic sarcoma, and from ascites and pleural effusions from patients with endometrial carcinoma, breast carcinoma or ovarian carcinoma. Tumor material was minced and centrifuged, and supernatants were eluted at pH 3.1. High and low molecular wt (MW) fractions (MW = >100,000 and <100,000, resp.) were separated from eluates by ultrafiltration. Low pH eluates were tested for blocking activity of the cytotoxic effect of lymphocytes immune to tumor-associated antigens of the various tumors by an *in vitro* microcytotoxicity assay. Target cells were cells from the tumor employed for elution or cells from other tumors of the same types. Lymphocytes were taken from patients bearing each of the various tumors or from normal donors. Whole unfractionated tumor tissue eluates blocked lymphocyte cytotoxicity. One-to-one mixtures of high and low MW fractions also showed blocking activity. There was no detectable blocking activity when each MW fraction was tested by itself. Blocking was obtained when target tumor cells and lymphocytes were incubated with high MW fractions of tumor eluates and then with low MW fractions but not when the sequence was reversed. The high MW fraction by itself blocked lymphocyte cytotoxicity with ovarian carcinoma target cells. It is concluded that tumor cells growing *in vivo* are coated with blocking factors.

72 IMPAIRMENT OF THE LYMPHOCYTE RESPONSE TO PHYTOHAEMAGGLUTININ IN CHICKENS WITH MAREK'S DISEASE. (E.) Alm, G. V. (Variety Club, S. Ctr., La Rabida-U. Chicago, Ill.), F. J. Accardi and R. D. A. Peterson. *Acta Pathol Microbiol and (A)* 80:109-114, 1972.

Chickens inoculated on the day of hatching with blood from chickens with Marek's disease (MD) were compared with uninoculated birds who developed "contact infection" with MD. Spleen lymphoid cells from both the inoculated and contact-infected chickens were collected and labeled with ^3H -thymidine; the response of the labeled spleen cells to phytohemagglutinin (PHA) was measured by ^3H -thymidine uptake. The PHA response of birds infected with MD by inoculation was significantly impaired compared to normals ($1287 \pm 646\%$ increase in ^3H -thymidine uptake caused by PHA in normal spleen cells vs $435 \pm 581\%$ increase caused by PHA in MD-infected birds' spleen cells). Spleen cells from contact-infected birds showed strikingly reduced PHA-stimulated spleen cell ^3H -thymidine uptake, even when compared to spleen cells of inoculated birds; the latter showed a slight response to PHA, but contact-infected birds showed no positive PHA response. PHA also caused a highly significant inhibition of ^3H -thymidine uptake in gonadal lymphoid cells from birds inoculated with MD.

4673 TUMOR-SPECIFIC RESISTANCE IN MICE DETECTED BY INHIBITION OF MACROPHAGE MIGRATION. (E.) Vaage, J. (U. Texas, M.D. Anderson Hosp. Tumor Inst., Houston), R. D. Jones and B. W. Brown. *Cancer Res* 32(4):680-687, 1972.

Female C3Hf/Bu mice were immunized with s.c. implants of a methylcholanthrene-induced fibrosarcoma or a spontaneous mammary carcinoma. Twenty-five days later the tumor implants were resected and the mice were injected with one of the following: 100,000 and 1,000 g centrifuge supernatants from fibrosarcoma or mammary carcinoma homogenates; irradiation-killed fibrosarcoma or mammary carcinoma cells; starch in NaCl solution; NaCl solution only (control). Macrophage migration in capillary tubes containing peritoneal exudate from presensitized mice given these regimens was observed. Both 100,000 and 1,000 g fibrosarcoma centrifugates strongly and specifically inhibited macrophage motility. Killed fibrosarcoma cells and starch granules showed nonspecific inhibition of macrophage migration. Similar results were found for the mammary carcinoma. Host resistance to fibrosarcomas and mammary carcinomas was also detected by observing the effect of tumor antigens on macrophage spreading on culture dishes. In a related experiment, mice were sensitized against tumors by s.c. implantations of tumor cells one or three wk before challenge tumor inoculation and testing of macrophage migration from peritoneal exudates. Host resistance to challenge as measured by macrophage migration was not fully developed in mice sensitized only one wk before testing.

4674 LYMPHOCYTE CYTOTOXICITY REACTIONS TO LEUKEMIA-ASSOCIATED ANTIGENS IN IDENTICAL TWINS. (E.) Rosenberg, E. B. (Nat'l. Cancer Inst., Bethesda, Md.), R. B. Herberman, P. H. Levine, R. H. Halterman, J. L. McCoy and J. R. Wunderlich. *Int J Cancer* 9(3):648-658, 1972.

The ^{51}Cr -release test was used to examine the cytotoxicity of lymphocytes from relatives and nonrelatives for freshly explanted leukemic blood cells from leukemia patients and for blood target cells from nonleukemic identical twins of these patients. Lymphocytes from nonleukemic twins, parents, siblings and nonrelatives were cytotoxic for target cells of leukemic patients but not for target cells from patients' normal twins in seven twin pairs. Lymphocytes from family members and nonrelatives were not cytotoxic for target cells from either the leukemic or the normal twin in three twin pairs. Allogeneic lymphocytes were cytotoxic for target cells from both the normal and the leukemic twin in four twin pairs. Forty-six percent of lymphocyte tests showed lymphocyte cytotoxicity when lymphocyte donors were older than 20 yr, but only 9% of tests were positive when lymphocyte donors were younger than 16 yr. Positive lymphocyte cytotoxicity reactions to leukemia-associated antigens indicate previous sensitization, which could have resulted from infection with an environmental agent such as a virus.

- 4675 CELLULAR IMMUNITY TO HUMAN BREAST CARCINOMA. (E.) Fossati, G. (Nat. Inst. Study Cure Tumor, Milan, Italy), S. Canevari, G. D. Porta, G. P. Balzarini and U. Veronesi. *Int J Cancer* 10(2):391-396, 1972.

An *in vitro* microassay technique was used to study the cellular immunological response of 16 breast carcinoma patients against tumor-associated antigens. Target cells were obtained from five patients who had pleural effusion due to metastases from breast carcinomas. Lymphocyte suspensions from each of the patients were incubated with either breast carcinoma cells or control cell lines. The lymphocytes obtained from the peripheral blood of three of the five target cell donors had a specific killing effect on autochthonous cancer cells. Lymphocytes from nine of the other 13 cancer patients killed at least one of the target tumor cell lines. Lymphocytes from five of six patients with benign breast lesions, three patients with endometrial, ovarian or colonic cancers, and one female patient without tumor showed no cytotoxic effect on any of the target cells. Negative reactions were obtained with lymphocytes from three of six patients with a localized tumor, but with lymphocytes from only one of ten patients with metastases.

- 4676 IMMUNOLOGIC AND VIROLOGIC STUDIES OF A NON-PRODUCER TUMOR INDUCED BY MURINE SARCOMA VIRUS (HARVEY). (E.) McCoy, J. L. (Natl. Cancer Inst., Bethesda, Md.), R. C. Ting, D. L. Morton and L. W. Law. *J Nat Cancer Inst* 48(2):383-391, 1972.

The growth of PD₄T-1 Harvey murine sarcoma virus (H-MSV)-induced hamster tumors was studied on transplantation of tumor cells to normal adult hamsters and to hamsters immunodepressed by 350 R of X-irradiation. PD₄T-1 was a nonvirus-producing variant cell line derived from the PD₄-MSV(H) cell line, a line which arose from infection of hamster cells with H-MSV and which did produce virus. PD₄T-1 tumor cells grew progressively and killed 14 of 14 irradiated hosts while only five of 12 unirradiated hamsters died from the tumor inoculation. When adult hamsters were given three injections of lethally (15,000 R) irradiated PD₄T-1 cells and challenged s.c. one month later with viable PD₄T-1 cells, significant resistance to tumor cell challenge was seen; 13 of 15 hamsters not preimmunized with tumor cell inocula died from challenge-induced tumors while none of 11 immunized hamsters died. Preimmunized tumor-resistant hamsters were challenged again 43 days after the initial challenge with a ten times larger PD₄T-1 inoculum. Fifteen of 16 nonimmunized, nonresistant hamsters developed progressively growing tumors after this challenge, while tumors grew in only five of 11 preimmunized, resistant hamsters. Preimmunization with producer PD₄-MSV(H) conferred resistance to challenge with PD₄T-1 cells. H-MSV-neutralizing antibodies were not detected in sera of preimmunized PD₄T-1-resistant hamsters, but were seen in sera of hamsters immunized with PD₄-MSV(H).

- 4677 MYELOMA PROTEINS AS TUMOR-SPECIFIC TRANSPLANTATION ANTIGENS. (E.) Lynch, R. G. (Washington U. Sch. Med., St. Louis, Mo.), R. J. Graff, S. Sirisinha, E. S. Simms and H. N. Eisen. *Proc Nat Acad Sci USA* 69(6):1540-1544, 1972.

Female BALB/cAnN mice were immunized with purified myeloma proteins 315 or 460 ten days before challenge with corresponding MOPC-315 and MOPC-460 myeloma tumors. BALB/c mice immunized with proteins 315 and 460 produced antibodies specific for their respective idiotypic determinants. Mice immunized with protein 315 were resistant to challenge with MOPC-315; tumors developed in all unimmunized mice, but in only 11% of protein 315-immunized mice challenged with 5,000 MOPC-315 cells and in 40-60% of immunized mice given 10,000 tumor cells. Immunization with protein 460 conferred resistance to MOPC-460, but this resistance was more difficult to discern than that in the MOPC-315 system. Most of the MOPC-315 tumors which grew in immunized hosts were variants that did not produce protein 315 but rather the light chain of this protein. It is possible that these variants of MOPC-315 grew in immunized mice because the anti-idiotypic immune response selects against myeloma cells that produce the intact myeloma protein and not against cells that produce its light chain only.

- 4678 DELETION OF LIVER-CELL SURFACE MEMBRANE COMPONENTS FROM AMINOAZO-DYE-INDUCED RAT HEPATOMAS. (E.) Baldwin, R. W. (Cancer Res. Campaign Lab., U. Nottingham, England) and D. Graves. *Int J Cancer* 9(1):76-85, 1972.

Cells of a 4-dimethylaminoazobenzene-induced rat hepatoma were reacted in membrane immunofluorescence tests with rabbit antisera prepared against rat liver membrane components. Normal antigens expressed on the surface of rat liver cells were demonstrated when viable liver cells were reacted with the rabbit antiserum. To determine whether individual rat hepatomas showed a loss in antigen normally expressed on liver cells, rabbit anti-liver membrane antiserum was absorbed with hepatoma tissue until it was no longer able to react positively with hepatoma cells. Absorbed serum was then assayed for reactivity against hepatoma and normal liver cells. Absorbed antisera which did not react with hepatoma cells continued to react with normal liver cells, indicating that normal liver-specific cell-surface antigens were deleted in hepatoma cells. In studies with six different hepatomas, antigens deleted from one hepatoma were present in others. This suggested that antigen deletions associated with hepatoma cells result from the replacement of normal liver antigenic components by new tumor-specific antigens.

- 4679 ANTIGENICITY OF L1210 LEUKEMIC SUBLINES INDUCED BY DRUGS. (E.) Nicolin, A. (Natl. Cancer Inst., Bethesda, Md.), S. Vadlamudi and A. Goldin. *Cancer Res* 32(4):653-657, 1972.

Increased antigenicity was manifested by 30 sublines of L1210 ascitic leukemia which were partially or completely resistant to antitumor drugs. Drug-resistant L1210 cells were inoculated into CDF₁ mice. In some cases, mice were given 18 mg/kg 1,3-bis(2-chloroethyl)-1-nitrosourea (BCNU) s.c. six days after inoculation of L1210 cells. The mean survival time (MST) of BCNU-treated and untreated mice given inoculations of drug-resistant L1210 cells was significantly increased relative to the MST of mice inoculated with cells of the original, drug-sensitive L1210 leukemia. Increases in MST of BCNU-treated and untreated mice were reduced if animals were immunosuppressed with cyclophosphamide before inoculation of leukemic cells; the therapeutic effect of BCNU was almost completely reversed in immunosuppressed mice. More direct evidence of increased immunogenicity of drug-resistant L1210 cells was obtained when mice were immunized with X-irradiated drug-sensitive cells or X-irradiated drug-resistant cells. On challenge with viable cells corresponding to those used for immunization, mice were protected more effectively against the drug-resistant challenge cells than against sensitive challenge cells. Sera from mice immunized against drug-resistant L1210 cells demonstrated specific cytotoxic antibodies against the cells of the same drug-resistant leukemia. Animals immunized against the sensitive leukemia cells developed a weak antiserum which did not evidence specific cytotoxic activity.

THE IMMUNOSUPPRESSIVE EFFECTS OF RAUSCHER LEUKEMIA VIRUS (RLV) UPON SPLEEN CELLS CULTURED IN CELL-IMPERMEABLE DIFFUSION CHAMBERS. III. INHIBITION OF RLV-INDUCED CELL PATHWAYS BY ANTIGENIC STIMULATION WITH HEMOCYANIN. (E.) Borella, L. (U. Tennessee Med. Units, Memphis). *J Immunol* 108(1):45-1972.

Spleen cells from normal or Rauscher leukemia virus (RLV)-infected BALB/c mice inoculated with keyhole limpet hemocyanin (KLH) were cultured with or without stimulating doses of KLH in cell-impermeable diffusion chambers that were implanted in irradiated syngeneic mice. Cytomorphologic studies and studies of *in vitro* immunoglobulin synthesis were performed to determine the effects of RLV and KLH on the cells. In uninfected, KLH-restimulated spleen cells in diffusion chambers, a marked transient increase in number of immunoblasts and plasma cells was seen; immunoglobulin synthesis increased markedly in KLH-restimulated spleen cells as compared to KLH-primed spleen cells not restimulated with KLH in diffusion chambers. KLH-restimulated, RLV-infected spleen cells in diffusion chambers also showed increased plasma cell differentiation and increased immunoglobulin synthesis. In RLV-infected spleen cells with KLH, there was an increase in the absolute numbers of blast, myeloid, erythroid and mono-histoid cells (82, 73, 17 and 30 cells/culture $\times 10^4$, resp.). Stimulation with KLH reduced the numbers of blast, myeloid, erythroid and mono-histoid cells to 15, 18, and 11 cells/culture $\times 10^4$, resp. It is postulated that antigenic stimulation of RLV-infected spleen

cells by KLH shifts the differentiation pathway of these stem cells from blast-hematopoietic cells to lymphoid-plasma cells.

4681 LACK OF ANTIGENICITY OF MAMMARY TUMORS INDUCED BY CARCINOGENS IN A NONANTIGENIC PRENEOPLASTIC LESION. (E.) Halpin, Z. T. (Cancer Res. Lab., U. California, Berkeley), J. Vaaga and P. B. Blair. *Cancer Res* 32(10):2197-2200, 1972.

Eight mammary carcinomas were induced by either 3-methylcholanthrene or 7,12-dimethylbenz(a)anthracene in a nonviral- and noncarcinogen-induced preneoplastic (preinvasive) alveolar nodule which had arisen in a hormonally stimulated BALB/c female mouse. The preneoplastic mammary nodule outgrowth was found to be nonantigenic when tested in the strain of origin. Seven of the eight carcinogen-induced carcinomas were also found to exhibit no clear-cut evidence of antigenicity. The eighth tumor, however, was shown to produce tumor-specific immunity in BALB/c mice. The results suggest that carcinogens may not directly induce the appearance of new antigens in the tumors they produce. Furthermore, carcinogens may act in a different manner when inducing a tumor from preexisting preneoplastic lesion.

4682 COMPARATIVE EFFECT OF *MYCOBACTERIUM BOVIS*- AND NEURAMINIDASE-TREATED TUMOR CELLS ON THE GROWTH OF ESTABLISHED METHYLCHOLANTHRENE FIBROSARCOMAS IN SYNGENEIC MICE. (E.) Rios, A. (Dept. Surgery, U. Minnesota, Minneapolis) and R. L. Simmons. *Cancer Res* 32(1):16-21, 1972.

A comparison of the relative efficiency of BCG (*Mycobacterium bovis* strain G) and VCN (*Vibrio cholerae* neuraminidase) treated tumor cells in producing the rejection of established syngeneic fibrosarcomas is presented. C3H/HeJ adult female mice, 8 to 16 weeks old, were inoculated s.c. with 0.5 mg of methylcholanthrene (MCA), dissolved in 0.1% triolein, to produce a fibrosarcoma (MC-42). Sterile tumor cells for inoculation were then prepared from the MC-42 tumors. The basic experimental procedure was to inoculate adult female C3H/HeJ mice with a predetermined number of normal MC-42 tumor cells in suspension, then follow, at various intervals, with a challenge dose of either BCG injected directly into the tumor nodule or s.c. into distant sites from the tumor. A comparative group of cohort mice received injections of 10^6 tumor cells treated with VCN plus mitomycin or of heat-inactivated VCN plus mitomycin. BCG, in doses greater than 0.001 mg, when injected into firmly established MC-42 tumors of C3H/HeJ mice, slowed the growth of the tumors. The greatest inhibition of growth was obtained at a dose of 1 mg BCG/mouse. One injection of VCN-treated tumor cells produced the total regression of one out of ten firmly established MC-42 tumors, and prolonged life to the same degree as did injection of BCG directly into the tumor. Injections of cells with heat-inactivated VCN had no effect on tumor growth. It

was concluded that injection of VCN-treated cells is a more efficient mode of inducing immunity to pre-existing solid tissue tumors than is the introduction of BCG, even if BCG is injected directly into the tumor.

- 4683 AUSTRALIA ANTIGEN IN SINGAPORE CHINESE PATIENTS WITH HEPATOCELLULAR CARCINOMA AND COMPARISON GROUPS: INFLUENCE OF TECHNIQUE SENSITIVITY ON DIFFERENTIAL FREQUENCIES. (E.) Simons, M. J. (World Hlth. Org., Singapore), E. H. Yap, M. Yu and K. Shanmugaratnam. *Int J Cancer* 10(2):320-325, 1972.

Immune adherence hemagglutinin tests (IAHA) were performed on serum from 156 Singapore Chinese with hepatocellular carcinoma (HCC) to determine Australia antigen (Au) in these sera. In electro-osmofusion (EOD) tests, the Au frequency in HCC patients was 1.9%, not significantly higher than in Au frequencies in normal Chinese blood donors. In the more sensitive IAHA tests, HCC patients had Au frequencies of 35.3%, four times higher than normal Au frequencies as determined by IAHA (1.9-7.5%). The relative insensitivity of the EOD test may have accounted for a previous finding of low Au frequencies in Chinese HCC patients. However, the age distribution of patients studied in the previous tests may also have affected results. Younger Chinese HCC patients were shown to have lower Au titers than older patients. There may also be true biological differences between HCC patients in different countries. The Singapore Chinese HCC patients had lower Au titers than Ugandans with HCC.

- 4684 CARCINOEMBRYONIC ANTIGEN (CEA) IN GASTROINTESTINAL AND EXTRAGASTROINTESTINAL TUMORS AND ITS RELATIONSHIP TO TUMOR-CELL DIFFERENTIATION. (E.) Denk, H. (Path. Anat. Inst., U. Vienna, Austria), G. Tappeiner, R. Eckerstorfer and J. H. Holzner. *Int J Cancer* 10(2):262-272, 1972.

Tissue sections from human colonic, gastric, pancreatic, liver, tonsil, bronchial, mammary, ovarian and anal carcinomas were reacted with rabbit anticarcinoembryonic antigen (CEA) sera. The presence of CEA in tumors of different degrees of differentiation was observed by indirect immunofluorescence. In colonic tumors, CEA was found as a rim of specific fluorescence on the tumor cell surface or as cloudy masses in lumina of distended glands. CEA was abundant in well-differentiated colonic carcinomas and less abundant in more anaplastic tumors. Hypersecretory mucoid carcinomas were high in CEA when well-differentiated and low in CEA when poorly differentiated. Well-differentiated colonic carcinoma metastases were high in CEA, poorly differentiated metastases were low. Normal colonic mucosa near tumors, normal mucosa more than 7 cm from tumors, and normal colonic mucosa from tumor-free subjects were negative for CEA. Gastric carcinomas were

less well-differentiated than colonic tumors; well-differentiated gastric tumors had less CEA than comparable colon tumors. Pancreatic tumors contained CEA, but a gastrointestinal lymphosarcoma, a hepatoma, and tonsil, bronchial, mammary, ovarian and anal tumors lacked CEA.

- 4685 CELLULAR REACTIONS AGAINST BURKITT LYMPHOMA CELLS. I. COLONY INHIBITION WITH EFFECTOR CELLS FROM PATIENTS WITH BURKITT'S LYMPHOMA. (E.) Hewetson, J. F. (Karolinska Inst., Stockholm, Sweden), S. H. Golub, G. Klein and S. Singh. *Int J Cancer* 10:142-149, 1972.

Burkitt lymphoma-derived lymphoblastoid cells (line P3HR-1) were used as target cells in tests of colony formation inhibition (CI) with blood leukocytes from Burkitt's lymphoma patients, nasopharyngeal carcinoma patients, and normals (controls) as effector cells. Effector cells were mixed in semi-solid medium with target cells at an effector:target cell ratio of 100:1. Only five of the 62 Burkitt's lymphoma or nasopharyngeal carcinoma effector cells samples inhibited colony formation by more than 30% when compared with normal control cells. However, when effector-target cell mixtures were stimulated by phytohemagglutinin (PHA), almost all effector cell samples caused significant CI. Only six of 31 PHA-treated effector cell samples caused less than 20% CI and 21 showed greater than 40% inhibition. Leukocyte samples which showed high levels of stimulation by PHA were usually active in CI tests, while samples which responded less than one log₁₀ U to PHA inhibited colony formation by less than 40%. Lymph node cells, but not peripheral leukocytes, caused significant CI when tested against autochthonous or allogeneic target cell lines.

- 4686 IN VIVO AND IN VITRO STUDIES OF THE INFLUENCE OF THE IMMUNE STATUS OF C3Hf/Bu MICE ON THE EFFECTIVENESS OF LOCAL IRRADIATION OF A METHYLCHOLANTHRENE-INDUCED FIBROSARCOMA. (E.) Jurin, M. (U. Texas M.D. Anderson Hosp. Tumor Inst., Houston) and H. D. Suit. *Cancer Res* 32(10):2201-2211, 1972.

The influence of the immune status of C3Hf/Bu mice on the effectiveness of local irradiation of a transplanted, methylcholanthrene-induced fibrosarcoma was studied. The numbers of tumor cells that transplanted the tumor into one-half of the recipients were 3.0×10^4 , 2.9×10^2 , and 5.7×10^5 for normal, immunodepressed, or immunized recipients, resp. A tumor reached 12 mm in diameter more quickly when transplanted into immunized recipients than when transplanted into control animals. Also, the radiation dose that controlled one-half of the treated 12-mm tumors was about 1000 rads higher in immunized than in normal recipients. *In vitro* studies showed that lymphoid cells from tumorous mice were effective in inhibiting colony formation

fibrosarcoma cells. The degree of inhibition of colony formation by the lymphocytes decreased according to the size of tumor borne by the lymphocyte donor. Also, lymphocytes collected from tumor-bearing donors were less effective if the donor had been immunized prior to transplantation. The most effective lymphoid cells came from pre-immunized but non-tumor-bearing donors. Serum from tumor-bearing but not from immunized mice contained blocking antibodies, i.e., abolished inhibition of colony growth by lymphoid cells.

7 THE DEVELOPMENT OF SPECIFIC CELLULAR AND HUMORAL IMMUNITY IN MICE INFECTED WITH RAUSCHER LEUKEMIA VIRUS AS NEONATES OR ADULTS.

J. McCoy, J. L. (Bionetics Res. Lab., Bethesda, Md.), A. Fefer, R. C. Ting and J. P. Glynn. *Cancer Res.* 32:1671-1678, 1972.

Neonatal and adult C57BL/6 mice were inoculated with Rauscher leukemia virus (RLV) prepared from splenic homogenates of RLV-infected mice. Mice were given 10^{-1} , 10^{-3} or 10^{-5} dilutions of RLV 1-16 wk before challenge with cells of a Rauscher lymphoma, RBL-3. Adult mice immunized with 10^{-1} RLV were only resistant to RBL-3 challenge as early as 8 wk after immunization. These adults remained resistant for 16 wk. Immunization with smaller dilutions of RLV induced resistance, but only after a 2-16 wk delay. Newborns also developed resistance to RBL-3 challenge after RLV immunization. Resistance appeared 8 wk after immunization (10^{-1} or 10^{-3} dilution of RLV) in newborns and persisted for 12 wk, declining by 16 wk and disappearing by 32 wk. Newborns given 10^{-1} RLV developed primary Rauscher leukemia in 40% of cases; adult mice given RLV did not develop Rauscher disease. Mice given RLV as newborns showed fluorescent tumor antibodies 4 wk postimmunization; the number of newborns with antibodies increased by wk 32, but on transplantation resistance had disappeared. Newborns could resist syngeneic polyoma-induced tumors or grafts even after their resistance to RBL-3 disappeared.

8 TUMOR IMMUNITY IN VITRO: DESTRUCTION OF A MOUSE ASCITES TUMOR THROUGH A CYCLING MECHANISM. (E.) Berke, G. (Duke U. Med. Ctr., Durham, N.C.), K. A. Sullivan and D. B. Amos. *Immunology* 177(4047):433-434, 1972.

Lymphocytes in peritoneal exudates from BALB/c mice injected with EL4 mouse leukemia cells were incubated with ^{51}Cr -labeled EL4 target cells. The effector lymphocytes were extremely effective in destroying the target cells. When EL4 cells were incubated with increasing numbers of effector lymphocytes, it was found that destruction of target cells by lymphocytes depended on the number of lymphocyte-target cell interactions. The effector lymphocytes involved in target cell lysis were not destroyed or inactivated; instead, they recycled and interact with and destroy additional tumor cells.

4689 ISOLATION AND CHARACTERIZATION OF CARCINO-EMBRYONIC ANTIGEN. (E.) Coligan, J. E. (City Hope Natl. Med. Ctr., Duarte, Calif.), J. T. Lautenschleger, M. L. Egan and C. W. Todd. *Immunochimistry* 9:377-386, 1972.

Tumor tissues from 11 human digestive tract tumors, including tumors of the rectum, colon, stomach and liver, were lyophilized and subjected to Sepharose gel and Sephadex gel chromatography. Carcino-embryonic antigen (CEA) was assayed in treated tumor tissues by a radioimmune assay. Individual tumors, even though of the same tissue type, varied greatly in CEA content; one rectal tumor had a final CEA yield of 407 mg/kg, while another rectal tumor had a final yield of 59 mg/kg. CEA was extracted from several tumors by gel filtration on Sephadex G200. The material showed two peaks, one with a sedimentation constant of 10.1S and one with a constant of 6.8S. The latter was the more commonly seen CEA size. The 10.1S CEA could not be converted into 6.8S CEA by dithiothreitol reduction.

4690 SYNTHESIS OF IMMUNOGLOBULINS BY BIOPSIED TISSUES AND CELL LINES FROM BURKITT'S LYMPHOMA. (E.) Further, R. van (U. Hosp., Leiden, Netherlands), H. Gorter, J. J. Nadkarni, E. Klein and P. Clifford. *Immunology* 22:847-857, 1972.

Cell suspensions of Burkitt's lymphomas and 21 cell lines established from the tumors were studied for immunoglobulin synthesis. The capacity of biopsied tissues and cell lines to synthesize immunoglobulin was studied by incubating samples in a medium with radioactive amino acids. Of 50 tumor cell suspensions, 31 synthesized IgG (γ -chains) with type κ and/or λ light chains and five synthesized IgM. Of the cell lines, 12 synthesized IgG (γ -chains); ten of these lines produced type κ light chains and three produced type λ light chains. Three cell lines synthesized μ chains. Neither cell lines nor biopsied tissue material synthesized IgA. Comparison of immunoglobulin synthesis by the biopsied tissues and their derived cell lines showed good agreement in all but three cases. Evidently, immunoglobulin synthesis by cell lines and original tumors showed the same pattern. Observation of cells from biopsies of Burkitt tumors taken at different times and of cells from cell lines showed that the capacity to synthesize particular immunoglobulins and chains remained constant over time.

4691 USE OF THE ^{51}Cr RELEASE TEST TO DEMONSTRATE PATTERNS OF ANTIBODY RESPONSE IN HUMANS TO HERPESVIRUS TYPES 1 AND 2. (E.) Smith, J. W. (Baylor Coll. Med., Houston, Texas), E. Adam, J. L. Melnick and W. E. Rawls. *J Immunol* 109(3):554-564, 1972.

Sera from humans infected with type 1 or type 2 herpesvirus were reacted with herpesvirus-infected,

⁵¹Cr-labeled hamster, rabbit or chick cells and cell cytotoxicity was assayed by the ⁵¹Cr release test. Cytolytic antibodies were evident in all sera in tests with all infected cells. Cytotoxicity by serum from herpesvirus type 1-infected humans was unaffected by absorption of the serum with uninfected cells prior to reaction with ⁵¹Cr-labeled target cells. However, cytotoxicity by this serum was reduced from 85 to 60% by absorption with type 2-infected cells before the ⁵¹Cr release assay and was abolished by absorption with type 1-infected cells. Similar results were seen when anti-type 2 serum was absorbed with uninfected, type 1- or type 2-infected cells. Sucrose gradient separation of sera showed that cytolytic activity resided in the IgM and IgG fractions of sera collected up to 28 days after onset of illness, and in the IgG fraction only of sera collected after 8 months. Cytolytic anti-type 2 antibodies were seen in convalescent sera of patients whose acute sera were negative for type 1 antibody; type 2 antibodies were not removed from these sera by absorption with type 1-infected cells. However, patients with antibodies in acute phase sera had little or no type 2 antibody activity in convalescent sera after absorption with type 2-infected cells.

- 4692 ANTIGENIC CHANGES IN MOUSE EPIDERMIS AT VARIOUS STAGES OF NEOPLASTIC TRANSFORMATION. (E.) Carruthers, C. (Roswell Park Mem. Inst., Buffalo, N.Y.) and M. Bhattacharaya. *Gann* 63(3): 299-305, 1972.

Differences in the urea-extractable antigens in normal epidermis, 3-methylcholanthrene (MC)-induced hyperplastic epidermis, and MC-induced papillomas and skin carcinomas from Ha/ICR mice were investigated in immunodiffusion tests with the urea antigens and immunoglobulins raised against them. Hyperplastic epidermis had antigens distinct from, or present in greater amounts than, those in normal skin. Some antigens, however, were clearly shared by hyperplastic and normal epidermis. There were antigenic differences between normal epidermis, and papillomas and carcinomas. Hyperplastic skin shared some urea antigens with papillomas and carcinomas. Papillomas and carcinomas were evidently identical in urea antigen pattern. Apparently differences develop in the course of neoplastic development in the urea antigen pattern of tissues. Normal tissues develop as quite distinct from papillomas and carcinomas, while hyperplastic tissues are intermediate, sharing some urea antigens with normal tissues and some with neoplastic tissues.

- 4693 ANTIBODY IN SERA OF PULMONARY CANCER PATIENTS AGAINST SPECIFIC SURFACE ANTIGEN OF OAT CELLS. (E.) Oboshi, S. (Nat'l. Cancer Ctr. Res. Inst., Tokyo, Japan), T. Seido and S. Tsugawa. *Gann* 62(6):515-522, 1971.

Search for possible tumor-specific reaction in

human lung cancer was attempted by an indirect membrane immunofluorescence technique. Living cells of the established cell line, OAT, derived from human lung cancer of oat cell type, were used as the target cells and both fluorescein isothiocyanate-conjugated anti-human IgG and IgM goat sera were used as the second reagent. Five out of eight sera from the patients with primary lung cancer of oat cell type gave positive membrane immunofluorescence reaction with anti-IgM reagent but not with anti-IgG. However, 27 sera from the patients with other types of carcinoma, including nine cases of primary adenocarcinoma of the lung, and eight sera from healthy individuals gave no positive reaction. No membrane immunofluorescence reaction was given by the selected positive sera, when they were tested against the cell line of Burkitt lymphoma origin, P3HR-1. These results strongly suggest that antibody against the cell surface of OAT cells resides in the IgM fraction of sera from patients with oat cell carcinoma and that the antigen is specific for and common to oat cell carcinomas of the lung.

- 4694 SUPPRESSION OF GROSS LEUKEMIA CELL-SURFACE ANTIGENS: A KIND OF ANTIGENIC MODULATION. (E.) Aoki, T. (Sloan-Kettering Inst., New York, N.Y.) and P. A. Johnson. *J Nat Cancer Inst* 49(1): 183-192, 1972.

The EoG2 Gross virus-induced leukemia of C57BL/6 mice was transplanted i.p. into C57BL/6 mice immunized with cells of an AKR spontaneous leukemia (K36). Tumor growth rate was measured and the presence of G cell-surface antigens (GCSA) in EoG2 tumor cells was determined by cytotoxicity tests with antisera and tumor cells. EoG2 grew more slowly in immunized than in unimmunized mice. In immunized mice the expression of the GCSA antigen was completely suppressed on EoG2 cells. GCSA reappeared on these cells when they were retransplanted back into unimmunized mice. Other cell surface antigens, including H-2^b, GCSAb and G_{IX}, were not suppressed on EoG2 cells in immunized mice. In electron microscopy studies of transplanted EoG2 leukemias, antibody to GCSA antigen did not affect the budding of Gross virus from tumor cells.

- 4695 POSSIBILITY OF *IN VITRO* ALTERATIONS IN CULTURES OF MAMMARY CARCINOMA CELLS, AND ALTERED IMMUNOLOGICAL RESPONSE IN THE RAT: ACQUIRED CAPACITY TO REJECT INJECTIONS OF MAMMARY CARCINOMA CELLS AND IMPLANTS OF MAMMARY CARCINOMA. (E.) Stone, D. (Worcester State Hosp., Mass.), S. A. Zaccarian and K. Pickering. *Brit J Cancer* 26:315-320, 1972.

Male rats were injected s.c. with 5 x 10⁶ cells from cell cultures of a rat mammary adenocarcinoma; cells were treated *in vitro* before inoculation, as follows: no treatment; treatment with sonicates of cultured hamster cells; treatment with sonicates of autochtho-

nous mammary carcinoma cells; treatment with calf-thymus DNA; treatment with salmon-sperm DNA. Of 25 rats given untreated carcinoma cells, only one (4%) failed to develop mammary carcinoma. Of five rats given calf-thymus DNA- or hamster cell sonicate-treated cells, all developed mammary tumors. Of 12 rats given salmon sperm DNA- or cancer cell sonicate-treated cells, nine (75%) did not develop mammary tumors. Five of these 12 rats (41.7%) showed no carcinoma growth at all after injection of tumor cells and all five developed the ability to reject cultured mammary tumor cell inocula. Four rats from this group could also reject implants obtained directly from mammary carcinoma.

4696 COLD-ANTIBODIES IN RAT SERUM AGAINST YOSHIDA-HEPATOMA ASCITES CELLS. (Ger.) Bayer, R. (Max-Planck Inst. Biochem., Munich, West Germany) and I. von Boehmer. *Z Krebsforsch* 77:40-44, 1972.

Antibodies against Yoshida hepatoma ascites (YA) cells were found in rat serum, which required a cold and a warm phase to produce a cytotoxic reaction. When human complement was added, this reaction took place at 37 C only if the cells were first incubated with antibodies-containing serum at 0 C. A relation between the existence of cold antibodies and ascites transplantation was observed in BDE rats; only one of 44 untreated BDE rats possessed cold antibodies compared with 15 of 25 ascites-bearing BDE rats. In BD VI and Sprague-Dawley rat strains, cold antibodies were found in both treated and untreated rats. Furthermore, cold antibodies also occurred in the serum of 12 of 20 BDE rats that did not manifest tumors after transplantation of YA cells. It is possible that the cold antibodies against YA cells occur after an infection, which, in the case of BDE rats, was stimulated by transplant of fresh YA cells.

4697 SEPARATION OF SKIN REACTIVE INTESTINAL CANCER ANTIGEN FROM THE CARCINOEMBRYONIC ANTIGEN OF GOLD. (E.) Hollinshead, A. C. (George Washington U. Med. Ctr., Washington, D.C.), C. G. McWright, C. C. Alford, D. H. Glew, P. Gold and R. B. Herberman. *Science* 177(4052):887-889, 1972.

Patients with rectal and colonic carcinomas were inoculated i.d. with gel fractions of sonicated cell membranes of allogeneic intestinal tumors or with fetal intestinal cell membrane material. Both membrane preparations produced positive delayed skin hypersensitivity reactions. When tumor and fetal intestinal cell membrane soluble fractions were further fractionated by polyacrylamide gel electrophoresis, the Gold carcinoembryonic antigen (CEA) was found in regions 1 and 2 of the gels. No positive skin reactions were associated with these regions. Another antigen was found in regions 3 and 4. Positive skin reactions were elicited by the proteins in these regions. The results indicate that there are two separable types of human intestinal antigen. Each

is found in fetal extracts and, therefore, can generically be called a carcinoembryonic antigen. The antigen that produces the delayed hypersensitivity reaction presumably has a lower molecular wt than the Gold CEA.

4698 NEWER CONCEPTS OF CANCER OF THE COLON AND RECTUM: CELLULAR IMMUNITY TO HUMAN COLONIC CARCINOMAS. (E.) Hellström, I. (U. Washington Med. Sch., Seattle) and K. E. Hellström. *Dis Colon Rectum* 15(2):100-105, 1972.

Experiments are reported in which human colonic carcinoma cells were cultivated and exposed to peripheral blood lymphocytes of autochthonous or allogeneic patients. Killing of tumor cells by lymphocytes was monitored by a microcytotoxicity assay. Lymphocytes from colon carcinoma patients destroyed colonic tumor cells but did not damage autochthonous normal cells or other types of tumor cell. Lymphocytes from normals and from donors with noncolonic cancer were not cytotoxic. Both autochthonous and allogeneic lymphocytes were cytotoxic. In related experiments, lymphocytes from colonic carcinoma patients destroyed cells from human fetal gut epithelium but did not kill human fetal kidney cells. Although lymphocytes from tumor-bearing subjects can destroy colonic tumor cells *in vitro*, colon tumors do grow progressively *in vivo*. This was attributed to serum factors which block cellular immune cytotoxicity.

4699 THE CATABOLISM OF HUMAN γ G IMMUNOGLOBULINS OF DIFFERENT HEAVY CHAIN SUBCLASSES. III. THE CATABOLISM OF HEAVY CHAIN DISEASE PROTEINS AND OF Fc FRAGMENTS OF MYELOMA PROTEINS. (E.) Spiegelberg, H. L. (Scripps Clin., La Jolla, Calif.) and B. G. Fishkin. *Clin Exp Immunol* 10(4):599-607, 1972.

Fc fragments were isolated from γ G, γ G₃ and γ G₄ human myeloma proteins; H chain disease proteins were also isolated from patients. Proteins were labeled with ¹³¹I or ¹²⁵I and injected into men or monkeys. Catabolic parameters for Fc fragments and H chain proteins were established and compared with the catabolism of intact γ G immunoglobulin. Intact γ G myeloma proteins had significantly different half-lives, while Fc fragments were all eliminated at similar rates. Average plasma half-life of all Fc fragments was 4.3 days. This suggested that structures not present on Fc fragments are responsible for the faster turnover of γ G₃ immunoglobulins and for the different half-lives of myeloma proteins within a given subclass. Plasma half-lives, fractional turnover rates, amounts of protein bound radioactivity excreted in urine and extent of intra- and extra-vascular equilibrium did not differ significantly in any of the three pairs of H chain disease proteins. The fractional turnover rate of these proteins averaged 8% of the intravascular pool/day, as compared to 4% for γ G. One-half to 1% of the intravascular H chain protein pool was excreted into the urine, as compared to 0.1% of γ G.

- 4700 THE DEVELOPMENT OF CELLULAR IMMUNITY TO TUMOR CELLS. (E.) Cerilli, J. (Coll. Med., Ohio State U., Columbus) and M. C. Smith. *Surg Gynecol Obstet* 134(5):739-745, 1972.

CBA mice were sensitized by s.c. and i.p. injections of allogeneic tumor cells (a C3H mammary adenocarcinoma or a DBA methylcholanthrene-induced sarcoma). Ten to 14 days later, mice were challenged with allogeneic tumor cells and the migration of macrophages in peritoneal exudates of the mice was observed. Migration of peritoneal exudate from mice sensitized with allogeneic tumor cells was inhibited. Migration inhibition occurred across both the H-1 and H-2 histocompatibility barriers. When mice were sensitized with isogeneic tumor cells, macrophage migration was inhibited. Migration inhibition by isogeneic tumor cells was specific, e.g., peritoneal cells from DBA mice immunized to the isogeneic sarcoma were inhibited in migration but peritoneal cells from DBA mice immunized with C3H adenocarcinoma were not inhibited. In tests with mice bearing progressively growing tumors, the magnitude of cellular immunity increased linearly with time after challenge with isogeneic tumor cells.

- 4701 PASSIVE IMMUNIZATION AGAINST MURINE LYMPHOMA. (E.) Shirato, E. (M.D. Anderson Hosp., Houston, Tex.), J. G. Sinkovics and E. W. Thornell. *Oncology* 26:80-86, 1972.

Newborn Swiss mice were inoculated i.p. with cells of a virus-induced murine lymphoma displaying the "starry sky" histological pattern (620 cells); some mice were injected with 818 cells, a malignant line derived from 620. Both 818 and 620 cells were lymphoblasts which produced leukemia virus and virus-specific immune globulins. Twelve hr after the inoculation of 620 or 818 cells, mice were injected with rabbit anti-620 or anti-818 sera. Anti-818 serum prolonged survival of lymphoma-bearing mice. Mice given 818 cells and no serum survived for about 18 days, while mice given anti-818 serum and 818 cells survived for 28 days. Anti-620 serum prolonged survival of mice injected with 818 cells to about 21 days. From one mouse, a subline of 818 cells was recovered which had developed resistance to antisera.

- 4702 CELL-BOUND MYELOMA PROTEINS ON THE SURFACE OF MYELOMA CELLS: POTENTIAL TARGETS FOR THE IMMUNE SYSTEM. (E.) Hannestad, K. (Washington U. Sch. Med., St. Louis, Mo.), M.-S. Kao and H. N. Eisen. *Proc Nat Acad Sci USA* 69(8):2295-2299, 1972.

Cells from 11 mouse ascites myelomas were tested for rosette formation when mixed with 2,4,6-trinitrophenylated (Tnp)-sheep erythrocytes; rosette formation was used to demonstrate membrane-bound myeloma proteins (MOPC-315 and MOPC-460) with affinity for Tnp groups. Seventy-nine percent of MOPC-315 tumor cells and 57% of MOPC-460 tumor cells formed rosettes directly with Tnp-erythrocytes. Rosette formation with cells from other tumors required addition of hybrid antibodies

with one site specific for Tnp and the other specific for an appropriate tumor cell surface immunoglobulin. The cellbound immunoglobulin in MOPC-315 and MOPC-460 had the same heavy and light chains, idiotypic determinants and ligand-binding specificities as the respective myeloma proteins secreted by these tumors. A tumor designated MOPC-315-NR was grown from a small proportion of MOPC-315 cells that did not directly form rosettes with Tnp erythrocytes. In Ouchterlony gel diffusion, MOPC-315-NR cells were found to secrete only the light chain of protein 315 and to carry this chain on the cell surface. MOPC-315-NR resembled other tumors in mice challenged with MOPC-315 cells during immune responses to the idiotype of protein 315.

- 4703 HOST IMMUNITY TO A GROWING TRANSPLANTED METHYLCHOLANTHRENE-INDUCED GUINEA PIG SARCOMA. (E.) Cohen, A. M. (Natl. Cancer Inst., Bethesda, Md.), R. C. Millar and A. S. Ketcham. *Cancer Res* 32(11):2421-2426, 1972.

Host immunity to a growing antigenic solid tumor was studied with a transplanted methylcholanthrene-induced sarcoma (MCA-25) in inbred female strain 2 guinea pigs. Tumor-specific cellular immunity was evaluated *in vivo* by delayed cutaneous hypersensitivity reactions to a transplantation antigen extract of the tumor and *in vitro* by splenic lymphocyte-mediated cytotoxicity. Animals receiving 100,000 MCA-25 cells i.m. demonstrated tumor-specific cellular cytotoxicity from seven days to the conclusion of the study 28 days after tumor transplant. Tumors were 10% body weight at this time. MCA-25-bearing animals had a degree of tumor-specific cellular cytotoxicity similar to those of guinea pigs "hyper-immunized" to the MCA-25 antigen. Guinea pigs pre-sensitized to dinitrochlorobenzene developed a delayed cutaneous hypersensitivity reaction to a dinitrochlorobenzene challenge in the presence of a growing MCA-25 tumor. Seven and 14 days after tumor transplant, animals developed a delayed cutaneous hypersensitivity reaction to MCA-25 antigen extract. Animals with tumors larger than 1 cm reacted to dinitrochlorobenzene but minimally to the tumor antigen. To explain the discrepancy between *in vitro* and *in vivo* detectable tumor-specific cellular immunity in animals with tumors larger than 1 cm, the effects of serum from these animals on cellular cytotoxicity were evaluated. Serum from animals with palpable MCA-25 tumors completely inhibited MCA-25-specific cellular cytotoxicity but not cellular cytotoxicity directed against another methylcholanthrene-induced tumor. Studies with serum from animals bearing 1- to 1.5-cm tumors suggested that this inhibition was mediated, at least in part, by antibody directed against the MCA-25 tumor-specific antigen.

- 4704 ANTIBODY AGAINST NEOPLASTIC PLASMA CELLS. II. SUPPRESSIVE EFFECT ON ANTIBODY-PRODUCING CELLS. (E.) Watanabe, T. (Roswell Park Mem. Inst.,

Buffalo, N.Y.), Y. Yagi and D. Pressman. *J Immunol* 107(6):1706-1713, 1971.

Rabbit antisera against five lines of BALB/c mouse myeloma were found to contain antibodies which are specific for surface antigens present on both normal and neoplastic plasma cells. When spleen cells from mice previously immunized with sheep erythrocytes were exposed to the antisera and rabbit complement prior to assay, the formation of hemolytic plaques was strongly suppressed, even though the viability of spleen cells in general was not affected. The suppressive effects of anti-myeloma sera on direct and indirect plaque-forming cells (PFC) were similar in both primary and secondary responses. The suppressive effect was seen with PFC of all nine inbred mouse strains tested. The surface antigens which reacted with the PFC-suppressive antibodies were also present on myeloma cells, but did not appear to be present in significant amounts on lymphocytes of thymus, lymph node and spleen, or on cells of liver and kidney.

705 CLONING OF MOUSE MYELOMA CELLS AND DETECTION OF RARE VARIANTS. (E.) Coffino, P. (Albert Einstein Coll. Med., New York, N.Y.), R. Baumal, Laskov and M. D. Scharff. *J Cell Physiol* 79(3):429-440, 1972.

706 A TRANSIENT LYMPHOTOXIC SERUM FACTOR IN A PATIENT WITH CHRONIC LYMPHOCYTIC LEUKEMIA. (E.) Spengler, G. A. (Dept. Biochem., Case Western Reserve U., Cleveland, Ohio) and R. L. Stjernholm. *N J Med Sci* 263(4):241-252, 1972.

707 THE SECRETION OF A BENCE-JONES TYPE LIGHT CHAIN FROM A MOUSE PLASMACYTOMA. (E.) Melchers, F. (Max-Planck Inst. Molecular Genetics, Berlin, Germany). *Eur J Immunol* 1(5):330-335, 1971.

708 STUDIES ON IMMUNOGLOBULINS IN LEUKEMIC PATIENTS. (E.) Szmigiel, Z. (Med. Acad., Racow, Poland). *Acta Med Pol* 12(4):503-522, 1971.

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See also:

- * (Rev): 4336, 4341, 4345
- * (Chem): 4363, 4401, 4444
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- 80 FOCAL LOSS OF RIBONUCLEASE ACTIVITY IN PRENEOPLASTIC RAT LIVER. (E.) Daoust, (Cancer Inst., Montreal, Quebec, Canada). *Cancer Res* 32(11):2502-2509, 1972.

The distribution of RNase activity in livers of rats fed 4-dimethylaminoazobenzene and of rats fed 3'-methyl-4-dimethylaminoazobenzene was examined by means of an improved substrate film method. The development of liver nodules in these animals was accompanied by a loss of RNase activity. This loss was focal and it preceded the formation of hyperbasophilic foci and hepatomas, which were also RNase negative. The loss of RNase activity occurred earlier in animals fed the highly potent 3'-methyl derivative than in those submitted to the less active azo dye. The results suggest that a deficiency in RNase activity may represent a prerequisite in tumor formation.

- 81 SIMPLE ATROPHIC GASTRITIS AND GASTRIC CARCINOMA. (E.) Walker, I. R. (Royal Melbourne Hosp., Australia), R. G. Strickland, B. Ungar and I. R. Mackay. *Gut (London)* 12(11):906-911, 1971.

Four cases of gastric carcinoma in patients who had atrophic gastritis 9, 10, 18 and 21 yr before diagnosis of cancer are presented. The four cases were derived from long-term observations of 40 atrophic gastritis patients. The four patients included two men, aged 54 and 40 yr, resp., and two women, aged 64 and 57 yr, resp. Tests of vitamin B₁₂ absorption in three patients gave normal results and no gastric autoantibodies were detected in the four patients tested. The gastritis developed by the four patients was multifocal and involved the antrum in three patients; it, therefore, differed from the diffuse gastritis associated with pernicious anemia. Atrophic gastritis without pernicious anemia was concluded to be a more common precursor of gastric carcinoma than atrophic gastritis with pernicious anemia.

- 82 METABOLIC CONTROLS IN PRECANCEROUS LIVER: DEFECTIVE CONTROL OF CHOLESTEROL SYNTHESIS IN RATS FED N-2-FLUORENYLACETAMIDE. (E.) Horton, J. (Waite Agric. Res. Inst., Adelaide, Australia) and J. R. Sabine. *Europ J Cancer* 7(5):459-465, 1971.

Male rats were fed N-2-fluorenylacetamide (FAA) as 0.5% of a basal diet for 2, 3 or 5 wk. Control of cholesterol synthesis during carcinogen treatment was tested by feeding 5% cholesterol for three days, then killing the rats and observing production of ¹⁴C-cholesterol in liver slices treated with 1-¹⁴C-acetate. Liver slices from rats not receiving FAA showed normal control of cholesterol synthesis, while livers of FAA-fed rats showed enhanced cholesterol synthesis with complete loss of feedback control at 3 wk and partial loss at 11 wk. By 16 wk, feedback control was restored in liver but not in hyperplastic nodules present on

some livers at that time. Mean cholesterol synthesis values for FAA-red rat groups were highly variable, ranging from 0.43-1.64% of ¹⁴C recovered from 1-¹⁴C-acetate. Mean values for rats given neither FAA nor cholesterol were 0.22-1.20%, while mean values for rats given cholesterol but no FAA were 0.03-0.10%.

- 4783 AREGENERATIVE ANEMIA WITH HYPERCELLULAR SIDEROBLASTIC MARROW. A PRELEUKEMIC CONDITION. (E.) Reizenstein, P. (Karolinska Hosp., Stockholm, Sweden) and B. Lagerlöf. *Acta Haemat* 47:1-12, 1972.

Twenty-three patients with aregenerative anemia (i.e., anemia with an erythrocyte radio-iron incorporation below 55%) were divided into three groups on the basis of bone marrow morphology: patients with hypocellular, fat-rich marrow (group A); patients with a hypercellular marrow with little fat (group B); and patients with marrow fibrosis (group C). Group A patients had granulocytopenia, but no thrombocytopenia and did not develop leukemia; four of 14 Group B patients died with acute myeloblastic or promyelocytic leukemia; these patients had no granulocytopenia but did have thrombocytopenia and sideroblastosis. Group C patients (three) died with either pancytopenia, leukocytosis or thrombocytosis. Aregenerative anemia with hypercellular marrow and sideroblastosis was considered to be a preleukemic condition.

- 4784 SUBCELLULAR LOCALIZATION OF SURFACE ADENOSINE TRIPHOSPHATASE ACTIVITY IN PRENEOPLASTIC LIVER PARENCHYMA. (E.) Karasaki, S. (Cancer Inst. Montreal, Quebec, Canada). *Cancer Res* 32:1703-1712, 1972.

Male Wistar rats were fed a diet containing 0.06% N,N'-dimethylaminoazobenzene (DAB) for 90 or 180 days. DAB-fed rats were killed and livers were removed and examined (by the Wachstein-Meisel technique) under light and electron microscopes for the presence and distribution of surface adenosine triphosphatase (ATPase). In normal liver parenchyma and in regenerative liver nodules of DAB-fed rats, ATPase reactions were largely confined to bile canaliculi; no ATPase was seen in cell cytoplasm. In contrast, hyperbasophilic foci exhibited ATPase activity over the entire surface of hepatocytes, rather than only at the bile canaliculi. This altered pattern of ATPase was seen even in well-differentiated hepatocytes within the foci. Surface changes of ATPase in hyperbasophilic foci were followed by an increased irregularity of plasma membranes and alterations of other cell organelles, suggestive of dedifferentiation. DAB-induced hepatomas showed cellular atypism and pleomorphism. The entire surfaces of atypical hepatoma cell were usually covered by ATPase reaction products.

- 4785 ELECTRON MICROSCOPIC OBSERVATIONS ON STRUCTURES RELATED TO THE EPITHELIAL BASEMENT MEMBRANE IN SQUAMOUS CELL CARCINOMA. (E.) Frithiof, L. (Karolinska Inst., Stockholm, Sweden). *Acta Otolaryngol (Stockh)* 73:323-334, 1972.

Half-desmosomes, filaments traversing the lamina lucida and aperiodic fibrils were examined in oral epithelium from patients with epithelial hyperplasia, carcinoma *in situ* or suspected invasive carcinoma. Electron microscopy showed that when the basement membrane of cells was absent or atypical, half-desmosomes, traversing filaments and aperiodic fibrils were absent or altered in structure. Observations suggested that the extracellular portions of half-desmosomes originated from the lateral aggregation of the traversing filaments. Half-desmosomes were thought to play a part in the transport of material from basal cells. Aperiodic fibrils were regarded as tropocollagen aggregates. It was concluded that aperiodic fibrils and basement membrane material have a common epithelial origin.

- 4786 BONE MARROW INVOLVEMENT IN BURKITT'S LYMPHOMA: RESULTS OF A PROSPECTIVE STUDY. (E.) Bluming, A. Z. (Uganda Cancer Inst., Kampala), J. L. Ziegler and P. P. Carbone. *Brit J Haemat* 22(3):369-376, 1972.

Bone marrow involvement was studied in 85 previously untreated Burkitt's lymphoma patients. Fourteen patients had bone marrow involvement at some time during the course of their disease (seven of these presented with bone marrow involvement). Bone marrow involvement was generalized; in no case were marrow tumors confined to a single site. Of the 14 patients with bone marrow involvement, only four had tumor cells in peripheral blood; of these four, two had 90% or more circulating tumor cells. Neither sex appeared inordinately prone to bone marrow involvement. The prognosis was slightly worse in patients developing marrow involvement following initial cyclophosphamide treatment than in patients presenting with marrow involvement. Pretreatment bone marrow lymphocytes were 50% higher in patients who later developed bone marrow involvement than in patients who never showed marrow involvement.

- 4787 COMPARATIVE MORPHOGENESIS OF MALIGNANT SKIN MELANOMA. (E.) Blinova, G. A. (Petrov Inst. Oncol., Leningrad, USSR). *Tumori* 57(6):361-371, 1971.

Malignant skin melanomas from 181 female and 95 male patients were examined and classified histologically. The commonest sites of melanomas were the leg in women and the trunk in men. The 276 tumors were divided into those originating from junctional melanoblasts (epidermo-dermal malignant melanomas, or ED type) and those originating from intradermal nevi without involvement of melanoblasts (intra-

dermal malignant skin melanomas or ID type). The ED type was seen more often in legs and feet and the ID type on the trunk. Both types showed rapid as well as slow growth, and there were no clear differences in size, invasiveness or morphological properties between the two types. Lymph node metastasis was more evident in ID than in ED tumors, and ID tumors had a poorer prognosis than ED tumors.

- 4788 PATHOGENESIS OF LYMPHOID NEOPLASIA IN CATS AND ITS RELATIONSHIP TO IMMUNOLOGIC CELL PATHWAYS. I. MORPHOLOGIC ASPECTS. (E.) Mackey, L. J. (U. Glasgow Vet. Sch., Scotland) and W. F. H. Jarrett. *J Nat Cancer Inst* 49(3):853-865, 1972.

Development of lymphoid neoplasia in the cat was studied. Both naturally occurring and experimentally induced neoplasms were examined. They occurred in 4 morbid anatomical distributions: alimentary, multicentric, and thymic lymphosarcoma and leukemia, and in 5 cytologic categories: stem cell, lymphoblastic, prolymphocytic, histiocytic, and lymphohistiocytic. The sites of multiplication and routes of migration through the primary and secondary lymphoid organs were distinct in each morbid anatomic form. In alimentary lymphosarcoma, Peyer's patches and the germinal centers of lymph nodes were initially involved, whereas in multicentric and thymic lymphosarcoma, the early lymph node lesions affected only the paracortical or thymus-dependent areas. In leukemia, the main route was hematogenous, with malignant cells in the bone marrow, red pulp of the spleen, and in the medulla of lymph nodes, as well as the bloodstream. Our results indicate a parallel between the distribution of cells in each form of neoplasia and in different compartments of the immunocyte-producing system. The implications for leukemogenesis are discussed.

- 4789 RELAPSE PATTERNS IN BURKITT'S LYMPHOMA. Ziegler, J. L. (Makerere U. Med. Sch., Kampala, Uganda), A. Z. Bluming, L. Fass and R. H. Morrow, Jr. *Cancer Res* 32:1267-1272, 1972.

The clinical course of 130 patients with histologically confirmed Burkitt's lymphoma seen at the Lymphoma Treatment Center in Kampala, Uganda, was reviewed. Death occurred soon after treatment in 18 (14%), and failure to respond to chemotherapy was observed in five (4%). Of the 107 patients who achieved complete remissions, 84 were followed for at least one yr, or until relapse. Tumor relapse was observed to be of two distinct types. Early relapse was characterized by recurrent tumor growth in the same site as the original tumor and occurred within ten wk of initial therapy. Patients with early relapse tended to have generalized disease on admission, responded poorly to subsequent treatment, and had a poor prognosis. Late relapse occurred more than ten wk after initial therapy and usually appeared in previously uninvolved anatomical sites.

Responses to subsequent chemotherapy were excellent, and the prognosis was good. The pattern of relapse appeared to be independent of the aggressiveness of the initial chemotherapeutic regime. Drug resistance, immunoresistance and/or host immune failure are postulated to explain the emergence of early relapse. Although immunological mechanisms may be operative in the pathogenesis of late relapse, reinduction of tumor remains a possibility.

4790 ANTIGEN-DEFICIENT CELL VARIANTS IN PRENEOPLASTIC FOREIGN BODY REACTION OF MICE.

(E.) Brand, K. G. (Med. Sch., U. Minnesota, Minneapolis), L. C. Buoen and I. Brand. *J Nat Cancer Inst* 49(2):459-465, 1972.

Sarcomas were induced in F₁ hybrids of congenic CBA/Br and CBA/H-T6 or CBA/H mice by s.c. implantation of plastic films. Antigen-deficient variants were derived from 80% of such hybrid tumors by transplantation of multiple tumor pieces to nonhybrid animals of either parent genotype. This percentage was slightly higher than that recorded for chemically induced and spontaneous tumor groups. In another experiment, the implants and surrounding tissue capsules were removed from the hybrid animals during the preneoplastic period 7 1/2 months after implantation. Segments of this material were transferred to nonhybrid animals of either parent genotype. In 60% of preneoplastic transfer experiments, antigen-deficient variant tumors were obtained up to 14 months after transfer. Hybrid origin of the tumors was confirmed on the basis of 16 chromosomes. It is concluded that preneoplastic antigen-deficient variant cells are quite regularly produced in foreign body reactions of mice which, much later, may lead to sarcomas. Quantitative considerations suggest that, in the original hybrid host, preneoplastic variant cells are less competitive than preneoplastic nonvariant cells.

4791 ASPARTATE TRANSCARBAMYLASE CONCENTRATIONS IN RELATION TO GROWTH RATES OF FETAL, ADULT, AND NEOPLASTIC RAT TISSUE. (E.) Herzfeld, A. (Harvard Med. Sch., Boston, Mass.) and W. E. Knox. *Cancer Res* 32:1842-1847, 1972.

Aspartate transcarbamylase activity was assayed in rat tissues and the limitation caused in some tissues by carbamyl phosphate hydrolysis was avoided. Significant activity was found in the particulate cell fractions, especially in fetal and neoplastic tissues, as well as in soluble fractions. The enzyme of the particulate fraction was more sensitive to heat and had greater affinity for aspartate than had the soluble enzyme. Total aspartate transcarbamylase concentrations, relative to the liver standard, were generally higher in fetal tissues and decreased within three weeks after birth to normal adult levels. In the mammary gland, it rose and fell during the lactation cycle in parallel with cellular growth. In transplanted tumors, the relative enzyme concentration was significantly correlated with measured rates of

growth in tumor volume over a 6-fold range of levels and rates. Relative concentrations per g in the faster tumors were similar to those in fetal tissues that grew at similar rates.

4792 TUMORS DEVELOPING FROM *IN VITRO*-TRANSFORMED CELLS IN HOMOLOGOUS AND HETEROLOGOUS ANIMALS. (Rus.) Kuz'mina, S. V. (Inst. Biophys., Moscow, USSR) and L. I. Kalinina. *Vop Onkol* 17(11):59-62, 1971.

A study was made of the tumor-forming activity of four new lines of mouse fibroblasts (MED-14, MED-15, MED-21, and MED-23) when inoculated into mice and hamsters and heterologous recipients. The fibroblasts were cultivated in a mixture of 2/3 Eagle's medium, 1/3 0.5% lactalbumin hydrolyzate, and 10% bovine serum. The fibroblasts were obtained from trypsinized cultures of embryonic fibroblasts of C₃Hf pu II mice by prolonged cultivation *in vitro*. The cells, plain or trypsinized were injected s.c. into 2-30-day-old C₃Hf pu II mice. Some 14- and 30-day-old mice received single s.c. injections of 2.5 mg cortisone acetate 1-2 days before inoculation with fibroblasts. The lines MED-14, MED-15, and MED-23 were contaminated with mycoplasma and were later treated with antibiotics. Syrian hamsters (40), 20 and 30 days old, were injected in both cheek pouches with these fibroblasts. Tumors were morphologically examined immediately and one month after their appearance. All four fibroblast lines produced tumors in C₃Hf pu II mice. Tumors appeared 1-2 days earlier after inoculation of non-trypsinized cells than after trypsin-treated cells. Tumors appeared earlier after inoculation with mycoplasma-free than with mycoplasma-infected cells. In all mice tumors developed early, in the first week after inoculation and, in some cases, were then resorbed. Tumors were sarcomas: mostly spindle-cell and less often polymorphic. In mice given a single s.c. injection of 2.5 mg cortisone acetate, large tumors developed, causing death of the animals. Irreversible large tumors (spindle-cell sarcomas) developed in hamsters which had received MED cells in the cheek pouches. Thus, all cell lines of MED studied showed tumorigenic properties after prolonged *in vitro* cultivation.

4793 ADENOCARCINOMA *IN SITU* OF THE UTERINE CERVIX. (E.) Weisbrot, I. M. (Dept. Path., Norwalk Hosp., Conn.), C. Stabinsky and A. M. Davis. *Cancer* 29(5):1179-1187, 1972.

Case histories of five patients suffering from adenocarcinoma *in situ* (AIS) of the uterine cervix, a rare lesion that may be a precursor of invasive adenocarcinoma, are reported. A starting coincidence with epidermoid carcinoma *in situ* was found. The following observations support the hypothesis that AIS is a precursor of invasive adenocarcinoma: 1) the neoplastic cells line endocervical glands; 2) transitions between benign and malignant epithelium occur in glands retaining a normal or an organoid pattern; 3) individual epithelial cells exhibit pleomorphic changes of carcinoma; 4) the supporting stroma re-

tain a normal relationship to the involved glands; 5) infiltration of stromal connective tissue by minute acini, cell clusters or single file columns was not observed; and 6) none of the cases of AIS treated by complete excision had recurrence of invasive tumor tissue.

- 4794 PATHOGENESIS OF ABELSON-VIRUS-INDUCED MURINE LEUKEMIA. (E.) Siegler, R. (Boston U. Sch. Med., Mass.), S. Zajdel and I. Lane. *J Nat Cancer Inst* 48(1):189-218, 1972.

Neonatal strain Ha/ICR mice injected i.p. with 0.1 ml Abelson virus stock developed a previously unrecognized form of leukemia. The earliest alterations seen in treated mice was retardation or developmental failure of lymph nodes (19 days postinoculation). From 15-20 days postinoculation, 80 of 100 treated mice showed proliferation of undifferentiated stem cells in bone marrow. Proliferating marrow cells spread out from the marrow cavity to invade contiguous structures. Death usually occurred within 30 days postinoculation. C-type virions were seen in tissues of mice inoculated with Abelson virus. Rats given 0.2 ml virus stock within 24 hr of birth developed enlarged (five- to tenfold) cystic lymph nodes and also a severe hemolytic anemia. A mechanism of oncogenesis by Abelson virus which differs from conventional models of viral leukemogenesis is proposed.

- 4795 MULTIPLE PRIMARY TUMOURS IN THE OROPHARYNX AND THE LARYNGOPHARYNX. (E.) Thomas, K. (Northampton Gen. Hosp., England). *J Laryngol Otol* 86(4):327-334, 1972.

- 4796 LIGHT-CHAIN DISEASE (HYPOGAMMAGLOBULINEMIA AND BENCE JONES PROTEINURIA) AND SIDEROBLASTIC ANEMIA -- PRELEUKEMIC CHRONIC GRANULOCYTIC LEUKEMIA. (E.) MacSween, J. M. (Dept. Med., U. Dalhousie, Halifax, N.S., Canada) and G. R. Langley. *Can Med Assoc J* 106(9):995-998, 1972.

- 4797 PAROTID CLEAR-CELL ADENOMA OF POSSIBLE MYOEPITHELIAL ORIGIN. (E.) Saksela, E. (Dept. Path., U. Helsinki, Finland), J. Tarkkanen and J. Wartiovaara. *Cancer* 30(3):742-748, 1972.

- 4798 NEW CONCEPTS OF THE PATHOGENESIS AND TREATMENT OF NON BETA ISLET CELL CARCINOMA OF THE PANCREAS. (E.) Friesen, S. R. (U. Kansas Sch. Med., Kansas City). *Bull Soc Int Chir* 31(1):39-45, 1972.

- 4799 RESPONSIVENESS OF PRENEOPLASTIC AND NEOPLASTIC MOUSE MAMMARY TISSUES TO HORMONES: CASEIN AND HISTONE SYNTHESIS. (E.) Hohmann, P. (Cancer Res. Lab., U. California, Berkeley), H. A. Bern and R. D. Cole. *J Nat Cancer Inst* 49(2):355-360, 1972.

- 4800 A SEARCH FOR GENE DEREPRESSION IN RNA OF PRIMARY RAT HEPATOMAS. (E.) Shearer, R. W. (Sch. Med., U. Washington, Seattle) and E. A. Smuckler. *Cancer Res* 31:2104-2109, 1971.

- 4801 URAEMIA AND MAST-CELL PROLIFERATION. (E.) Neiman, R. S. (U. Southern California, Sch. Med., Los Angeles), M. D. Bischel and R. J. Lukes. *Lancet* (7757):959, 1972.

- 4802 STUDIES ON TUMOR VARIABILITY. III. H₁₀Z TUMOR ASCITIC TRANSFORMATION. (E.) Fadei, L. (Inst. Oncol., Bucharest, Romania). *Oncology* 26:68-79, 1972.

- 4803 THE SPECTRUM OF BENIGN TO MALIGNANT LYMPHO-PROLIFERATION IN SJÖGREN'S SYNDROME. (E.) Anderson, L. G. (Natl. Inst. Hlth., Bethesda, Md.) and N. Talal. *Clin Exp Immunol* 10(2):199-221, 1972.

- 4804 ORGAN CULTURES OF NORMAL, DYSPLASTIC, HYPERPLASTIC, AND NEOPLASTIC HUMAN MAMMARY TISSUES. (E.) Wellings, S. R. (Sch. Med., U. California, Davis) and V. L. Jentoft. *J Nat Cancer Inst* 49(2):329-338, 1972.

- 4805 THE POSSIBLE ROLE OF DERMAL LYMPHATICS IN THE DISSEMINATION OF BREAST CANCER. (E.) Kett, K. (U. Med. Sch. Pecs, Hungary), I. Kadas, L. Tabar and L. Lukacs. *Lymphology* 5:37-41, 1972.

- 4806 LYMPHATIC DISSEMINATION OF CANCER CELLS IN MICE TRANSPLANTED INTRATIBIALLY WITH EHRlich CARCINOMA. (E.) Franchi, G. (Inst. Pharmacological Res., Milan, Italy), I. R.-D. Innocenti, S. Garattini, O. Alfieri, G. Cademartiri and G. Ottaviani. *Lymphology* 5:31-36, 1972.

See also:

- * (Rev): 4306, 4316, 4331, 4354
- * (Chem): 4364, 4385, 4389, 4400, 4407, 4415, 4429, 4437, 4440, 4452, 4455, 4464
- * (Viral): 4572, 4576
- * (Immun): 4624, 4681, 4692
- * (Epid): 4830

4807 DISPOSITION TO LUNG CANCER, AGE AND MONTH OF BIRTH. (Ger.) Danneel, R. (Zool. Inst. U. Bonn, West Germany). *Z Krebsforsch* 76(4):231-235, 1971.

An attempt to link cancer proneness with month of birth in certain age groups is reviewed. The assumption that bronchial carcinoma occurs more frequently in individuals born in February or March is not acceptable on the basis of the data presented. As determined by statistical evaluation of this data, the control groups used for comparison of significance were inadequate. In one case of such attempt at correlation, the control group used was a normal population, and in another case, the control group data were limited to hospital records (cancer cases being omitted) of men aged 50-70 yr. Aside from the unlikelihood of such results being reproducible, it is doubtful that geophysical or cosmic situations in which a man is born could influence his inherited physical and mental constitution to such an extent that they would prevail for the rest of his life. For the individual, such correlations are meaningless, and statistical evidence would have to be based on a very large population.

808 INCIDENCE OF GONADAL CANCER IN THE QUAAHAUG *MERCENARIA MERCENARIA*. (E.) Barry, M. M. Natl. Marine Water Quality Lab., West Kingston, I.I.) and P. P. Yevich. *Oncology* 26:87-96, 1972.

The incidence of gonadal cancers was determined in male and female *M. mercenaria* collected during the summers of 1969 and 1970 in the vicinity of Rose Island Narragansett Bay, Rhode Island. Of 316 females and 223 males studied, 12 females had ovarian tumors and two males had testicular neoplasms. Only one animal (a female) showed evidence of neoplastic cellular invasion which involved the red gland, heart and genital pores. Female and male tumors were histologically the same and were apparently of germ cell origin. Although quahaug neoplasias had several of the characteristics of mammalian germ cell tumors, their lack of lymphocytic infiltration of the connective tissue stroma and the absence of a lobular arrangement of vesicular cells were distinguishing.

809 ANALYSIS OF TRENDS IN AGE-ADJUSTED INCIDENCE RATES FOR 10 MAJOR SITES OF CANCER. (E.) Sullivan, P. D. (Connecticut State Dept. Hlth., Hartford), B. Christine, R. Connelly and H. Barrett. *Am Public Health* 62(8):1065-1071, 1972.

x- and age-specific incidence rates for ten primary cancer sites for 1935-1965 were compared from Connecticut Tumor Registry data. Highly significant increases in incidence of stomach cancer and intestinal cancer were found for both sexes over the 30 yr study period. Stomach cancer and prostate incidence decreased. Lung cancer increased among males more rapidly than other cancers; a significant increase in lung cancer among females was seen for the period 1950-1965. Female

breast cancer increased somewhat, while the incidence of ovarian cancer remained the same during the study period. Uterine cervix cancer remained constant from 1935-1950, then increased significantly between 1950-1965. Uterine corpus cancer incidence rose, probably because cervical cancers formerly registered as "not specified" were later designated as corpus cancer.

4810 RATHKE-POUCH TUMORS IN CHILDREN TREATED AT THE NEUROSURGERY DEPARTMENT OF THE MEDICAL ACADEMY IN KRAKOW. (Pol.) Kunicki, A. (Acad. Med., Cracow, Poland), S. Lechowski, E. Madroszkiewicz and E. Szwagryk. *Neurol Neurochir Pol* 21(5):715-720, 1971.

Clinical manifestation and therapy of 28 children with craniopharyngioma are presented. Five of the children (1 boy, 4 girls) were 0-5 yr; 12 (6 girls, 6 boys) were 6-10 yr; and 11 (4 girls, 7 boys) were 11-14 yr. The most frequent clinical symptoms included headache (85.7%), vomiting (57.2%), impairment of visual acuity (60.7%), impaired growth (50%), obesity (25%), diabetes insipidus (21.5%), drowsiness (17.8%), mental retardation (10.7%), double vision (10.7%) and hemiparesis (3.5%). Endocrine disturbances causing impairment of somatic development, visual disturbances and symptoms of increased intracranial pressure often occurred early in life. Prediagnostically, the most common symptoms were headaches (average duration, 10 months), vomiting (8 months) and impairment of vision (5 months). The most common ocular symptoms were simple atrophy and choked optic disc. Radiologic changes included supra- and intracellar calcification (20 out of 28). Surgery was performed on 27 children: eight are alive 1-9.4 yr later (28%), six died 1-8 yr after surgery, five had recurrence 4-36 months later, six died during the first operation (22%) and four out of five died during the second operation performed because of recurrence.

4811 STATISTICS OF MULTIPLE PRIMARY MALIGNANT NEOPLASMS AND RELATED PROBLEMS. (Jap.) Baba, K. (Keio U. Sch. Med., Tokyo, Japan), Y. Shimosato, S. Watanabe and T. Tajima. *Jap J Cancer Clin* 17(6):424-436, 1971.

Autopsy records for 2104 cases of malignant tumors diagnosed at the National Cancer Research Center (NCC) in Tokyo between May 1962-December 1969 were statistically analyzed for incidence of multiple primary malignant neoplasms. For comparison, records of 486 malignant neoplasms autopsied at Keio University between January 1962-December 1966 were also studied. Frequency of multiple primary malignant neoplasms, including latent, bilateral, single-organ neoplasms or a combination of malignant epithelial and nonepithelial neoplasms, at NCC was 5.4% (111 cases). Excluding bilateral and single-organ primary multiple malignant neoplasms, the frequency was 3.1% (64 cases). The incidence of primary malignant multiple neoplasms, excluding bilateral and single-organ neoplasms, at Keio University Hospital was 2.9%. The annual rate

of increase of frequency of multiple primary malignant neoplasms was 6.8% for Keio University and 10.6% for NCC. These values are higher than the expected frequency calculated according to Warren and Gate's method (1.5%).

- 4812 GEOGRAPHIC DISTRIBUTION OF SKIN CANCER. (E.) Urbach, F. (Temple U. Sch. Med., Philadelphia, Pa.). *J Surg Oncol* 3(3):219-234, 1971.

The role of the ultraviolet radiation of sunlight is presented in relation to the etiology and incidence of skin cancer. A chemical dosimeter system sensitive to UV light was coated on mannequin heads. These in turn were exposed to natural UV light for varying periods. By calculating exposure angles, simulation of a ten-minute exposure representing the month of July at 10 A.M. or 2 P.M. and 8 A.M. or 4 P.M. was achieved. Distribution of sun and sky UV radiation over the irregular surfaces of the mannequin heads was noted. Protection (by shading) of the orbits, upper lip, anterior neck under the chin, retroauricular and nasolabial fold areas was striking. In contrast, tips of ears, nose, scalp, lower posterior neck received maximum amounts of radiation. These findings are important for an understanding of diseases probably due to light (lupus erythematosus, porphyria, polymorphic light eruption and certain types of skin cancer). In additional tests of reflected radiation, grass, water, sand and aluminum foil were used as reflector materials. Grass and water did not significantly affect UV light exposure through reflection. A striking increase was noted in the exposure to radiation by reflection of previously protected head areas when sand and aluminum foil were used as reflector materials. A preliminary study of the distribution by site indicated tendency for squamous cell carcinoma to occur primarily on sites most heavily exposed to UV radiation. In contrast, basal cell carcinomas appeared on areas slightly exposed to UV radiation, indicating that some factor in addition to UV radiation is active in this type of carcinoma. These results demonstrate that anatomical contours have a significant effect on the amount of UV radiation reaching various skin areas. Detailed epidemiologic, meteorologic and biologic studies are presently being carried out on an international basis to develop appropriate prophylactic measures for certain types of cancers related to UV exposure.

- 4813 IMMUNOEPIDEMIOLOGICAL AND *IN VITRO* STUDIES OF POSSIBLE RELATIONSHIPS BETWEEN AUSTRALIA ANTIGEN AND HEPATOCELLULAR CARCINOMA. (E.) Smith, J. A. (Dept. Path., U. Ibadan, Nigeria) and T. I. Francis. *Cancer Res* 32:1713-1720, 1972.

Sera from 50 African hepatocellular carcinoma patients were tested by double diffusion and electrophoresis for Australia antigen (Au(1)) and its antibody for the α -fetoprotein (AF). Sera from control patients with other diseases and liver

tissue from liver cancer patients and controls were also studied. One of the 50 liver cancer patients had Au(1) in serum and two had the Au(1) antibody. Thirty-four liver cancer patients, including the Au(1)-positive carcinoma patient, were AFP positive. The two liver cancer patients with Au(1) antibody were AFP-negative. Liver biopsies of liver cancer patients were negative in direct immunofluorescence tests with anti-Au(1) sera; liver biopsies from some normal blood donors showed positive fluorescence. No control sera showed Au(1). No changes were seen in cultured liver cells treated with Au(1)-positive human sera; cytoplasmic and nuclear Au(1)-associated fluorescence appeared in these cultures 72 hr after initiation. Liver cancer cells treated with Au(1)-positive sera showed cytopathic effects and became nonviable, while serum-treated control liver cell cultures remained viable. No malignant transformation was seen in any liver cell culture. Liver cell cultures treated with 2-acetylaminofluorene and tannic acid showed conversion to an AFP-positive state, a change thought to signalize malignant transformation. Liver cells transplanted into rats continued to produce human AFP in rat sera. Cultured liver cells treated with Au(1)-positive sera had more chromatid breaks in chromosomes than did untreated cultured liver cells.

- 4814 BIAS IN AN AFRICAN CANCER REGISTRY. (E.) Templeton, A. C. (Dept. Path., Makerere U., Kampala, Uganda) and A. Bianchi. *Int J Cancer* 10:186-193, 1972.

Data on cancer incidence throughout Uganda collected since 1952 by the Kampala Cancer Registry were compared with data from Kyadondo County, Uganda, an area where there are many hospitals with reliable records. The comparison indicated that, especially in its early years, the Kampala Registry tended to under-register females, sometimes on the order of two- or three-fold. This bias against female patients was detected by observing increases in female cancer rates in recent years. The age distribution of cancer incidence in all regions of Uganda has remained constant since 1954; there was little correlation between year of study or rate of registration and the proportion of patients over 45 years old. Deep tumors were also formerly underdiagnosed in the Kampala Registry. The biases against female patient registration and against inaccessible tumors have diminished in recent years, probably because of changing social patterns and the increase in hospitals.

- 4815 FAMILIAL OCCURRENCE OF NEOPLASMS OF THE CENTRAL NERVOUS SYSTEM. (Pol.) Bromowicz, J. (Neurosurg. Clin. WAM, Lodz, Poland), H. Araszkiewicz and B. Kinderman. *Neurol Neurochir Pol* 21(5):721-725, 1971.

Two pairs of rare neoplasms (occurring among 1,000 cerebral neoplasms and 200 spinal cord neoplasms treated at a Polish clinic) are described. The first

pair involves two sisters (aged 5 and 10) with optic nerve glioma (astrocytoma), which had caused blindness in their left eyes and severe loss of vision in their right eyes. Head X-rays of both girls showed almost identical changes. The second pair involves a 30-yr-old mother who was operated on with good results for a spinal ependymoma (extra-medullary location at the Th₁-Th₄ level) and her 8-yr-old son who was operated on for astrocytoma of the vermis, which blocked the fourth ventricle. It is stressed that although in the second pair of cases the neoplasms were not identical in structure, they were located in the middle line of the central nervous system.

- 4816 TWO MAJOR HISTOLOGICAL TYPES OF GASTRIC CARCINOMA AMONG THE FIXED POPULATION OF HIROSHIMA AND NAGASAKI. (E.) Yamamoto, T. (Natl. Inst. Hlth., Tokyo, Japan) and H. Kato. *Cann* 62(5):381-387, 1971.

Lauren's histological classification of gastric carcinoma based on the presence of either intestinal or diffuse type was applied to autopsy cases in the fixed population sample of Hiroshima and Nagasaki for 1961-1969. The intestinal type was chiefly seen in older persons and the diffuse type was more frequent in younger persons, especially in women. The ratio of the intestinal type to the diffuse type in Japan was compared with this ratio for high or low risk areas in other countries. The trend of this ratio was similar to that in other cities. There was no statistically significant relation between the occurrence of either type of gastric carcinoma and radiation exposure.

- 4817 EPITHELIOMA OF THE SCROTUM IN SCOTLAND IN 1967. (E.) Doig, A. T. (No affiliation). *Hlth Bull* 28(3):45-51, 1970.

An analysis of 18 definite cases of scrotal epithelioma treated in a hospital in Scotland during 1967 is presented. Two-thirds of the cases were attributed to occupational exposure to oil (9), tar and bitumen (2), and pitch (1). Of the six cases classified as definitely or probably nonoccupational, lack of cleanliness and senility appeared to be the main etiological factors. Clinical aspects, including presence of ulceration or metastasis in glands; treatment; prognosis; and mortality for the individual cases are detailed. Lack of personal cleanliness stemming from inadequate plumbing facilities is seen as an important factor in the incidence of the disease.

- 4818 NASOPHARYNGEAL CARCINOMA IN UGANDA. (E.) Schmauz, R. (Med. Sch., Makerere U., Kampala, Uganda) and A. C. Templeton. *Cancer* 29(3):610-621, 1972.

The histologic features of nasopharyngeal carcinoma in Uganda are outlined. A five-year survey (1964-

1968) of neoplasms seen in the Department of Pathology, Makerere University, Kampala, revealed 90 cases of nasopharyngeal cancer, 83 of which were carcinomas. Histologically, the carcinomas were poorly differentiated and marked by the absence of keratinization and prickly cells. In some tumors, the nuclei were very large, usually round or oval, with a vesicular appearance and prominent nucleoli; these tumors were designated large-cell type. The Regaud type of tumor, in which cells occur in clumps, was quite common. Other tumors were the small-cell type; in these tumors the entire tumor mass was composed of small, often elongated, cells. In many cases histocytes were interspersed with tumor cells giving rise to a starry-sky pattern. Excluding 19 cases from outside Uganda, 44 of the patients with nasopharyngeal cancer were males and 20 were females. The small-cell type of tumor occurred predominantly in older men, and there was a trend toward increasing cancer incidence with age. The nasopharyngeal tumors appeared to be more common and to occur earlier in the northern Nilotic and Para-Nilotic peoples than in the southern Bantu and Sudanic groups. The extent to which these differences are due to hereditary and environmental factors is uncertain.

- 4819 EPIDEMIOLOGY OF LEUKEMIA AND LYMPHOMA IN AN AREA OF THE BUENOS AIRES PROVINCE (1967): COMPARISON WITH THE YEARS 1965-1966. I. LEUKEMIA. (Sp.) Delfor Podesta, L. (No affiliation), E. I. Calcagno, E. Quiroga Micheo and A. Fernandez. *Sangre* 16(1):45-64, 1971.

Mortality from leukemia amounted to 4.04/100,000 (4.66 males and 3.40 females/100,000) in an area covering 19 districts of Buenos Aires Province with an 1.8 million population in 1967. The incidence of leukemia was 3.72/100,000 in nine districts of the same area with a 1.6 million population. The 20-29 years-of-age group appeared to be the least (1.53/100,000) and the above 70 years-of-age group the most (23.67/100,000) affected. Incidence was higher among urban native Argentines than among rural natives, but the overall geographical distribution of leukemia appeared to be more homogeneous than in 1965 and 1966, when the city of Lobos constituted a high-incidence center of acute leukemia. The literature concerned with this is reviewed.

- 4820 NEOPLASMS OF THE CENTRAL NERVOUS SYSTEM. EPIDEMIOLOGIC CONSIDERATIONS. (E.) Percy, A. K. (Mayo Clin., Mayo Fdn., Rochester, Minn.), L. R. Elveback, H. Okazaki and L. T. Kurland. *Neurology (Minneapolis)* 22(1):40-48, 1972.

Mayo Clinic records and ancillary resources were reviewed to determine the incidence of various central nervous system (CNS) neoplasms in the resident population of Rochester, Minnesota, from 1935 through 1968. Of 297 identified cases of intracranial and intraspinal lesions, 174 had primary neoplasms and 123 had metastatic tumors. The 63 primary lesions diagnosed at autopsy included 36 meningiomas, 12 gliomas and 15 neoplasms of other histological types. The remainder

of the primary neoplasms were diagnosed while the patients were living and included 25 meningiomas, 37 gliomas and 48 lesions of other histologic types. The overall ratio of meningiomas to gliomas was 1.2 to 1. The most common primary pituitary tumor was chromophobe adenoma. Schwannomas were the most prevalent spinal cord tumor. The incidence of primary and metastatic neoplasms of the brain increased with age. Meningiomas were twice as prevalent in females as in males. No significant sex difference was noted for astrocytomas or for primary brain and spinal cord tumors. Five-year survival rates for gliomas and meningiomas were 22% and 59%, resp. Investigation of death certificates led to the observation that reliance on them can result in underestimation of the incidence of CNS neoplasms and in confusion or inaccuracy of diagnosis concerning known cases of CNS tumors.

- 4821 EPIDEMIOLOGY OF LEUKEMIA AND LYMPHOMA IN AN AREA OF THE BUENOS AIRES PROVINCE (1967). COMPARISON WITH THE YEARS 1965-1966. II. LYMPHOMA. (Sp.) Delfor Podesta, L. (No affiliation), E. Quiroga Micheo, E. J. Calcagno, S. I. Calabria and N. L. De Olivos. *Sangre* 16(3):258-272, 1971.

The 1967 mortality from lymphoma in 19 districts of Buenos Aires Province, 1.8 million population, amounted to 3.64/100,000; nine districts of the same province with a 1.6 million population had a 3.22/100,000 incidence of lymphoma. Both figures presented a significant increase with respect to 1965 and 1966 data, and Canuelas was considered to constitute a center of high mortality from lymphoma in 1967. Increased incidence was ascertained mainly in lymphosarcoma and Hodgkin's disease among native Argentines. The low frequency in exposure to ionizing radiation or chemical agents in the history of both leukemia and lymphoma patients is pointed out. No evidence for a familial factor in the susceptibility to Hodgkin's disease was found.

- 4822 THE GROSS RATES OF GROWTH OF HUMAN MAMMARY CARCINOMA. (E.) Kusama, S. (Ellis Fischel State Cancer Hosp. Cancer Res. Ctr., Columbia, Mo.), J. S. Spratt, Jr., W. L. Donegan, F. R. Watson and C. Cunningham. *Cancer* 30(2):594-599, 1972.

Among 912 female patients with mammary carcinoma who had radical mastectomy performed at the Ellis Fischel State Cancer Hospital, Columbia, Mo., between 1940 and 1960, two or more gross measurements of the same cancer focus were recorded on different dates for 199. The records of these 199 patients were studied to determine if any relationship existed between the tumor growth rate and the characteristics of the host or the cancer. Tumor growth rates were independent of anatomical site (i.e., breast, lymph node, lung or peritoneum), marital status, race, tumor size, frequency of lymph node metastasis at the time of mastectomy, and frequency

and site of the postoperative metastasis. Tumor volume doubling time did, however, correlate directly with the age of the patient, being faster in patients 21 to 30 yr of age and relatively slow in patients over 60 yr of age. Tumor doubling times tended to be shorter in patients whose preoperative symptoms were of short duration. Prognosis was better for patients with slow-growing tumors, especially those with volume doubling times of greater than eight months.

- 4823 HIGH LUNG CANCER RATES LINKED TO HEARTLAND OF STEEL INDUSTRY. (E.) Cecilioni, V. A. (No affiliation). *Water Pollution Control* 110(8):48-49, 1972.

The death rate due to primary lung cancer was 34 per 100,000 for the years 1966 through 1968 in the industrial steel city of Hamilton, Ontario. A breakdown on the basis of local geography showed that the highest incidence (65 per 100,000) was in the area of the city closest to the main heavy industry section. During the period 1938 to 1968, although the population of Hamilton failed to double, lung cancer deaths increased ten-fold and the iron and steel production increased 15-fold. During this same period, the use of cigarettes and fluorspar (used in steel making) also increased greatly. High airborne fluoride levels were reflected in considerable damage to local vegetation, some of which occurred several miles downwind of the pollution source. Plant life fluoride levels were 20 to 30 times the maximum permissible amount. Fluoride levels in bone samples from six lung cancer victims were three to five times higher than those of noncancer controls. Nearly one-half the cases from the high incidence area of Hamilton were of the oat cell variety, a type which normally is seen in about 20% of primary lung cancers in male smokers.

- 4824 THYMECTOMY AND CANCER--A FOLLOW-UP STUDY. (E.) Vessey, M. P. (Radcliffe Infirmary, Oxford, England) and R. Doll. *Brit J Cancer* 26(1):53-58, 1972.

In an attempt to determine whether adult thymectomy is associated with increased risk for developing neoplastic disease, 423 patients who underwent thymectomy for myasthenia gravis (1942-1964) were identified. Of these, 382 were followed through 1967. A total of five fatal extrathymic tumors was seen in these patients; the expected number of such tumors was 5.5. Three deaths from extrathymic tumors were seen at ages 20-39, while only 0.51 was expected. Five patients developed nonfatal tumors. These results do not suggest that thymectomy in adult life leads to any special risk of cancer, but a more prolonged follow-up of the patients is required before a final conclusion can be drawn.

- 4825 CANCER OF THE OESOPHAGUS AND ALCOHOLIC DRINKS IN EAST AFRICA. (E.) Cook, P. (M. R. C. Statistical Res. Services Unit, London, England) and C. H. Collis. *Lancet* (7758):1014, 1972.
- 4826 CANCER OF THE UTERINE CERVIX DIAGNOSED FROM 1951-1960 IN THE MUNICIPALITY OF FREDERICKSBERG. A CLINICAL REVIEW WITH FOLLOW-UP FOR 10-19 YEARS. (Dan.) Gad, C. (Frederiksberg Hosp., Denmark) and E. Ostergaard. *Ugeskr Laeger* 134(12):601-610, 1972.
- 4827 COMPARISON OF THE CANCER DEATHS IN THE BLACK AND WHITE U.S.A. POPULATION FROM 1949-1967. (E.) Fontaine, S. A. (Howard U. Coll. Med., Washington, D.C.), U. K. Henschke, L. D. Leffall, Jr., C. H. Mason, A. W. Reinhold, R. Schneider and J. E. White. *Med Ann DC* 41(5):293-298, 1972.
- 4828 PREVALENCE AND DISTRIBUTION OF CANCER OF THE UTERINE CERVIX IN AGRA DISTRICT, INDIA. (E.) Wahi, P. N. (S.N. Med. Coll., Agra, India), U. K. Luthra, S. Mali and M. B. Shimkin. *Cancer* 30(3):720-725, 1972.
- 4829 CARCINOMA OF THE GALLBLADDER IN CALIFORNIA: 1955-1969. (E.) Krain, L. S. (UCLA Med. Ctr., Los Angeles, Calif.). *J Chronic Dis* 5(2):65-71, 1972.
- 4830 EPIDEMIOLOGICAL STUDY OF THE PROGRESSION OF CANCER, ILLUSTRATED BY WILMS'S TUMOUR. (E.) Draper, G. J. (Dept. Social Med., U. Oxford, England) and P. D. Gorbach. *Proc R Soc Med* 65(3):42-244, 1972.
- 4831 CARCINOMA OF THE PROSTATE. INCIDENCE, HISTORY, DIAGNOSIS, PROGNOSIS, CLASSIFICATION, AND THERAPY. (E.) Herman, J. R. (Albert Einstein Coll. Med., Yeshiva U., New York). *NY State J Med* 72(7):841-850, 1972.
- 4832 CANCER OF THE HEAD AND NECK. EPIDEMIOLOGY AND ETIOLOGY. (E.) Muir, C. S. (Internat'l Agency Res. Cancer, Lyon, France). *JAMA* 220(3):393-394, 1972.
- 4833 REPORT OF THE INTERNATIONAL SEMINAR ON EPIDEMIOLOGY OF OESOPHAGEAL CANCER. (E.) Jassawalla, D. J. (Tata Mem. Hosp., Bombay, India). *Int J Cancer* 10(2):436-441, 1972.
- 4834 AN EPIDEMIOLOGIC STUDY OF ORAL CANCER AND PRECANCEROUS CONDITIONS AMONG 101,761 VILLAGERS IN MAHARASHTRA, INDIA. (E.) Mehta, F. S. (Tata Inst. Fundamental Res., Bombay, India), P. C. Gupta, D. K. Daftary, J. J. Pindborg and S. K. Choksi. *Int J Cancer* 10:134-141, 1972.
- 4835 FAMILIAL MELANOMAS. (E.) Robinson, M. J. (Miami Beach, Fla.) and L. Manheimer. *JAMA* 220(2):277, 1972.
- 4836 GENOTYPE-DEPENDENT MODIFICATION OF SARCOMA 37 GROWTH IN CASTRATED MICE. (E.) Wolff, G. L. (Inst. Cancer Res., Philadelphia, Pa.). *Cancer Res* 31:1570-1572, 1971.
- 4837 EPIDEMIOLOGY OF SURVIVAL FROM CANCER OF THE CERVIX. (E.) Graham, S. (Dept. Sociol. Social Preventive Med., St. U. New York, Buffalo), R. L. Priore, E. F. Schueller and W. Burnett. *J Nat Cancer Inst* 49(3):639-647, 1972.
- 4838 ETHER-LIPIDS, α -GLYCEROL PHOSPHATE DEHYDROGENASE, AND GROWTH RATE IN TUMORS AND CULTURED CELLS. (E.) Howard, B. V. (George Washington U. Med. Sch., Washington, D. C.), H. P. Morris and J. M. Bailey. *Cancer Res* 32:1533-1538, 1972.
- 4839 THE PATTERNS AND PRESENTATION OF INTRACRANIAL TUMOURS IN UGANDA. (E.) Bailey, I. C. (Mulago Hosp., Kampala, Uganda). *E Afr Med J* 48(10):565-575, 1971.

See also:

- * (Rev): 4308, 4313, 4318, 4333, 4356, 4359, 4360
 * (Chem): 4418, 4436
 * (Immun): 4723

4840 CHARACTERISTICS OF RNA SYNTHESIS IN ISOLATED CELL NUCLEI OF M-1 SARCOMA AND LIVER OF RATS.

(Rus.) Rubtsova, G. V. (I. M. Sechenov Inst Moscow Med. Inst., USSR), I. I. Votrin and S. S. Debov. *Vop Med Khim* 17(4):415-422, 1971.

DNA functional activity in the RNA-polymerase system of cellular nuclei from primary M-1 sarcoma of rats and nuclei from normal and partially hepatectomized, regenerating liver was studied. Cell nuclei from normal and regenerating liver tissue and tumor liver tissue were homogenized in $MgCl_2$ -containing sucrose solution for study of enzymatic activities. The incubation sample used contained cell nuclei preparation (0.2 ml), nucleosidetriphosphates such as GTP, ATP, and CTP (0.05 ml), C^{14} -uridine triphosphate (0.017 micromole), and tris-HCl buffer (0.2 ml). After incubation, the specimens were frozen, centrifuged for examination of the radioactivity and for isolation of RNA products. RNA polymerase activity, measured by incorporation of C^{14} -uridine monophosphate, was pronounced in all cell nuclei: 43.5 micromicro-mole/mg protein/min in sarcoma M-1, 23.02 in normal liver and 71.9 in regenerating liver. Without ribonucleoside triphosphates, C^{14} -uridine monophosphate incorporation was suppressed in all cell nuclei: 4.3 in sarcoma M-1, 12.0 in normal liver, and 17.6 in regenerating liver. It was also suppressed in all cell nuclei by addition of RNase (500 mcg/ml), DNase (500 mcg/ml) and actinomycin D (60 mcg/ml): 7.4-23.52 micromole/mg protein/min. C^{14} -uridine monophosphate incorporation into RNA nuclei of M-1 sarcoma increased by addition of $(NH_4)_2SO_4$ in the incubation medium as compared to the regenerating nuclei. This indicates that the functional activity of DNA of M-1 sarcoma is lower than that of the regenerating liver. Addition of ammonium sulfate increased the ionic strength of the incubation medium, thereby changing the nucleotide composition of RNA. RNA-polymerase reaction products were studied by a sucrose density gradient method. The sedimentograms of the cell nuclei preparations of the hepatectomized liver showed heterogeneous molecular weights. High-molecular fractions increased with the addition of ammonium sulfate. The sedimentograms of newly-formed RNA of sarcoma were characterized by low-molecular fractions.

4841 TRANSCRIPTIONAL TRANSFORMATION OF WALKER TUMOR CHROMATIN BY NONHISTONE PROTEINS.

(E.) Kostraba, N. C. (Biol. Dept., New York St. U., Buffalo) and T. Y. Wang. *Cancer Res* 32(11): 2348-2352, 1972.

Nonhistone proteins fractionated from normal rat liver and Walker carcinosarcoma can stimulate chromatin-templated RNA synthesis *in vitro*. This was demonstrated using RNA polymerase prepared from rat liver, Walker tumor, or *Micrococcus luteus*. The RNA isolated from these fractionated nonhistone proteins did not activate transcription from chromatin. As judged by DNA-RNA hybridization studies, the altered transcription of chromatin effected by the nonhistone proteins reflects the characteristic transcription from chromatin homologous to the nonhistone proteins.

Thus, when rat liver nonhistone proteins were used to activate transcription from Walker tumor chromatin, the activated transcript was found to contain RNA species similar to that synthesized *in vitro* from rat liver chromatin. Conversely, Walker tumor nonhistone proteins can activate the synthesis of RNA from rat liver chromatin to that partly characteristic of Walker tumor chromatin transcript. It is concluded that the nonhistone proteins are tissue specific in the alteration of transcription of chromatin.

4842 RELATION BETWEEN KARYOTYPE AND CYTOLOGY IN CHRONIC MYELOGENOUS LEUKAEMIA. (E.)

Pedersen, B. (Cancer Res. Inst., Danish Cancer Soc., Radium Ctr., Denmark). *Scand J Haematol* 8(6):494-504, 1971.

A detailed analysis of the karyotype/cytology relationship in 27 patients with chronic myelogenous leukemia is reported. Blood cultures established from patients in all stages of the disease were compared with the cytological character of corresponding peripheral blood samples. Results of these observations indicate that the presence of high numbers of specific chromosomes delays the maturation of granulocyte precursors and leads to the development of hematologic relapse and ultimate blastic crisis. The significant specific observations made in this study are: 1) increasing frequency of hyperdiploid metaphases characterized by supernumerary C members and associated with circulation of more granulocytic precursors; 2) pseudodiploid metaphases with high frequency of small acrocentric chromosomes which were unrelated to the peripheral blood picture; and 3) a different Denver group composition of supernumerary chromosomes.

4843 BLASTIC TRANSFORMATION OF LYMPHOCYTES IN PHA-STIMULATED CULTURES IN CASES OF LYMPHOSARCOMA AND RETICULOSARCOMA AND ITS CLINICAL SIGNIFICANCE. (Pol.) Pluzanska, A. (Acad. Med., Lodz, Poland), E. Polkowska-Kulesza, H. Krauze-Jaworska and E. Krykowski. *Pol Arch Med Wewn* 47(12):685-691, 1971.

Blastic transformation (IB) and mitotic (IM) indexes were determined in 3-day cultures of unstimulated and PHA-stimulated white blood cells obtained from 21 patients (10 mature cell and 6 immature cell lymphosarcoma, 5 reticulosarcoma; 16 previously untreated, 5 tested one month after interruption of therapy) and were compared with those for 20 healthy controls. In unstimulated cultures, the indexes were 0-2% for both patients and controls. In PHA-stimulated patient cultures, the IB varied from 0-63% (mean 19.7%) and the IM from 0-70% (mean 13.1%); in control cultures, IB and IM were 65-81% (mean 71.8%) and 28-90% (mean 51.7%), resp. There was no correlation between extent of disease or histologic type and IB or IM values. Low IB and IM values were seen in all histologic types, but normal or only slightly decreased values were (contrary to reports in the literature) observed most frequently in patients with mature cell lymphosarcoma.

Patients with systemic manifestations and sarcoma cells in peripheral blood had markedly decreased indexes, while those with a mild course and those responding to therapy with remissions had high IB values. It is suggested that IB determination has prognostic value and could also be used in differential diagnosis between lymphosarcoma (in which IB is normal or slightly depressed) and chronic lymphatic leukemia (in which IB is strongly depressed).

4844 THE ROLE OF GLUTAMINE IN THE OXIDATIVE METABOLISM OF MALIGNANT CELLS. (E.) Kovacević, Z. (City of Hope Med. Ctr., Cuerte California), and H. P. Morris. *Cancer Res* 32(2):326-333, 1972.

Experimental evidence is presented indicating a correlation between mitochondrial glutaminase activity and respiration rate of tumor mitochondria in the presence of glutamine. Respiration was studied in purified mitochondrial fractions from homogenates of Morris hepatomas 7316A 7800 and 28A (slow-growing), 5123D (medium-growing), 5123tc and 7777 (fast-growing), MK3 kidney tumor (slow-growing) and Ehrlich ascites cells in Buffalo rats. Oxygen electrode experiments showed that glutamine was a better substrate for mitochondrial respiration than the fast-growing tumors and Ehrlich ascites cells than in the slow-growing hepatomas or normal liver cells. Hepatoma 7777 mitochondria respired at approximately the same rate in the presence of optimal concentrations of glutamine or glutamate (22.0 and 22.5 μ M atoms O_2 /mg/protein/min, resp.), but glutamine K_m for respiration was much lower than glutamate K_m (0.2 mM vs 1.3 mM), indicating a more efficient utilization of glutamine. Normal liver mitochondria respired faster in the presence of glutamate than in the presence of glutamine (37.3 and 23 μ M atoms O_2 /mg/protein/min, resp.), and glutamate K_m for respiration was lower (0.5 mM) than glutamine K_m (11.0). Respiration of malignant tumor mitochondria incubated with pyruvate was always low (e.g., 5.1 μ M atoms O_2 /mg/protein/min in hepatoma 7777) compared with respiration in the presence of glutamine. Pyruvate originating from glycolysis did not inhibit production of labeled CO_2 from ^{14}C -glutamine during incubation of Ehrlich ascites cells. Aerobic oxidation of ^{14}C -glutamine was 1.6- to 2.0-fold greater than that of ^{14}C -glucose in intact Ehrlich ascites cells. Estimates of glutaminase activity in mitochondrial suspensions, based on the rate of conversion of ^{14}C -glutamine to ^{14}C -glutamate and compared with the rate of mitochondrial respiration in the presence of glutamine, revealed that the high enzyme activity and its probable intramitochondrial location were the main factors enabling mitochondrial respiration in the presence of glutamine. Transport of glutamine is not a rate-limiting step in mitochondrial glutaminase activity. Results of mitochondrial swelling experiments showed a correlation between the relative impermeability of the mitochondrial membrane to glutamate and the ability of mitochondria to respire in low concentrations (10-20 μ M) of glutamine. Glutamate accumulated considerably in hepatoma 5123tc and Ehrlich ascites mitochondria during

glutaminase activity in the presence of rotenone. The fact that $NAD(P)^+$ was rapidly reduced by glutamine suggested that this may be one of the factors in the maintenance of the great difference between the oxidation-reduction state of intra- and extra-mitochondrial pyridine nucleotides.

4845 NOTES ON SOME PECULIARITIES OF ENZYMIC PROCESSES IN MALIGNANT TUMOURS AND TISSUES OF THE HOST. (E.) Shapot, V. S. (Acad. Med. Sci., Moscow, USSR), G. I. Vornovitskaya, E. G. Gorozhanskaya, S. Ya. Davidova, A. A. Zhubanova, G. D. Krechetova and I. A. Chudinova. *Neoplasma* 19(4):335-340, 1972.

Unification of the lactate dehydrogenase isoenzyme system (LDH-IS), an indication of biochemical anaplasia, was studied in human leukemias. LDH-IS of myeloid and lymphoid leukemic cells had the same general electrophoretic features as normal granulocytes and lymphocytes, indicating that LDH-IS unification is not an essential property of malignant cells. A comparison of anabolic and catabolic processes in an advanced Zajdela rat hepatoma and in a normal liver showed that the tumor synthesized ribonucleotide precursors of RNA through orotidine-5-phosphate and through uracil (the preferred pathway). When ^{14}C -orotic acid was used as substrate instead of uracil, normal liver converted only one-fifth of it into CO_2 , the bulk being used to synthesize RNA. Apparently, *de novo* synthesis of pyrimidine nucleotides was the main pathway used by normal liver. The impairment of complex enzymic processes by tumors was also studied using a number of different tumor-host systems. The feedback inhibition system controlling cholesterol synthesis in the livers of female rats was found to be impaired in mice with mammary tumors. These findings support the notion that host tissue metabolism comes to resemble tumor tissue metabolism in tumor hosts.

4846 EFFECT OF PREGNANCY, LACTATION AND PITUITARY ISOGRAFTS ON THE GENESIS OF SPONTANEOUS MAMMARY GLAND TUMORS IN THE MOUSE. (E.) Bruni, J. E. (U. Western Ontario Hlth. Sci. Ctr., London, Canada) and D. G. Montemurro. *Cancer Res* 31:1903-1907, 1971.

The incidence of spontaneous mammary tumors was observed in five groups of C3H/HeJ x DBA/2J hybrid female mice: mice given no treatment and force bred to males (group 1); mice given no treatment and remaining virgins (group 2); mice nursing full litters for 25 days (group 3A); mice nursing reduced litters (two or three young) (group 3B); and virgin mice given two intact pituitary isografts under the kidney capsule (group 4). Forced breeding increased mammary tumor incidence (14 of 15 mice in group 1 developed tumors vs 11 of 15 in group 2). Pituitary isografts also caused a significant increase in tumor incidence (14 of 15 mice in group 4). Mice nursing reduced litters and mice nursing full litters did not differ appreciably from force-bred controls or isografted mice in tumor development. Latent periods for tumor development

were longer in groups 2-4 than in group 1. Tumors which developed were adenocarcinomas.

- 4847 STUDIES IN FAMILIAL THYROID CANCER. (E.)
Melvin, K. E. W. (Tufts U. Sch. Med., Boston, Mass.), A. H. Tashjian, Jr. and H. H. Miller. *Trans Assoc Am Physicians* 84(10):144-151, 1971.

An investigation into the hereditary characteristics and biosynthetic activity of medullary carcinoma of the thyroid is reported. Since the hereditary incidence of medullary carcinoma of the thyroid is well established, a study was made of the J family, seven of whom had been diagnosed as having medullary carcinoma. Three of the family members had died of the disease. Sixty-seven adult family members had 4 hr i.v. infusion of calcium gluconate at a dose of 15 ml calcium/kg of body weight. Blood and urine samples were subsequently assayed for their calcitonin and parathyroid hormone content. A control group of 47 normal persons was set up parallel to the test group. Results indicated that all the control group members and 55 test family members presented normal calcitonin and parathyroid hormone levels. Abnormally high levels of both substances were found in 12 of the test group. Of those showing high levels, 11 were surgically treated and tumors were found in all. Total thyroidectomy with removal of lymph nodes was carried out and histologic confirmation of bilateral medullary carcinoma was made. None of the tumors was preoperatively palpable, nor was any evident on radioisotope scan of the thyroid with ^{131}I , ^{99}Tc or ^{95}Se . The calcitonin content of the tumor tissues was counted and showed a 650 to 16,000-fold increase over that found in normal tissue. Genealogy of the family confirmed previously postulated autosomal dominant inheritance of the disease. The first generation progenitor immigrated to the United States in 1901. In the second generation seven of the eight siblings were affected. In the third generation, 11 of 25 offspring of the affected members have confirmed medullary carcinoma of the thyroid. The fourth generation comprising 53 children, who were not included in this study, are expected to have half of their number develop the disease in time. This study will be continued with that group. These results establish a valuable role for radioimmunoassay of serum and urine of calcitonin in high-risk individuals for this disease.

- 4848 GRAWITZ TUMOUR OF THE KIDNEY AND BLOOD GROUPS (PRELIMINARY REPORT). (E.) Uhlir, K. (J. E. Purkyne U., Brno, Czechoslovakia). *Scripta Med* 44(5):273-276, 1971.

A preliminary report on the possible relationship between specific blood groups and the occurrence of Grawitz tumors, the most common of all kidney tumors, is presented. In 219 patients with histologically confirmed Grawitz tumors, the following trend was seen in the blood group analysis: 97 patients had type A blood; 71 had type O; 33 had type B; and 18 had type AB. No specific conclusions were drawn from this

analysis due to the limited number of observations made as related to the total population. However, further investigations appear warranted.

- 4849 EXPRESSION OF DIFFERENTIATED FUNCTIONS IN HEPATOMA CELL HYBRIDS: II. ALDOLASE. (E.) Bertolotti, R. (C.N.R.S., Gif-sur-Yvette, France) and M. C. Weiss. *J Cell Physiol* 79(2):211-223, 1972.

Aldolase assays were performed in the H4IIEC3 rat hepatoma cell line and in four subclones derived from it; aldolase was also assayed in somatic hybrids between 3T3 mouse cells and rat hepatoma cells, and between mouse cells and rat skin cells. Aldolase patterns of H4IIEC3 and one of its subclones showed a strikingly high level of the aldolase A monomer (the ubiquitous glycolytic isozyme) relative to normal rat liver. Hepatoma cells and subclones also synthesized aldolase monomers B (the form characteristic of liver) and C. *In vitro* and *in vivo* passage of hepatoma cells resulted in a reversible modulation of aldolase A activity. All somatic hybrids lacked aldolase B, which was present only in the hepatoma parent. Aldolase A, which was present in cells other than hepatoma cells, appeared in hybrids. The absence of aldolase B in hybrids did not appear due to factors such as species differences, increase in ploidy, inactivation of hepatoma aldolase genes or chromosome loss. Extinction of aldolase B from hybrids more likely reflects a genetic regulatory phenomenon.

- 4850 ACCUMULATING FILAMENTS AND OTHER ULTRASTRUCTURAL ASPECTS OF DECLINING CELL CULTURES DERIVED FROM HUMAN BREAST TUMORS. (E.) Tumilowicz, J. J. (Inst. Med. Res., Camden, N.J.) and N. H. Sarkar. *Exp Molec Path* 16(2):210-221, 1972.

Cells from malignant and benign human breast tumors were observed under the electron microscope during the first, fifth and declining subcultivations. In declining cultures (in which cell replication had effectively ceased), intracytoplasmic filaments 110 Å in diameter were seen in large numbers. In some cells, the cytoplasm was completely occupied by filaments. Filaments were composed of smaller (20 Å diameter) subunits arranged helically with six subunits to one turn of the helix. Declining WI38 cell cultures contained similar 110 Å filaments but in smaller numbers. Budding virus-like particles, resembling the Mason-Pfizer monkey virus, were seen in one of the declining cultures from breast tumors.

- 4851 THE REGULATION OF β -HYDROXY- β -METHYLGLUTARYL COENZYME A REDUCTASE IN MORRIS HEPATOMAS 5123C, 7800, AND 9618A. (E.) Goldfarb, S. (Med. Sch., U. Wisconsin, Madison) and H. C. Pitot. *Cancer*

Res 31:1879-1882, 1971.

β -Hydroxy- β -methylglutaryl coenzyme A reductase was assayed in hepatoma and liver microsomes of Morris hepatoma-bearing and tumor-free rats fed a semisynthetic diet alone or a diet supplemented with cholesterol or cholestyramine under controlled conditions of lighting and feeding. Cholesterol depressed the enzyme activity in hepatoma host livers but not in the hepatomas themselves. Cholestyramine feeding increased the enzyme 4.4- to 10-fold in host livers but had no effect in two hepatomas and caused only a slight elevation of enzyme activity in a third hepatoma. A diurnal rise in enzyme activity, induced by feeding, was seen in host livers and in two hepatomas, but was absent from the third (slowest-growing) hepatoma. This diurnal rhythm and the absence of enzyme regulation in hepatomas after cholesterol or cholestyramine feeding indicate that β -hydroxy- β -methylglutaryl coenzyme A reductase is controlled by at least two different mechanisms.

352 ELONGATED NUCLEAR SHEET AND INTRANUCLEAR MYELIN FIGURE OF HUMAN MEDULLOBLASTOMA.

(E.) Tani, E. (Kyoto U. Med. Sch., Japan), J. Takeuchi, Y. Ishijima, N. Higashi, E. Fujihara, T. Metani and K. Ando. *Cancer Res* 31:2120-2129, 1971.

In sections from medulloblastomas from two patients with tumors in the cerebellum were examined electron microscopically. Nuclei of tumor cells showed two types of changes: cistern-limited nuclear sheets and intranuclear vacuolar profiles and myelin figures. The cistern-limited nuclear sheets were extremely elongated and were enclosed either side by the perinuclear cisterns. They were composed of a central granular or beaded heterochromatin layer between less dense layers, were further limited on either side by the inner nuclear membrane, and ranged from 350-430 Å in width. The central granular layer was continuous with the peripheral beaded layer of nuclear heterochromatin granules. A less dense layer on the nuclear periphery was seen between the inner nuclear membrane and the peripheral heterochromatin layer. The structural association of the inner nuclear membrane and its underlying less dense layer, as well as the peripheral heterochromatin layer, was similar in the cistern-limited nuclear sheet and the nuclear periphery and seemed to form a structural and functional unit. Intranuclear vacuolar profiles and myelin figures were irregular in form and might have been derived from the nuclear membranes by a complicated, irregular invagination. The membranes of the vacuolar profiles and myelin figures showed increased density and thickness and surrounded flocculent substances or islands of cytoplasm; these membranes were not covered by heterochromatin layers. The cistern-limited nuclear sheet and the intranuclear vacuolar profiles and myelin figures may have arisen from different changes in the nuclear membranes of medulloblastoma cells.

4853 ADENYL CYCLASE HORMONE RESPONSES OF CERTAIN HUMAN ENDOCRINE TUMORS. (E.)

Schorr, I. (Dept. Med., U. North Carolina, Chapel Hill), H. T. Hinshaw, M. A. Cooper, D. Mahaffee and R. L. Ney. *J Clin Endocrinol Metab* 34(3):447-451, 1972.

The response of the adenylyl cyclase of human endocrine tumors to hormone stimulation was assayed by observing the conversion of α - 32 P-ATP to 32 P-labeled cyclic AMP. The effect on tissues of sodium fluoride (NaF) was also observed. Adenylyl cyclase in two parathyroid tumors composed mainly of chief cells was increased by 60 and 90% above basal levels by glucagon. Adenylyl cyclase in a third parathyroid tumor was not stimulated by any hormone, but was stimulated by NaF. Adenylyl cyclase in a thyroid follicular adenoma was markedly stimulated by thyroid stimulating hormone, luteinizing hormone and NaF. Adenylyl cyclase in a chromophobe adenoma was increased twofold by ACTH. Pheochromocytomas from two patients were not stimulated by any hormone tested. Each of the bilateral pheochromocytomas from a third patient, however, was stimulated by ACTH and by thyroid stimulating hormone.

4854 KINETICS OF 3 H-5 α -DIHYDROTESTOSTERONE METABOLISM IN NORMAL MEN AND WOMEN AND MEN WITH PROSTATIC CARCINOMA: EFFECTS OF ESTROGEN ADMINISTRATION IN MEN. (E.) Bird, C. E. (Dept. Med., Queen's U., Kingston, Ontario, Canada) and A. F. Clark. *J Clin Endocrinol Metab* 34(3):467-472, 1972.

Metabolic clearance rates, transport and metabolic rate constants and distribution volumes for plasma 3 H-5 α -dihydrotestosterone (5 α -DHT) in nine normal males, four normal females and four men with prostate carcinoma were established. Subjects were given a single injection of 5 α -DHT. Metabolic clearance rates (expressed as liters (L)/24 hr) were significantly lower in prostate carcinoma patients than in normals, and were also lower in normal women than in normal men. Volumes of 5 α -DHT distribution were significantly smaller in patients than in normals. The rate constants for 5 α -DHT metabolism were similar in the three groups of subjects. These 5 α -DHT metabolic parameters in four older men with prostate carcinoma observed before gonadectomy or other therapy were similar to the same parameters in normal men. Oral estrogen therapy for these men decreased metabolic clearance rate values and distribution volume values. Similar changes were seen when oral estrogen was given to normal young men.

4855 CHANGING PATTERNS OF BREAST CANCER. (E.) Cady, B. (Lahey Clin. Fdn., Boston, Mass.). *Arch Surg (Chicago)* 104(3):266-269, 1972.

Pathologic findings (1929-1968) from 3,426 patients with primary operable breast cancer were analyzed

for the maximum diameter of the primary cancer and the number of metastatic axillary lymph nodes. Statistically significant trends toward progressively smaller primary cancers and fewer axillary metastases were noted, particularly over the 20 years ending in 1968. Based on 1968 records, the median maximum diameter of primary breast cancer is now 2.5 cm and the mean maximum diameter is 3.07 cm. Fifty-three percent of operative specimens now have negative axillary lymph nodes, 31% have one metastatic node, 14% have two metastatic nodes and 13% have three metastatic nodes. The changing patterns are assumed to be the result of increased public awareness of the implications of breast masses.

- 4856 COMPARATIVE STUDIES ON THE *IN VITRO* AND *IN VIVO* MORPHOLOGY OF CLONES OF EXPERIMENTAL CNS TUMOURS IN THE RAT. (E.) Thust, R. (Med. Acad., Erfurt, East Germany) and R. Warzok. *Acta Neuropath* 20:248-257, 1972.

Fourteen clones were established from two rat central nervous system sarcomas, one induced by N-nitroso-methylurea and one by ethylnitrosourea. In general, the clones showed high cell density but no complete monolayers; cells piled up to form a honeycomb pattern. Cloned cells injected into rats *in vivo*, produced spindle-shaped sarcomas with a characteristic orientation around the blood vessels. It was not clear whether these tumors were true sarcomas or dedifferentiated glial tumors. The *in vitro* morphology of clonal tumor cells differed from their *in vivo* morphology.

- 4857 METABOLISM OF HEPATOMAS OF DIFFERENT GROWTH RATES *IN SITU* AND DURING ISCHEMIA. (E.) Weber, G. (Indiana U. Sch. Med., Indianapolis), M. Stubbs and H. P. Morris. *Cancer Res* 31:2177-2183, 1971.

Tissue samples were taken from regenerating rat liver and from three Morris hepatomas and assayed spectrophotometrically for fifteen metabolites. Tissue samples were taken initially and again during ischemia up to ten minutes after the initial samples. In Morris hepatomas 5123-D (slow-growing) and 3924-A (fast growing), levels of ATP, total adenine nucleotides and the ATP/ADP ratio were markedly lower than those in livers. During ischemia in liver and in 5123-D and 9618-A (also slow-growing), ATP, total adenine nucleotides and the ATP/ADP ratio decreased while AMP levels increased. In hepatoma 3924-A, ischemia did not change ATP or AMP concentrations. Glucose and pyruvate concentrations were 11-43% lower in all hepatomas than in liver. During ischemia, glucose levels increased in liver and in 9618-A. Initial lactate and glutamate concentrations were much higher in 3924-A than in liver or in the slow-growing hepatomas. 2-Oxoglutarate concentrations were low in all tumors. Acetyl-CoA, acyl-CoA, total glycerides, phospholipids and total lipids in

3924-A were 20-50% of liver values. In ischemia, acyl-CoA concentrations increased in liver but did not change in tumors. Acetyl-CoA, glyceride, phospholipid and total lipid content did not change either in liver or in 3924-A. Acetoacetate in liver increased five- to six-fold during starvation and 13-20-fold in hepatomas.

- 4858 INCREASED ANDROGENIC ACTIVITY AS AN ETIOLOGIC FACTOR IN HUMAN BREAST CANCER. (It.) Grattarola, R. (Natl. Inst. Tumor Studies and Ther., Milan, Italy). *Tumori* 57(4):279-285, 1971.

Urinary steroids were determined in 15 premenopausal 30 to 53-year-old women and in seven postmenopausal 55 to 72-year-old women 3 to 6 months after breast cancer mastectomy and compared with those of age-related healthy subjects. A single 24 hr urine sample was collected on the 22-23rd day of the menstrual cycle in the younger group and an endometrial biopsy was performed subsequently. The controls had an ovulatory cycle according to the excreted pregnanediol levels (2.03 mg/24 hr) and to the progestational features of the premenstrual endometrium; testosterone excretion ranged from 2.5 to 22.7 μ g/24 hr. Of the 15 premenopausal patients, seven had an ovulatory cycle with a progestational premenstrual endometrium, and testosterone excretion from 7.5 to 35.0 μ g/24 hr. The other eight patients had an anovular cycle and presented an atypical hyperplastic structure of the premenstrual endometrium with urinary testosterone levels from 36 to 113 μ g/24 hr. No significant differences in estrogen excretion were ascertained among these three groups. In the third group, three patients with the highest androgenous activities (67, 88, and 100 μ g testosterone excretion per 24 hr) had advanced hyperplasia of the interstitial cells of the ovaries as observed upon bilateral surgery. Three other patients in the same group, who received no treatment after mastectomy, developed lung metastases 6 months after this investigation. The average urinary testosterone was 9.4 μ g and 35.6 μ g/24 hr in the postmenopausal control and mastectomized patient groups, resp. Hypotrophic endometrium was found in patients with the lowest testosterone excretion levels (12 μ g/24 hr), while hyperplastic features were observed in the biopsy samples of endometrium from patients with urinary testosterone from 40 to 75 μ g/24 hr. Since the highest testosterone excretion levels occurred in breast cancer patients with anovular menstrual cycle and hyperplastic endometrium, androgenous activity is viewed as a possible factor in the etiology of mammary gland cancer.

- 4859 STUDIES ON BRANCHED CHAIN AMINO ACIDS TRANSAMINASE ISOZYMES IN VARIOUS CANCER CELLS AND ONCOGENESIS. (Jap.) Ogawa, K. (Tokushima U., Sch. Med. Japan). *J Jap Biochem Soc* 43(4):197-209, 1971.

This study was conducted to examine the transformation

of the branched chain amino acid transaminase isozyme pattern caused by cancerous growth. The Yoshida ascites liver cancer AH 130 showed a different isozyme pattern (I plus III) from the mother cell, presumably the liver of a rat, which had the isozyme pattern I plus II. The new type isozyme contained in the new tumor cell was extremely similar as far as its biochemical and immunologic properties are concerned to type III enzyme which exists in the brain of a normal rat. Its immunologic properties are completely different from type I enzyme within the same cell. The formation of type III isozyme and the disappearance of type II isozyme was repeated not only in AH 130 but in other Yoshida ascites liver cancers and Yoshida tumors. Type III isozyme was found in some Morris mutation liver cancers; also, an isozyme pattern midway between a normal liver and the Yoshida ascites liver cancer was recognized in the Morris cancer. There is a correlation between the formation of type III isozyme and the proliferation rate of the Morris mutation liver cancer. A mixed type of liver cancer and cholangioma was induced by administering a synthetic diet containing 0.06% of 1-methyl-4-dimethylaminoazobenzene to normal rats. In all cases except one, type III isozyme occurred, and type II isozyme disappeared where type III appeared. However, noncancerous cells still showed I plus II isozyme pattern, and III was not recognized in them.

285-290, 1972.

Phenylalanine ammonia-lyase effectively inhibited DNA synthesis in leukocytes from five patients with acute lymphoblastic leukemia and caused a rapid cessation of cell growth in murine L5178Y lymphoblasts, with eventual loss of cell viability and concomitant cell death. Addition of 0.125 and 0.250 units of the enzyme to the human leukemic lymphocytes inhibited DNA synthesis by 60 and 80%, resp. Approximately 3.25 units were required for rapid cessation of growth in the murine lymphoblasts; however, lower concentrations (0.5-3.0 units) also prevented subsequent cell growth. Phenylalanine ammonia-lyase was as effective as asparaginase in inhibiting DNA synthesis in leukemic cells. Pretreatment of nondividing normal lymphocytes with phenylalanine ammonia-lyase had essentially no effect on DNA synthesis resulting from subsequent PHA stimulation; but treatment of normal dividing cells after PHA addition caused delayed onset of DNA synthesis and marked inhibition. Neither cinnamic acid, coumaric acid and ammonia, the products of phenylalanine and tyrosine deamination, nor inactivated phenylalanine ammonia-lyase affected lymphoblast growth. These results suggest that phenylalanine ammonia-lyase exerted its effects by depriving leukemic lymphocytes of phenylalanine and tyrosine.

860 ENZYME-SUBSTRATE COMPLEXES OF ATP-SULFURYLASE FROM MOUSE MASTOCYTOMA. (E.) Shoyab, M. U. Southern California, Sch. Med., Los Angeles) and Marx. *Biochim Biophys Acta* 258(1):125-132, 1972.

ATP-sulfurylase (ATP:sulfate adenylyltransferase, EC 2.7.7.4) was purified from Furth mouse mastocytoma. ATP-enzyme complex was isolated from an ATP-enzyme incubation mixture by Sephadex G-75 elution. Experiments using γ - ^{32}P labeled ATP-enzyme complex incubated in the presence of Na_2SO_4 indicated that sulfate replaced the γ phosphate of ATP. Incubation of unbound enzyme with $\text{Na}_2^{35}\text{SO}_4$ did not result in formation of ^{32}S -enzyme, but in the presence of ATP, the reaction yielded radioactive sulfate bound by ATP-sulfurylase. It was concluded that enzyme-bound ATP reacted with sulfate to form adenylyl sulfate (APS) with release of pyrophosphate. An exogenous divalent cation was necessary for conversion of ATP-enzyme to APS. Pyrophosphate inhibited conversion of ATP-enzyme to APS, possibly by reacting with APS to produce ATP and SO_4^{2-} . Incubation of $[\text{S}^{35}]\text{APS}$ and yeast APS kinase in the presence of ATP and Mg^{+2} resulted in a 100% yield of enzyme-bound $[\text{S}^{35}]\text{3'-phosphoadenylylsulfate (PAPS)}$, which was then released from the enzyme. Based on experimental evidence, a reaction sequence is proposed involving ATP-sulfurylase-ATP and ATP-sulfurylase-adenylylsulfate complexes as intermediates.

4862 INCREASED ACTIVITY OF TRANSFER RNA N^2 -GUANINE DIMETHYLASE IN TUMORS OF LIVER AND KIDNEY. (E.) Craddock, V. M. (Med. Res. Council Labs., Carshalton, Surrey, England). *Biochim Biophys Acta* 272(2):288-296, 1972.

The methylation of *E. coli* tRNA by enzyme extracts prepared from normal tissue and from dimethyl- and diethylnitrosamine-induced tumors from albino Porton strain rat liver and kidney was studied using S-adenosyl($\text{Me-}^{14}\text{C}$) methionine as methyl donor. The *in vitro* assay methylated tRNA product was hydrolyzed and analyzed on a Dowex 50-X12 column with 7-methylguanine as a reference. Normal tissue extracts methylated N^2 -methylguanine to a limiting extent, indicating saturation kinetics, whereas tumor extracts showed an increased extent of tRNA N^2 -methylguanine methylation which was not saturable. Extracts from dimethyl- or diethylnitrosamine-"damaged" livers, from thioacetamide-treated nodular livers, and from normal regenerating liver showed methylase activities similar to that of normal rat liver. The relative increase of N^2 -dimethylguanine formation in liver and kidney tumors appeared to be related to the malignant state or to cellular differentiation. Evidence suggested that the increased N^2 -guanine dimethylase activity in tumor tissues was possibly due to loss of a nondialyzable inhibitor of the enzyme.

861 THE EFFECTS OF PHENYLALANINE AMMONIA-LYASE ON LEUKEMIC LYMPHOCYTES *IN VITRO*. (E.) Bell, C. W. (U. Oklahoma Med. Ctr., Oklahoma City), J. Stith and D. S. Hodgins. *Cancer Res* 32(2):

4863 INCREASED TOLERANCE OF LEUKEMIC MICE TO ARABINOSYL CYTOSINE WITH SCHEDULE ADJUSTED TO CIRCADIAN SYSTEM. (E.) Haus, E. (St. Paul-Ramsey Hosp., St. Paul, Minn.), F. Halberg, L. E.

Scheving, J. E. Pauly, S. Cardoso, J. F. W. Kuhl, R. B. Sothorn, R. N. Shiotsuka and D. S. Hwang. *Science* 177(4043):80-82, 1972.

Male BDF₁ mice were kept in light-controlled environments before being injected i.p. with L1210 mouse leukemia cells. About two days after injection, mice were put on one of two courses of leukemia chemotherapy with arabinosyl cytosine (ara-C). One group was given eight i.p. doses of ara-C at 3 hr intervals over a 24 hr period (total dose = 240 mg/kg/day) at four day intervals. Another group of mice was given ara-C in sinusoidally increasing and decreasing 24 hr courses, the largest doses being given at previously determined circadian and circannual times of peak host resistance to ara-C. The early mortality of L1210-inoculated, ara-C-treated mice was due to drug toxicity; none of the mice showed gross evidence of leukemia at autopsy. Ara-C treatment adjusted for periodicity significantly improved tolerance to ara-C in leukemic mice as determined by survival times. The survival time for mice given the adjusted ara-C regimen was 28.4 days (mean), while that for mice given the standard unchanging ara-C regimen was 15.0 days (mean).

4864 ISOLATION OF TUMOR CELL SURFACE BINDING SITES FOR CONCAVALIN A AND WHEAT GERM AGGLUTININ. (E.) Wray, V. P. (Grad. Sch. Biomed. Sci., U. Texas, Houston) and E. F. Walborg, Jr. *Cancer Res* 31:2072-2079, 1971.

Previous results had shown that a sialoglycopeptide-containing fraction released by papain digestion of Novikoff ascites tumor cells could inhibit the agglutination of ascites tumor cells by concanavalin A (con A) and wheat germ agglutinin (WGA). The present report describes a procedure for the resolution of this glycopeptide fraction into its components and the characterization of each of these components with respect to inhibition of cell agglutination by con A and WGA. The original sialoglycopeptide fraction was further digested with pronase and was then submitted to gel filtration on Sephadex G-50 and finally to ion-exchange chromatography on DEAE-cellulose. The glycopeptides were resolved by gel filtration into a low (mw = 2000-3300) and a high (mw >3300) molecular wt fraction. The low molecular wt fraction was separated on DEAE-cellulose into five sialoglycopeptide fractions, four of which inhibited agglutination of Novikoff ascites cells by con A but not by WGA. DEAE-cellulose chromatography of the high molecular wt fraction resolved seven fractions, one of which could inhibit agglutination of ascites cells by WGA but not by con A.

4865 INSECT TRANSFER OF LABELED ERYTHROCYTES, WITH IMPLICATIONS FOR CIRCULATING TUMOR CELLS. (E.) Woke, P. A. (Dept. Biol., American U., Washington, D.C.) and N. Konwinski. *J Nat Cancer Inst* 48(1):219-222, 1972.

This study confirms that a bloodsucking insect, *Aedes aegypti*, could transfer circulating tumor cells of hamster reticulum cell sarcoma TM from tumor-bearing to tumor-free hamsters. Measurement of blood cell transfer, with chromium-51 as a tracer, a spectrometer system, and a well-type scintillation detector, are described. Radiochromium, identified in recipient hamsters, indicated that the fly *Stomoxys calcitrans* and the mosquito *A. aegypti* had transferred labeled erythrocytes by bite. A quantitative experiment indicated that *A. aegypti* transferred 0.00021-0.00066 μ l of blood to the recipients. These quantities normally contain approximately 1500-5000 red blood cells, 1.5-5.0 normal white blood cells, or, in leukemia, 10-132 tumor cells. Tumor developed from <10 tumor cells injected by needle. Insect transfer of blood from hamster to hamster implies that tumor cells from TM blood ingested from the peripheral circulation of a leukemic donor are potentially transferable to a tumor-free recipient. Such an occurrence provides a possibility for tumor to develop.

4866 ELECTROCONDUCTIVITY CHANGES DURING THE MITOTIC CYCLE IN EHRlich ASCITES TUMOUR CELLS. (E.) Malenkov, A. G. (USSR Acad. Sci., Moscow), V. L. Voeikov and Yu. A. Ovchinnikov. *Biochim Biophys Acta* 255:304-310, 1972.

Changes in electrical parameters of the plasma membrane during the mitotic cycle in Ehrlich ascites tumor cells were studied. Tumor cells (50×10^6) were inoculated i.p. in white mongrel mice and harvested seven to eight days later (500×10^6 to 600×10^6 cells/mouse). Five cell fractions were obtained after separating cells according to size by a velocity sedimentation technique in a linear gradient (5-45%) of bovine serum in Medium 199; fraction 1 contained cells with the highest speed of sedimentation and fraction 5 the slowest cells. DNA synthesis was followed using ³H thymidine tracer. Specific activity distribution patterns obtained for fractions 1-4 indicated that cell size depends on cell position in the mitotic cycle, i.e., fractions 1-2 and 3-4 were enriched with cells in the G₂, S and G₁ periods, resp. As measured by the bridge technique at 9 kHz, specific electroconductivity of the cells was high in the G₁ period, decreased by a factor of 2 to 2-5 in the S period and increased again in the G₂ period. Changes in cell electroconductivity are indicative of changes in the passive permeability of cells, periods of high permeability corresponding to membrane synthesis and initiation of cell division in autonomously dividing cells.

4867 THE PRESENCE OF "FETAL" THYMIDINE KINASE IN HUMAN TUMORS. (E.) Stafford, M. A. (Div. Med. Genetics, U. California, San Diego) and O. W. Jones. *Biochim Biophys Acta* 277(2):439-442, 1972.

Tissue extracts from surgical specimens of rhabdo-

myosarcoma, Wilm's tumor, bladder adenocarcinoma and a benign uterine fibroma were tested for the presence of a fetal type thymidine kinase. The fetal enzyme can be differentiated from the adult type by its inability to use CTP as a phosphate donor, its low activity at pH 4.5, the lack of inhibition by dCTP, and by its characteristic slow migration rate in polyacrylamide gel electrophoresis. On the basis of these criteria, the rhabdomyosarcoma, Wilm's tumor, and bladder adenocarcinoma all predominantly contained the fetal type enzyme, whereas the benign uterine fibroma, although containing some fetal type activity, primarily showed normal adult type activity. These results suggest that gene expression for human fetal thymidine kinase is repressed in post-natal tissues and in all probability is transmitted vertically as part of the host genome. This gene is apparently derepressed under certain conditions associated with carcinogenesis.

868 CHARACTERIZATION OF A FACTOR REQUIRED FOR THE DIFFERENTIATION OF MYELOID AND LYMPHOID CELLS IN VITRO. (E.) Watson, J. (Salk Inst. Biol. Studies, San Diego, Calif.) and J. Prichard. *J Immunol* 108(5):1209-1217, 1972.

Culture supernatants of leukemia virus-infected spleen cells of the JLS-V5 line were found to contain a factor which stimulated a primary immune response to sheep erythrocytes in immunologically unresponsive ALB/c or C57BL/6 mouse spleen cells prepared from nonimmunized mice and cultured in a medium deficient in fetal bovine serum. The same factor also stimulated the growth of colonies when mouse bone marrow cells were cultured in soft agar; factor-induced colonies contained cells which differentiated from immature granulocytes at early stages of growth into granulocytes and macrophages. The JLS-V5 culture supernatants were precipitated with ammonium sulfate, centrifuged and fractionated on a 90 x 3 cm Sephadex 100 column. Two main fractions were collected, and it was found that the ability to stimulate bone marrow and spleen cells was always associated with the same fraction. JLS-V5 factor was treated with a variety of enzymes and chemicals, including α -chymotrypsin, trypsin, pronase, collagenase, neuraminidase, ribonuclease, or deoxyribonuclease, urea, mercaptoethanol or dithiothreitol. The factor retained its ability to stimulate spleen and bone marrow cells through all treatments. Periodate treatment, however, destroyed the stimulatory activity of the JLS-V5 factor. Acrylamide gel electrophoresis indicated that the active component of the JLS-V5 factor had a molecular wt of 70,000 to 80,000.

869 CYCLIC 3', 5'-NUCLEOTIDE PHOSPHODIESTERASES OF NOVIKOFF RAT HEPATOMA, MOUSE L, AND HeLa CELLS GROWING IN SUSPENSION CULTURE. (E.) Schröder, (U. Minnesota Med. Sch., Minneapolis) and P. G. W. Bagemann. *Cancer Res* 32(5):1082-1087, 1972.

Cell fractions were prepared from Novikoff rat hepatoma cells (N1S1-67), mouse L cells (LB-67 and LG-67) and HeLa cells (HeLa-S3-67) by sonic oscillation or homogenization followed by centrifugation. The supernatant fractions were assayed for phosphodiesterase activity by measuring the production of ^3H -AMP from ^3H -cyclic 3',5'-AMP. At 0.4 mM cyclic 3',5'-AMP in the assay mixture, mouse L cells contained 20- to 40-fold more activity than N1S1-67 cells whose specific activity, in turn, was only five to 10% that of similar extracts from rat liver (six to seven μM phosphodiesterase/mg protein). Activity of mouse L cells (eight to 16 μM /mg) was three to four times that of mouse liver (three to four μM /mg). Twenty to 30% of the cAMP converted to AMP by N1S1-67 extracts was further converted to adenosine by 5'-nucleotidase. Mouse L cells showed no further degradation of cAMP; however, the conversion of cAMP (0.5-1.5 mM) to adenosine was almost quantitative (48% of total radioactivity) in HeLa cell extracts indicating a high level of 5'-nucleotidase in HeLa but not in L cells. Kinetic studies of enzyme activities of cell extracts at 0.25 μM to 1.0 mM cAMP indicated that there were two phosphodiesterase activities in each cell line; one with a low K_m (1.0 to 2.0 μM) and one with a high K_m (0.1 to 0.4 mM). The similarity of K_m 's for all four cell lines indicated similar phosphodiesterases in these lines despite their diverse origin. V_{\max} did differ between cell lines with that for the high K_m enzyme, being 30 times higher in L cell extracts (16 nmoles/min/mg protein) than in N1S1-67 extracts (0.55 nmoles/min/mg protein) and three to four times higher than in HeLa extracts (3.0 to 4.0 nmoles/min/mg protein). V_{\max} for the low K_m enzyme was similar (0.1 to 0.3 nmoles/min/mg protein) for all four cell lines. Over 90% of both enzyme activities was present in the "postnuclear" fraction of all four lines with most (60 to 70%) of the activity in the "cell sap". Both enzymes from all four cell lines were inhibited by theophylline with similar K_i 's (one to seven mM). However, the high K_m enzymes were competitively inhibited while the low K_m enzymes were inhibited in a noncompetitive manner. Both enzyme activities were independent of the cell growth cycle. Neither insulin (ten or 100 μM /ml) nor glucagon (5 μM) had any effect on either phosphodiesterase of N1S1-67 cells.

4870 POLYAMINE AND NUCLEIC ACID CONCENTRATIONS IN EHRlich ASCITES CARCINOMA CELLS AND LIVER OF TUMOR-BEARING MICE AT VARIOUS STAGES OF TUMOR GROWTH. (E.) Andersson G. (Inst. Zoophysiology, U. Lund; Sweden) and O. Heby. *J Nat Cancer Inst* 48(1):165-172, 1972.

The concentrations of putrescine, spermidine, spermine, DNA, and RNA in Ehrlich mouse ascites carcinoma cells were determined at various stages of tumor growth. The putrescine concentration was markedly elevated in the latter phases of rapid multiplication, but declined considerably with increasing tumor mass. The changes in the concentration of spermidine, spermine, and nucleic acids were similar to each other. There were concomitant maxima in the

polyamine-N/nucleic acid-P ratio and the number of prophase during tumor growth. The concentrations of polyamines and nucleic acids were also studied in the livers of tumor-bearing mice. The results clearly demonstrated that the transplanted ascites tumor greatly influenced the spermidine concentration in the liver. After a precipitous drop, it progressively increased to a value considerably higher than the initial value. However, the presence of the tumor did not markedly alter the DNA and RNA concentrations.

- 4871 FATE OF L-[3,5-³H] TYROSINE IN CELL-FREE EXTRACTS AND TISSUE CULTURES OF MELANOMA CELLS: A NEW ASSAY METHOD FOR TYROSINASE IN LIVING CELLS. (E.) Oikawa, A. (Natl. Cancer Ctr. Res. Inst., Tokyo, Japan), M. Nakayasu, M. Nohara and T. Tchen. *Arch Biochem* 148(2):548-557, 1972.

Cell-free extracts from cells derived from cultured melanoma (C₂M cells) were incubated with L-(3,5-³H) tyrosine (1 mM) in the presence of 0.1 mM dopa. The hydroxylation of tyrosine to dopa by tyrosinase was observed. C₂M extracts and labeled tyrosine produced tritiated water at a steady rate for 15 hr with conversion of 20% of added radioactivity. Melanin and dopa were also produced, but the compounds contained little radioactivity. Extracts of C₂W cells, derived from an amelanotic line of melanoma cells, produced neither tritiated water nor melanin. On culture of C₂M cells in the presence of L-(3,5-³H)tyrosine, the radioactive reaction products were water, melanin and protein. C₂W cells cultured in the presence of labeled tyrosine produced only tritiated protein, indicating that C₂W cells lacked tyrosinase. The ratio of the amount of tyrosine hydroxylated by tyrosinase (ΔTy) to water (W) was observed during incubation of C₂M cell-free extract and during cultivation of C₂M cells. The ratio ΔTy/W remained fairly constant for reactions with a wide range of reaction rates (1.4 for cell-free extracts, 1.1 for C₂M cells in culture). ΔTy/W was also constant for reactions using enzymes from different sources, including human melanoma.

- 4872 TUBERCULOMAS OF THE BRAIN. (E.) Balaparameswararao, S. (Andhra Med. Coll, Visakhapatnam, India) and I. Dinakar. *Int Surg* 57(3):216-220, 1972.

- 4873 TUMORS OF THE JAW. (E.) Anonymous. *CA* 22(2):107-109, 1972.

- 4874 ASSAY OF C-CELL THYROID ADENOMA OF MAN FOR CALCITONIN ACTIVITY. (E.) Lorenc, R. (Postgrad. Med. Ctr., Warsaw, Poland) and M. Beskid. *Acta Histochem* 43(1):1-7, 1972.

- 4875 GIANT CELL TUMOUR OF THE LARYNX. (E.) Hall-Jones, J. (Invercargill, New Zealand). *J Laryngol Otol* 86(4):371-381, 1972.

- 4876 HAEMANGIOPERICYTOMA IN THE NASAL CAVITY IN IBADAN, NIGERIA. (E.) Alli, A. F. (U. Coll. Hosp., Ibadan, Nigeria) and S. P. Singh. *J Laryngol Otol* 86(4):405-410, 1972.

- 4877 CENTRAL GIANT-CELL GRANULOMA. SEVERAL INTERESTING CASES. (E.) Guralnick, W. C. (Harvard Sch. Dental Med., Boston, Mass.) and R. B. Donoff. *Br J Oral Surg* 9:200-207, 1972.

- 4878 MORPHOLOGIC ABNORMALITIES IN THE BONE MARROW SEGMENTED NEUTROPHILS OF TUMOR BEARING ANIMALS. (E.) Kastner, M. R. Q. de (Oswaldo Cruz Inst., Rio de Janeiro, Brazil). *Arch Geschwulstforsch* 39(4):293-299, 1972.

- 4879 PRIMARY MALIGNANT LYMPHOMA OF THE CERVIX UTERI. A REPORT OF PRIMARY RETICULUM CELL SARCOMA OF THE CERVIX. (E.) Mahran, M. (Dept. Obstetrics, Ain Shams U., Cairo, United Arab Republic) and S. G. Iskander. *Int J Gynecol Obstet* 10(3):81-86, 1972.

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ARONSON, S.A.	AOKI, T.	BALAPARAMESWARARAO, S.
4523, 4535	4555, 4694	4872*
BRATT, J.D.	ARASZKIEWICZ, H.	BALDWIN, R.W.
4490	4815	4678
BDU, N.I.	ARATA, T.	BALL, C.R.
4776*	4886*	4397, 4411
BDU, N.L.	ARIMA, T.	BALLARD, R.
4776*	4880*	4889*
BF, Y.	ARMSTRONG, R.W.	BALTIMORE, D.
4740*	4318	4967*
BELEV, G.I.	ARMUTH, V.	BALZARINI, G.P.
4723*	4392	4675
BELL, C.W.	ARNOLD, E.	BANKS, W.J.
4861	4366	4972*
BOSTA, A.	ARTHUR, K.	BANNASCH, P.
4340*	4327*	4472*
BAM, F.	ASAHIMA, S.	BANSAL, S.C.
4691	4366	4612, 4649, 4671
BELSTEIN, A.M.	ASOFSKY, R.	BARCLAY, D.L.
4308	4402	4914*
BAGI, T.	ASTALDI, G.	BARNETT, J.W.
4519	4357*	4611
BAG, M.	ASTEDT, B.	BARON, S.
4369	4983*	4553
BEDD, H.	ATERMAN, K.	BARRETT, H.
4942*	4423	4809
BERFT, R.F.	ATUK, N.D.	BARRY, E.J.
4434	4995*	4430
BEKSANDROWICZ, J.	AVILA, L.	BARRY, M.M.
4446	4735*	4808
BEXANDER, W.D.	AVIV, D.	BARSKI, G.
4762*	4896*	4642
BIERI, D.	AVRAMFAS, S.	BARTHEL, W.F.
4806*	4895*	4456*
BIFORD, T.C.	AXELRAD, A.A.	BARTLETT, G.L.
4697	4533	4655, 4761*
BLEGRI, G.	BABA, K.	BASOMBRI, M.A.
4921*	4811	4401
BLLI, A.F.	BACARDI NOGUERA, R.	BATTIFORA, H.A.
4876*	4978*	4500*
B.M. G.V.	BACHENHFIMER, S.	BATZING, B.L.
4672	4548	4618
BATO, D.	BADER, J.P.	BAUER, H.
4726*	4540	4570
BETANI, T.	BAGLIONI, C.	BAUM, S.G.
4852	4997*	4527, 4543
BOS, D.B.	BAGSHAW, K.D.	BAUMAL, R.
4688	4770*	4705*
BDRFR, F.A.	BAHLFY, YF.A.	BAYER, R.
4549	4440	4696
BDRSEN, P.R.	BAILEY, I.C.	BECKER, F.F.
4481*	4839*	4402
BDRSON, J.	BAILEY, J.M.	BEKESI, J.G.
4506	4838*	4653, 4719*
BDRSON, I.G.	BAINBRIDGE, D.R.	BELEHRADEK, J., JR.
4803*	4507	4642
BDRSSON, G.	BAKER, J.R.	BELLI, J.A.
4870	4522	4650
BDO, K.	BAKER, M.S.	BELMAN, S.
4852	4394, 4437	4368
BDRFA, J.	BAKER, R.S.U.	BELOUSOVA, A.K.
4366	4534	4439

BELPOMME, D. 4306	BISKIS, B.O. 4515	BRADA, Z. 4461*
BENDICH, A. 4400	BISSFELL, M.J. 4558	BRAI, M. 4363
BENDINELLI, M. 4507	BITTE, L. 4994*	BRAND, I. 4790
BENEDICT, W.F. 4409, 4433	BITTNER, J. 4956*	BRAND, K.G. 4790
BENNETT, S.J. 4625	BJOFRLIN, G. 4983*	BRAUN, J. 4729*
BENTVELZEN, P. 4305, 4309	BLACK, L.M. 4609*	BREISTEIN, L.S. 4370
BENTWICH, J. 4620	BLACKWELL, R. 4383	BRETTON, R. 4568
BERARD, C.W. 4630	BLAFSE, M.R. 4757*	BRIDGER, G.P. 4945*
BERENBLUM, I. 4392	BLAFSE, R.M. 4756*	BRIGGS, G.M. 4606*
BERG, J.W. 4436	BLAIR, P.B. 4681	BRISTOL, R. 4416
BERGS, M. 4544	BLINOVA, G.A. 4787	BROMOWICZ, J. 4815
BERGS, V. 4614	BLOCK, J. 4659	BROWN, B.W. 4673
BERGS, V.V. 4544	BLOOM, F.T. 4669	BROWN, M. 4559
BERKE, G. 4616, 4688	BLUMING, A.Z. 4657, 4786, 4789	BRUNI, J.E. 4846
BERN, H.A. 4799*	BOCK, F.G. 4408	BRUNNING, R.O. 4937*
BERNHARD, W. 4568	BOGDEN, A.F. 4522	BRYAN, G.T. 4387
BERNLOHR, R.W. 4900*	BOINCCHI, M. 4456*	BUCCIARELLI, E. 4371
BERNSTEIN, R. 4996*	BOLIN, M.G. 4927*	BUCH, H.G. 4909*
BERTOLOTTI, R. 4849	BOLLENGIER, W.F. 4373	BUEHRING, G.C. 4885*
BESKID, M. 4874*	BOLOGNESI, D.P. 4570	BUHL, S.N. 4496*, 4963*
BHAMARAPRAVATI, N. 4418	BONANNI, F. 4487*	BULBA, S. 4461*
BHATNAGAR, M.K. 4727*, 4972*	BONT, W.S. 4393	BUNDREN, J.C. 4736*
BHATTACHARAYA, M. 4692	BORFELLA, L. 4680	BUOEN, L.C. 4790
BHOOPALAM, N. 4765*, 4766*	BOREN, H. 4394	BURBANK, F. 4436
BIANCHI, A. 4814	BORLAND, R. 4398	BURCH, J.C. 4449*
BIANCIFIORI, C. 4476*	BORUN, T.W. 4997*	BURKI, H.R. 4573
BILGER, I. 4434	BOSMA, M. 4739*	BURNETT, W. 4837*
BIRD, C.F. 4854	BOSMANN, H.B. 4552	BURNS, F.J. 4434
BISCALDI, G.P. 4473*	BOTSMAN, N.E. 4396	BURTIN, P. 4624, 4755*
BISCHEL, M.D. 4801*	BOWEN, J.M. 4514, 4611	BUSCH, H. 4617, 4944*
BISHOP, Y. 4366	BOYD, C.B. 4910*	BUSCH, R.K. 4617

BUTEL, J.S.
 4509
 BUTLER, W.H.
 4398
 BYRD, B.F., JR.
 4449*
 BYRNE, G.E.
 4560
 CADFMARTIRI, G.
 4806*
 CADY, B.
 4855
 CAIN, W.A.
 4736*
 CALABRESI, P.
 4662
 CALABRIA, S.I.
 4821
 CALCAGNO, F.J.
 4819, 4821
 CALCUTT, G.
 4485*
 CALI, A.
 4561
 CANEVARI, S. D
 4675
 CAPRA, J.D.
 4754*
 CAPUTO, A.
 4903*
 CARBONE, P.P.
 4786
 CARDOSO, S.
 4863
 CARL, P.
 4952*
 CARMEL, A.
 4366
 CARRUTHERS, C.
 4692
 CARTER, D.
 4928*
 CARTER, R.L.
 4666
 CARURELLI, R.
 4736*
 CASALOTS, J.
 4978*
 CASPARY, E.A.
 4734*
 CASTANERA, T.J.
 4491
 CASTLEMAN, B.
 4934*
 CATER, D.R.
 4711*
 CATOVSKY, D.
 4641
 CAYOLLA DA MOTTA, I.
 4490
 CECILIONI, V.A.
 4823

CEGLOWSKI, W.S.
 4574
 CERILLI, J.
 4700
 CESARINI, J.P.
 4564
 CHAKI, F.
 4748*
 CHANG, P.W.
 4506
 CHARLES, R.T.
 4456*
 CHAVANEL, G.
 4755*
 CHEERS, C.
 4666
 CHEMAMA, R.
 4390
 CHIR, M.
 4355*
 CHIVERS, B.R.
 4367
 CHO, H.Y.
 4537
 CHOKSI, S.K.
 4834*
 CHOPRA, H.C.
 4522, 4550, 4556, 4600*
 CHOPRA, P.K.
 4960*
 CHRISTINE, B.
 4809
 CHU, T.M.
 4737*
 CHUANG, J.
 4737*
 CHUDECKI, B.
 4499*
 CHUDINOVA, I.A.
 4845
 CHUNG, E.B.
 4742*
 CHURCHILL, W.H.
 4650
 CHVAPIL, M.
 4461*
 CHYLE, M.
 4588*
 CHYLE, P.
 4588*
 CIHAK, A.
 4466*
 CLAPP, N.K.
 4618
 CLARK, A.F.
 4854
 CLARKE, S.
 4965*
 CLAY, A.
 4349*
 CLEMENS, J.A.
 4455*

CLIFFORD, P.
 4690
 CLIFTON, K.H.
 4493
 COBB, L.M.
 4733*
 CODINGTON, J.F.
 4764*
 COEZY, E.
 4390
 COFFIN, D.
 4366
 COFFIN, J.M.
 4518
 COFFINO, P.
 4705*
 COFFMAN, R.L.
 4760*
 COHEN, A.M.
 4703
 COHEN, E.
 4737*
 COHEN, I.
 4620
 COHEN, M.N.
 4996*
 COHN, N.K.
 4493
 COLE, R.D.
 4799*
 COLEY, G.M.
 4979*
 COLIGAN, J.E.
 4648, 4689
 COLLINS, G.B.
 4456*
 COLLIS, C.H.
 4825*
 CONGDON, C.C.
 4530
 CONNELLY, R.
 4809
 CONSTANS, J.P.
 4640
 CONTESSE, G.
 4346*
 CONZELMAN, G.M., JR.
 4469*
 COOK, P.
 4825*
 COOPER, H.L.
 4443
 COOPER, M.A.
 4853
 COOPER, R.W.
 4524
 CORK, A.
 4514
 COSCIA-PORRAZZI, L.
 4561
 COSTA, C.
 4921*

COSTEA, N.
 4766*
 COUTINHO, W.G.
 4769*
 COWAN, D.H.
 4726*
 COX, B.J.
 4947*
 CRADDOCK, V.M.
 4862
 CRAMER, R.
 4567
 CREMER, N.F.
 4513
 CREPALDI, G.
 4921*
 CRIST, W.
 4352*
 CROCKER, T.T.
 4362
 CRUSE, J.M.
 4668
 CULLITON, B.J.
 4610*
 CUNEO, J.M.
 4328*
 CUNNINGHAM, C.
 4822
 CURRIE, A.R.
 4414
 CURRIE, G.A.
 4336*
 CYKALFWICZ, Z.
 4447
 CZACHOR, M.
 4446
 DA COSTA, M.
 4969*
 DA SILVA HORTA, J.
 4490
 DAAMS, J.H.
 4305
 DAFTARY, D.K.
 4407, 4834*
 DAGNA, F.
 4357*
 DALTON, A.J.
 4334*
 DAMMACCO, F.
 4738*
 DANESHROOD, K.
 4990*
 DANNEFL, R.
 4807
 DAQUST, R.
 4780
 DAS, M.M.
 4322*
 DASKAL, Y.
 4617
 DAVID, J.R.
 4650

DAVID, S.S.
 4332*
 DAVIDOVA, S.YA.
 4845
 DAVIDSON, E.A.
 4750*
 DAVIDSON, J.K.
 4444
 DAVIES, A.J.S.
 4666
 DAVIS, A.M.
 4793
 DAVIS, G.
 4739*
 DAY, N.
 4456*
 DE ANTONI, A.
 4921*
 DE GIORGI, L.S.
 4927*
 DE HALLEUX, F.
 4502
 DE KASTNER, M.R.O.
 4878*
 DE KOCK, D.H.
 4457*
 DE LANDAZURI, M.O.
 4621
 DE LUCA, L.
 4487*
 DE MICCO, C.
 4564
 DE OCAMPO, G.
 4326*
 DE OLIVOS, N.L.
 4821
 DE OME, K.B.
 4606*
 DE SERRES, F.J.
 4468*, 4483*
 DE THE, G.
 4347*, 4663
 DEROV, S.S.
 4840
 DECKERS, C.
 4732*
 DECLEVE, A.
 4502
 DEINHARDT, F.
 4532, 4572
 DEL GIACO, G.S.
 4712*
 DEL VILLANO, B.
 4750*
 DELFOR PODESTA, L.
 4819, 4821
 DELLA CUNA, G.R.
 4473*
 DELLA PORTA, G.
 4569
 DELLA TORRE, G.
 4569

DEMOISE, C.F.
 4537
 DENK, H.
 4684
 DENT, P.B.
 4646
 DEODHAR, L.P.
 4909*
 DHRU, R.
 4988*
 DI GARZIA, L.
 4345*
 DIETZ, M.
 4645
 DILLER, R.F.B.
 4454*
 DINAKAR, I.
 4872*
 DINTSMAN, M.
 4982*
 DIPPLE, A.
 4410
 DIRINGER, H.
 4549
 DIXON, J.R.
 4403
 DMOCHOWSKI, L.
 4611
 DOCHERTY, J.J.
 4504, 4520
 DOERFLER, W.
 4529
 DOCHERTY, D.G.
 4413
 DOIG, A.T.
 4817
 DOLL, R.
 4824
 DOMBOS, L.
 4575
 DONEGAN, W.L.
 4822
 DONOFF, R.B.
 4877*
 DOERFMAN, R.F.
 4932*
 DORRINGTON, K.J.
 4753*
 DOYLE, D.
 4906*
 DRAPER, G.J.
 4830*
 DUBE, V.E.
 4488*
 DUDLEY, B.M.
 4762*
 DUH, F.G.
 4537
 DULAK, M.
 4446
 DULBECCO, R.
 4541

DUNGWORTH, D.L.

4524

DUNHAM, I.J.

4354*

DUNKEL, V.C.

4654

DUNN, A.R.

4593*

DYAD'KOVA, A.M.

4528

EARLE, J.

4715*

ECKERSTORFER, R.

4684

EGAN, M.I.

4648, 4689

EISEN, H.N.

4677, 4702, 4751*

EISENFEID, A.J.

4373

EKARAPHANICH, S.

4959*

EL-FIKY, S.M.

4604*

ELGORT, D.A.

4723*

EISAESSER, E.

4952*

FIVERBACK, L.R.

4820

FIMMELDT, P.

4393

FINDO, H.

4482*

FING, C.P.

4727*

FIPSTEIN, M.A.

4320

FIPSTEIN, S.S.

4366

FIPSTEIN, W.L.

4652

FROZAN, Y.S.

4928*

FRTUEK, F.

4387

FSBER, H.J.

4522

FILDERINK, F.

4489

EVANS, D.L.

4611

EVANS, F.P.

4501*

EVANS, V.J.

4976*

FYAL, O.

4620

FADEI, L.

4802*

FAJARDO, L.F.

4964*

FARBER, E.

4417

FARR, H.W.

4327*

FASS, L.

4605*, 4759*, 4789

FAULKNER, C.S., II

4962*

FAVINO, A.

4473*

FFBVRE, H.

4640

FFCHNER, R.E.

4429, 4450*

FFFER, A.

4605*, 4687, 4759*

FELDMAN, P.S.

4931*

FERNANDEZ, A.

4819

FERRER, J.F.

4651, 4735*

FIELD, E.J.

4734*

FIELDS, J.F.

4668

FINKEL, M.P.

4515

FINKELSTEIN, J.Z.

4321, 4958*

FISCHINGER, P.J.

4521

FISHER, D.F.

4488*

FISHER, R.J.

4364

FISHKIN, R.G.

4699

FLANDRIN, G.

4716*

FLAXMAN, H.A.

4940*

FLESHER, J.W.

4365

FONTAINE, S.A.

4827*

FORBES, I.J.

4777*

FORBES, J.T.

4668

FORD, C.E.

4501*

FORNATTO, L.

4459*

FORSBERG, J.-G.

4370, 4464*

FOSSATI, A.

4357*

FOSSATI, G.

4675

FOX, R.I.

4527

FRANCHI, G.

4806*

FRANCIS, T.I.

4351*, 4813

FRANGIONE, B.

4738*

FRANKLIN, E.C.

4738*

FREEDMAN, M.H.

4767*

FREZOULS, G.

4554

FRIEDMAN, H.

4574

FRIEDMAN, L.

4379

FRIESEN, S.R.

4798*

FRITHIOF, L.

4785

FROLOV, A.F.

4396

FROST, J.K.

4928*

FUCHS, R.

4344*

FUJIHARA, E.

4852

FUJIOKA, S.

4590*

FUJIWARA, M.

4497*

FUJIWARA, Y.

4975*

FUKUDA, S.

4419

FUKUHARA, M.

4494

FUKUYAMA, K.

4652

FURTH, J.

4965*

GABRIEL, R.

4762*

GABRILOVE, J.L.

4893*

GAD, C.

4826*

GALLAGER, H.S.

4307

GALLAGHER, R.E.

4603*

GALLIMORE, P.H.

4593*

GALLO, R.C.

4590*, 4603*

GALTON, D.A.G.

4641

GANTT, R.R.

4977*

GARATTINI, S.

4806*

GARCIA, H.
4405
GARDNER, D.
4434
GARDNER, D.A.
4913*
GARDNER, W.U.
4373
GARNER, R.C.
4386
GAZDAR, A.F.
4550, 4553, 4599*, 4600*
GEJVALL, T.
4428
GELBOIN, H.V.
4443
GELDERBOM, H.
4570
GELFANT, S.
4919*
GEORGIADIS, J.
4339*
GERBER, G.B.
4374
GERBER, P.
4590*
GERFO, P.I.
4729*, 4775*
GERRARD, M.F.
4414
GHANTA, V.K.
4758*
GIBBS, C.J., JR.
4556
GIELEN, J.F.
4433
GILCHRIST, G.S.
4321
GILDEN, R.V.
4565
GILL, P.
4960*
GILLESPIE, G.Y.
4668
GILLMAN, T.
4941*
GLASER, R.
4536
GLASS, R.M.
4732*
GLAVES, D.
4678
GIEFFSON, M.H.
4622
GLEICHMANN, E.
4628
GLEICHMAN, H.
4628
GLEW, D.H.
4697
GLYNN, J.P.
4687

GOGGINS, J.F.
4508
GOLD, P.
4697
GOLDBERG, R.J.
4520
GOLDFARB, S.
4851
GOLDIN, A.
4679
GOLDMAN, R.L.
4898*
GOLDROSEN, M.H.
4767*
GOLUB, S.H.
4623, 4685
GORD, R.A.
4512
GOODMAN, J.
4411
GORBACH, P.D.
4830*
GORDON, J.E.
4418
GOROZHANSKAYA, E.G.
4845
GORTER, H.
4690
GOTHOSKAR, B.
4575, 4660
GOTO, K.
4721*
GOTO, M.
4721*
GOTOHDA, E.
4505
GRAFF, R.J.
4677, 4751*
GRAHAM, S.
4837*
GRALNICK, H.R.
4970*
GRANOFF, A.
4343*
GRANTHAM, P.H.
4732*
GRATTAROLA, R.
4858
GREEN, M.
4311
GRIFONI, V.
4712*
GRISWOLD, D.E.
4662
GROS, F.
4346*
GROSS, L.
4337*
GROTH, U.
4427
GROVER, P.L.
4445

GRUMET, F.C.
4670
GRUNDY, G.W.
4486*
GUINAN, P.
4737*
GULLOTTA, F.
4908*
GUPTA, P.C.
4407, 4834*
GURALNICK, W.C.
4877*
GURTSEVICH, V.E.
4631
GUTMANN, H.R.
4430
GUTTERMAN, J.U.
4749*
GYOERGY, E.
4946*
HABER, M.
4416
HACKETT, A.J.
4597*
HACKETT, R.L.
4377
HADFIELD, E.H.
4360*
HADFIELD, M.G.
4911*
HAKOMCRI, S.-I.
4773*
HALBERG, F.
4863
HALL-JONES, J.
4875*
HALL, M.G., JR.
4742*
HALLOWES, R.C.
4941*
HALPERN, M.S.
4760*
HALPIN, Z.T.
4681
HALTERMAN, R.H.
4643, 4674
HAMLIN, N.M.
4758*
HAMMER, J.E., III
4477*
HANDLEMAN, S.L.
4976*
HANEY, A.
4479*
HANNA, M.G., JR.
4413, 4618
HANNESTAD, K.
4702
HANSEN, H.H.
4888*
HANSEN, H.J.
4729*

HARANGHY, I.	HEPPNER, G.H.	HCEFFMAN, C.
4946*	4662	4478*
HARD, G.C.	HERBERMAN, R.H.	HCFSTRAND, H.J.
4398	4621, 4643, 4674, 4697	4757*
HARFL, J.	HERMAN, J.R.	HOGGAN, M.C.
4554	4831*	4525
HARFL, I.	HERNDON, R.M.	HOHMANN, P.
4554	4517	4799*
HARGREAVES, R.	HERSH, F.M.	HOKAMA, Y.
4649	4749*	4768*
HARRIS, A.W.	HERTER, F.P.	HOLDEN, H.T.
4667	4625, 4729*	4531
HARRIS, C.C.	HERZFELD, A.	HOLLAND, J.F.
4394, 4437	4791	4653
HARRIS, F.D., JR.	HESTER, R.R.	HOLLAND J.F.
4962*	4668	4719*
HARRIS, R.	HESTON, W.F.	HOLLANDER, C.F.
4622	4577	4883*
HARRISON, R.F.	HEWITSON, J.F.	HOLLINSHEAD, A.
4495*	4623, 4660, 4685	4710*
HASEGAWA, H.	HITASA, Y.	HOLLINSHEAD, A.C.
4595*, 4974*	4372, 4385	4697
HASHIMOTO, Y.	HIBBS, J.B., JR.	HOLT, P.J.L.
4470*	4984*	4641
HASHINOTSUME, M.	HICKS, R.M.	HOLYCKE, C.
4922*	4431	4737*
HATFIELD, P.M.	HIGASHI, N.	HOLZNER, J.H.
4933*	4852, 4985*	4684
HATIF, C.	HIGASHINAKAGAWA, T.	HONJO, I.
4558	4925*	4892*
HAUS, F.	HIGASHINO, K.	HOCKS, J.J.
4863	4922*	4556
HAWKS, A.	HIGGINS, G.R.	HCPP, M.L.
4417	4958*	4376
HAYMAKER, W.	HILICOT, B.L.	HCRIKAWA, M.
4498*	4646	4494
HAYS, F.F.	HINO, S.	HCRTON, B.J.
4658	4589*	4782
HEALD, R.J.	HIVSHAW, H.T.	HCRVATH, E.
4355*	4853	4931*
HEBY, D.	HIRAKI, K.	HCSHINO, K.
4870	4595*, 4974*	4463*
HEIDELBERGER, C.	HIRAMOTO, R.N.	HCSOKAWA, M.
4424, 4445	4758*	4505
HELFNA TAVARES, M.	HIRANO, H.	HCHWARD, B.V.
4490	4915*	4838*
HELLER, P.	HIRAO, F.	HCHWITZ, M.S.
4765*, 4766*	4384	4543
HELLMAN, A.	HIRAO, K.	HCHYER, B.
4413	4385	4548
HELLSTROM, I.	HIRSCH-KAUFFMANN, M.	HSU, T.C.
4638, 4671, 4698	4529	4884*
HELLSTROM, K.E.	HISAMATSU, T.	HUANG, A.S.
4638, 4671, 4698	4420	4967*
HENDERSON, W.R.	HOD, I.	HUANG, E.-S.
4652	4634	4516
HENLE, G.	HODGINS, D.S.	HUBERMAN, E.
4654	4861	4424, 4445
HENLE, W.	HOFKSTRA, J.	HUEBNER, R.J.
4654	4572	4665
HENSCHKE, U.K.	HOEL, D.G.	HUEPER, G.
4827*	4999*	4570

HUI, Y.H.
4606*
HUMPHRIES, E.H.
4511
HUNT, R.D.
4312
HUREZ, D.
4716*
HURWITZ, J.
4551
HWANG, D.S.
4863
HYMAN, R.
4615
IKAWA, Y.
4600*
ILIEVSKI, V.
4522
INGRAM, A.J.
4467*
INNOCENTI, I.R.-D.
4806*
ISHIDA, N.
4747*
ISHIGAMI, S.
4713*
ISHIJIMA, Y.
4852
ISHIZAWA, M.
4482*
ISKANDER, S.G.
4879*
ITO, A.
4965*
ITO, M.
4722*
ITO, N.
4372, 4385, 4462*
ITO, S.
4661
ITO, Y.
4453*
ITZE, L.
4412
IVERSEN, O.H.
4391
IWANAGA, T.
4987*
IZAK, G.
4620
JABARA, A.G.
4364
JACKSON, J.L.
4977*
JACOBS, A.J.
4426
JACOBS-LORENA, M.
4997*
JACOBS, R.P.
4756*
JACORY, B.
4770*

JAIN, K.K.
4960*
JAMES, A.E.
4933*
JARRETT, W.F.H.
4788
JASTY, V.
4506
JASZCZ, W.
4578*
JAWORSKA, H.
4639
JEANLOZ, R.W.
4764*
JENNINGS, R.H.
4914*
JENNISON, R.F.
4622
JENTOFF, V.L.
4804*
JIM, R.
4768*
JOHNSON, E.A.
4451*
JOHNSON, F.B.
4525
JOHNSON, G.S.
4508
JOHNSON, P.A.
4694
JOHNSON, R.T.
4517
JOKLIK, W.K.
4583*
JONES, D.C.
4491
JONES, K.W.
4593*
JONES, O.W.
4867
JONES, R.D.
4673
JOSEPH, J.M.
4659
JOSHI, S.
4366
JULLIEN, P.
4503
JUNGSMANN, R.A.
4375
JURIN, M.
4686
JUSSAWALLA, D.J.
4833*
KABAT, D.
4994*
KADAS, I.
4805*
KADON, C.I.
4421
KAKO, K.
4740*

KALE, V.V.
4909*
KALININA, L.I.
4792
KALLMAN, R.F.
4964*
KAMAMOTO, Y.
4372, 4385
KAMBARA, T.
4432
KAMEN, H.
4969*
KAMINSKAS, E.
4992*
KAMO, I.
4747*
KANEKO, I.
4968*
KANG, K.-Y.
4922*
KANISAWA, M.
4369
KAO, M.-S.
4702
KAPLAN, A.L.
4340*
KAPLAN, N.C.
4913*
KAPUR, B.M.L.
4955*
KARASAKI, S.
4784
KASPRZAK, K.S.
4348*
KATAOKA, N.
4579*
KATAOKA, Y.
4721*
KATAYAMA, I.
4950*
KATO, H.
4816
KATO, K.
4566
KATO, N.
4661
KAUFMAN, D.G.
4394, 4437
KAUFMAN, R.H.
4340*
KAUNITZ, H.
4965*
KAWAMOTO, Y.
4975*
KEDAR, E.
4620
KEHOE, J.M.
4754*
KEISER, H.R.
4882*
KELLICUTT, L.M.
4481*

KELLER, G.
 4565
 KELLY, J.
 4981*
 KEMBLE, J.V.H.
 4350*
 KENNEDY, B.J.
 4937*
 KENNEDY, F.T.
 4585*
 KERNOHAN, I.R.
 4414
 KERR, H.A.
 4976*
 KERSTING, G.
 4908*
 KETCHAM, A.S.
 4703
 KETT, K.
 4805*
 KIDWELL, W.R.
 4596*
 KIEFF, F.
 4548
 KIEFER, J.
 4629
 KIJIMOTO, S.
 4773*
 KIMELDORF, D.J.
 4491
 KIMURA, I.
 4453*, 4679*
 KINDERMAN, B.
 4815
 KING, J.M.
 4584*
 KIRCHNER, H.
 4757*
 KIRSTEN, W.H.
 4580*
 KIRYABWIR, J.W.M.
 4657
 KISIC, A.
 4778*
 KISSLING, R.F.
 4647
 KITAGAWA, T.
 4452*
 KITAJIMA, T.
 4376
 KITANO, M.
 4718*
 KLAVINS, J.V.
 4435
 KLEIN, F.
 4690
 KLEIN, G.
 4575, 4660, 4685
 KLEIN, H.7.
 4898*
 KLEIN, K.M.
 4407

KLEIN, W.J., JR.
 4752*
 KLETZLI, R.
 4577
 KLIETMANN, W.
 4566
 KLOPFER, U.
 4634, 4717*
 KNOX, W.F.
 4314, 4791
 KOBAYASHI, A.
 4330*
 KOBAYASHI, H.
 4505
 KOCH, M.A.
 4549
 KODA, T.
 4713*
 KODAMA, T.
 4505
 KOEPPE, H.
 4639
 KOLFSNICHENKO, T.S.
 4438
 KOLLMORGEN, G.M.
 4736*
 KOMP, D.M.
 4947*
 KONAGA, F.
 4779*
 KONDO, T.
 4975*
 KONWINSKI, N.
 4865
 KONYAR, E.
 4946*
 KOPROWSKI, H.
 4566
 KORB, J.
 4588*
 KORINEK, J.K.
 4598*
 KORTWRIGHT, K.
 4965*
 KOSAKI, G.
 4987*
 KOSTRABA, N.C.
 4841
 KOVACEVIC, Z.
 4844
 KOVACS, K.
 4931*
 Koyama, H.
 4579*, 4987*
 KOZENITZKY, I.
 4982*
 KRAIN, L.S.
 4829*
 KRAJINA, Z.
 4904*
 KRAUZE-JAWORSKA, H.
 4843

KRECHETOVA, G.D.
 4845
 KREIDER, J.W.
 4750*
 KROES, R.
 4626
 KRONENBERG, H.
 4325*
 KRUEGER, G.R.F.
 4636
 KRUSH, A.J.
 4902*
 KRYKOWSKI, E.
 4639, 4843
 KUBINSKI, H.
 4481*
 KUEHL, J.F.W.
 4863
 KUEHN, P.G.
 4979*
 KULEZA, E.
 4639
 KUMAR, S.
 4731*
 KUNICKI, A.
 4810
 KURATSUKA, H.
 4892*
 KURLAND, L.T.
 4820
 KURODA, K.
 4369
 KUROKI, T.
 4445
 KUSAMA, S.
 4822
 KUZ'MINA, S.V.
 4792
 KUZNETSOV, O.K.
 4528
 LAERUM, O.D.
 4391
 LAGERLOEF, B.
 4783
 LAINE, R.
 4778*
 LAMBERT, L.H., JR.
 4984*
 LANE, I.
 4794
 LANGE, J.
 4521
 LANGLEY, G.R.
 4796*
 LANGLEY, R.A.
 4421
 LASFARGUES, E.Y.
 4769*
 LASKOV, R.
 4705*
 LAU, T.J.
 4377

I AUTENSCHLEGGER, J.T. 4648, 4689	LITTMAN, B.H. 4619	MADDEN, J.W. 4479*
LAW, L.W. 4676	LO GERON, P. 4625	MADROSZKIEWICZ, E. 4810
LAWIER, S.D. 4980*	LOBB, D.S. 4980*	MAESTRI, N. 4487*
LAWLEY, P.D. 4480*	LOCHMAN, D.J. 4887*	MAGEE, P.N. 4417, 4460*
LECHOWSKI, S. 4810	LOCKHART-MEMMERY, H.E. 4355*	MAGRASSI, F. 4339*
LEFF, J.A.H. 4333*	LOFFROTH, G. 4428	MAHAFFEE, D. 4853
LEFF, I.F. 4586*	LOMBARD, L.S. 4492	MAHRAN, M. 4879*
LEFFALL, L.D., JR. 4742*, 4827*	LONG, C. 4565	MAIZEL, J.V., JR. 4543
LEGATOR, M.S. 4381	LOOMIS, R.C. 4338*	MAKIURA, S. 4372, 4385
LEIS, J.P. 4551	LORENC, R. 4874*	MALEJKA-GIGANTI, D. 4430
LENNETTE, F.H. 4513, 4608*	LUCIS, D.J. 4423	MALENKOV, A.G. 4866
LENNOX, F.S. 4915*	LUCIS, R. 4423	MALI, S. 4820*
LEONARD, F.J. 4619	LUOLUM, D.B. 4460*	MALLING, H.V. 4483*
LETHCO, F.J. 4379	LUDOVICI, P.P. 4504	MANCONI, P.E. 4712*
LEUCHARS, F. 4666	LUKACS, L. 4805*	MANHEIMER, L. 4835*
LEVAN, G. 4601*	LUKES, R.J. 4801*	MARCHESI, V.T. 4743*
LEVANTHAI, B.G. 4643	LUNDHOLM, K. 4930*	MARCHCW, L. 4348*
LEVY, R.H. 4616	LUNDHOLM, U. 4529	MARCZYNSKA, B. 4572
LEVIN, D.L. 4301	LUNDMARK, C. 4929*	MARGGRAF, W.D. 4549
LEVINE, P.H. 4630, 4674	LUPULESCU, A.P. 4910*	MARIANI, T. 4512
LEVINSON, C. 4484*	LUTHRA, U.K. 4828*	MARK, J. 4601*
LEVINSON, S.S. 4378	LYNCH, H.T. 4902*	MARKOWA, J. 4602*
LEWIS, G.K. 4668	LYNCH, J. 4902*	MARQUARDT, H. 4400, 4445
LEWIS, M.G. 4728*	LYNCH, R.G. 4677	MARRIOTT, G. 4622
LI, Y.-T. 4778*	MAC PHERSON, B.R. 4774*	MARSH, B.R. 4928*
LIAN, K.T. 4990*	MAC PHERSON, I.A. 4562	MARTIN, D.H. 4404
LIEBERMAN, M.W. 4410	MAC SWEFN, J.M. 4796*	MARTIN, D.W., JR. 4993*
LIJINSKY, W. 4381, 4405	MACIEIRA-COELHO, A. 4895*	MARTIN, E. 4624
LIN, C.D. 4463*	MACKAY, I.R. 4781	MARTIN, F. 4664
LINDSTROM, D.M. 4541	MACKFY, L.J. 4788	MARTIN, J.E. 4307
LISZKOWA, A. 4602*	MACNAB, J.C.M. 4607*	MARTIN, M.L. 4647

MARTIN, M.S.
4664
MARTIN, R.G.
4542, 4596*
MARTIN, T.F.
4991*
MARTINEZ-PALOMO, A.
4310
MARTINO, F.C.
4724*
MARUGAMI, M.
4385
MARUGAMI, N.
4462*
MARUYAMA, Y.
4512
MARX, W.
4860
MAS MARTINEZ, C.
4978*
MASON, C.H.
4827*
MASON, M.M.
4522
MASSIMO, L.
4357*
MASUJI, H.
4595*
MATSUMOTO, H.
4416
MATSUMOTO, T.
4745*
MATSUMOTO, Y.
4892*
MATSUNO, N.
4881*
MATTHEWS, R.H.
4897*
MAUNOURY, R.
4640
MAVLIGIT, G.
4749*
MAZURENKO, N.P.
4631
MC ALLISTER, W.
4352*
MC BRIDE, C.M.
4749*
MC CAMMON, J.R.
4710*
MC CARTHY, B.J.
4991*
MC CLAIN, K.
4580*
MC COY, J.L.
4674, 4676, 4687
MC CULLOCH, F.A.
4726*
MC DEVITT, H.O.
4670
MC DONALD, R.
4532, 4572

MC DOUGALL, J.K.
4593*
MC DOWELL, M.J.
4583*
MC INTIRE, K.R.
4644
MC LEOD, D.L.
4533
MC WRIGHT, C.G.
4697
MEGA, T.
4462*
MFHTA, F.S.
4407, 4834*
MEIREN, D.V.
4439
MEISTER, H.
4344*
MEITES, J.
4965*
MELCHERS, F.
4707*
MELENDEZ, L.V.
4312
MELLIN, H.
4659
MELNICK, J.L.
4691
MELTZER, M.S.
4619, 4761*
MELVIN, K.E.W.
4847
MEYER, G.
4567
MEYERS, P.
4531
MICKELSEN, O.
4330*
MICKLEM, H.S.
4501*
MIDFLL, A.I.
4887*
MIHAILOVICH, N.
4412, 4492
MIHICH, E.
4718*
MIKITTEN, T.M.
4484*
MILLAR, R.C.
4703
MILLER, E.
4383
MILLER, E.C.
4386
MILLER, H.H.
4847
MILLER, J.A.
4386
MILLER, J.M.
4763*
MILLER, L.
4425

MILLER, R.W.
4329*, 4486*
MINEGISHI, K.
4388
MINOWADA, J.
4306, 4571, 4948*
MIQUEL, J.
4498*
MITCHELL, G.F.
4670
MITCHELL, W.M.
4598*
MITELMAN, F.
4601*
MIYAKI, K.
4369
MIYAMOTO, H.
4722*
MIYAZAKI, K.
4714*
MIYOSHI, I.
4595*, 4974*
MIZUNC, D.
4661
MCDLINGER, R.S.
4893*
MCE, K.K.
4584*
MCFFITT, A.E., JR.
4403
MCHACSY, J.
4946*
MCNTEMURRO, D.G.
4846
MCNTGOMERY, P.C.
4753*
MCORE, D.H.
4769*
MCORE, G.E.
4306, 4948*
MCORE, J.
4629
MORGAN, J.F.
4727*, 4972*
MCRI, P.G.
4357*
MORRIS, H.P.
4838*, 4844, 4857, 4989*
MCRRROW, R.H., JR.
4789
MORTON, D.L.
4676
MORTON, J.I.
4559
MOSES, H.L.
4598*
MCSS, D.J.
4635
MOULTON, J.E.
4469*
MCY, P.
4965*

MUGGEN, M.
4921*
MUGGIA, F.M.
4888*
MUIR, C.S.
4832*
MUKERJEE, D.
4514
MUKHERJEE, A.B.
4996*
MUNN, A.
4304
MUNRO, T.R.
4741*
MURAMATSU, M.
4925*
MURPHY, G.P.
4737*
MURRAY-LYON, I.M.
4906*
MURRAY, R.K.
4587*
NADKARNI, J.J.
4690
NAGASAKI, H.
4462*
NAGATA, Y.
4416
NAGEL, G.A.
4725*
NAGURA, H.
4465*
NAHMIA, A.J.
4581*
NAKAHARA, W.
4594*
NAKATA, T.
4938*
NAKAYASU, M.
4871
NARAYAN, D.
4517
NARUTO, H.
4740*
NASSAR, V.H.
4945*
NATAR, R.N.
4944*
NEBERT, D.N.
4409
NEBERT, D.W.
4433
NEETHING, A.C.
4457*
NEIMAN, R.S.
4801*
NELSON, D.
4487*
NELSON-REES, W.A.
4524
NEMOTO, T.
4737*

NESNOW, S.
4478*
NETTESHEIM, P.
4404, 4413
NEUMANN, H.-G.
4427
NEWELL, R.F.
4413
NEY, R.L.
4853
NICOLIN, A.
4679
NICOLIS, G.L.
4893*
NICOLSON, G.L.
4915*
NII, S.
4591*
NIKAIDO, O.
4494
NISHIHARA, H.
4422
NISHIMURA, E.T.
4416, 4768*
NISHIO, O.
4453*
NISSELBAUM, J.S.
4894*
NIXON, G.W.
4958*
NOBEL, T.A.
4634
NODA, S.
4973*
NOHARA, M.
4871
NONOYAMA, M.
4516
NORRBY, E.
4563
NORTHROP, R.L.
4572
NORTON, S.J.
4939*
NOTKINS, A.L.
4581*
O'BRIEN, R.L.
4426
O'CONOR, G.T.
4630, 4723*
O'HOPP, S.
4590*
OBOSHI, S.
4693
OGATA, T.
4432
OGAWA, K.
4519, 4859
OGDEN, D.A.
4501*
OGURA, T.
4384

OHNUMA, T.
4948*
OHTAKI, N.
4714*
OIKAWA, A.
4871
OKADA, M.
4458*, 4470*
OKADA, T.
4576
OKANO, T.
4471*
OKAWA, Y.
4745*
OKAZAKI, H.
4820
OKIGAKI, T.
4886*
OKITA, G.T.
4573
OLSEN, C.
4763*
ONG, T.-M.
4468*
ONISHI, T.
4925*
OPPENHEIM, J.J.
4619, 4744*, 4756*, 4757*
ORR, T.
4614
ORTEGA, R.
4961*
ORTH, D.N.
4598*
OSHIRO, L.S.
4513, 4608*
OSLER, A.G.
4363
OSSKE, G.
4302
OSTERGAARD, E.
4826*
OTT, H.
4632
OTTAVIANI, G.
4806*
OVCHINNIKOV, YU.A.
4866
OWEN, N.T.
4993*
OWENS, R.B.
4597*
OYASU, R.
4376
OZER, H.L.
4525, 4596*
PAGANO, J.S.
4516
PALMER, E.L.
4647
PALOMBINI, L.
4561

PAMUKCU, A.M.	PHILIPS, F.S.	PRETLOW, T.G.
4387	4400	4758*
PANDOLFI, M.	PHILLIPS, J.	PREUD'HOMME, J.L.
4983*	4622	4716*
PANLILLI, P.	PHILLIPS, T.M.	PRICE, F.M.
4426	4728*	4976*
PAPWORTH, D.S.	PHILPOTT, R.M.	PRICE, J.M.
4501*	4906*	4387
PARKHOUSE, B.	PHIPPS, F.C.	PRICHARD, J.
4915*	4403	4868
PARR, I.	PICKERING, K.	PRIGOGINA, E.L.
4633	4695	4317
PARSHAD, R.	PILCH, Y.H.	PRINCLER, G.L.
4977*	4774*	4644
PASTAN, I.	PIMSTONE, B.L.	PRINEAS, J.W.
4508	4912*	4592*
PATEL, I.R.	PINDBOG, J.J.	PRIORE, R.L.
4644	4834*	4837*
PATOCKA, F.	PINKERTON, H.	PRITCHARD, D.J.
4588*	4560	4515
PATRUCCO, A.	PITCHUMONI, C.S.	PROFFITT, M.R.
4363	4451*	4530
PAUL, B.	PITOT, H.C.	PROUT, G.R., JR.
4409	4851, 5000*	4323*
PAULY, J.F.	PLAGEMANN, P.G.W.	PRUZANSKI, W.
4863	4869, 4900*	4767*, 4905*
PEACOCK, F.F., JR.	PLUZANSKA, A.	PRY, T.W.
4479*	4639, 4843	4654
PEARSON, D.	POGOSTANZ, H.E.	PUNDBERG, J.J.
4731*	4317	4407
PEARSON, G.	POLKOWSKA-KULESZA, E.	QUEENER, S.F.
4614	4843	4989*
PERDERSEN, R.	POLLINI, G.	QUIRCGA MICHEO, E.
4842	4473*	4819, 4821
PELTOKALLIO, P.	POPE, J.H.	RABIN, H.
4627	4635	4524
PENALVER, J.A.	POPPI, M.	RABINCWITZ, M.
4545	4953*	4720*
PENDOLA, R.	PORTA, G.D.	RABSON, A.S.
4506	4675	4538
PERCY, A.K.	PORTFOUS, D.D.	RABSTEIN, L.S.
4820	4741*	4665
PERDUF, J.F.	PORTER, D.	RACEVSKIS, J.
4557	4715*	4943*
PEREZ, C.	PORTER, N.H.	RACKER, E.
4352*	4906*	4316
PERMAN, P.	POUND, A.W.	RADZIKOWSKI, C.
4538	4399	4629
PERK, K.	POYNTER, R.W.	RAGAB, A.H.
4634	4411	4352*
PERTSEMLIDIS, D.	PRASAD, J.N.	RAICK, A.N.
4893*	4957*	4367
PETERS, R.L.	PRASAD, K.N.	RALPH, P.
4665	4916*, 4998*	4615
PETERSEN, G.R.	PRASAD, N.	RANDALL, Z.C.
4333*	4582*	4920*
PETERSON, R.D.A.	PRASAD, R.	RANKIN, B.J.
4672	4582*	4534
PETTENGILL, D.S.	PREHN, R.T.	RAO, K.V.N.
4951*	4401	4412, 4492
PETYAYEV, M.M.	PRESSMAN, D.	RAPP, F.
4474*	4704	4520, 4536

RAPP, H.J. 4619	RISCHBIETH, R.H. 4777*	RYWLIN, A.M. 4961*
RAPPORT, M.M. 4778*	RISSMAN, E. 4958*	SABINE, J.R. 4782
RASKAS, H.J. 4311, 4547	ROBB, J.A. 4526, 4542	SABINE, M.C. 4624
RASMUSSEN, R.F. 4362	ROBERTS, J.J. 4397	SACHS, L. 4613
RATHKAMP, G. 4478*	ROBINSON, M.J. 4835*	SACKMANN MURIEL, F. 4545
RAWLS, W.F. 4691	ROCKEY, J.H. 4753*	SADIKALI, F. 4882*
REARDON, M.A. 4917*	ROCKWELL, S.C. 4964*	SAEZ, S. 4971*
REDMON, I. 4614	ROIZMAN, B. 4548	SAFFIOTTI, U. 4394, 4437
REEDMAN, B.M. 4635	ROMEN, W. 4472*	SAHIAR, H.E. 4407
REEM, G.H. 4907*	ROSAT, J. 4743*, 4932*, 4990*	SAKAI, T. 4594*
REEVES, R.R. 4980*	ROSBASH, M. 4967*	SAKSELA, E. 4627, 4797*
REGAN, J.D. 4496*, 4963*	ROSE, D.P. 4920*	SAKUMA, F. 4453*
REILLY, C.A., JR. 4515	ROSEN, V.J. 4491	SALZBERG, S. 4547
REINHOLD, A.W. 4827*	ROSENBERG, E.B. 4643, 4674	SANFORD, K.K. 4976*, 4977*
REIFENSTEIN, P. 4783	ROSENBERG, G.L. 4581*	SARAL, R. 4596*
REMINGTON, J.S. 4984*	ROSENBLUM, W.I. 4911*	SARKAR, N.H. 4850
RENNER, F.D. 4900*	ROSENTHAL, W.S. 4451*	SARKAR, S. 4615
REYNOLDS, R.K. 4535	ROSS, E.J. 4319	SARMA, P.S. 4524, 4550
REYNOLDS, S.A. 4966*	ROTHENBERG, S.P. 4969*	SATO, G.H. 4913*
REYNOLD, G. 4737*	ROUSE, B.T. 4667	SATO, H. 4721*
RHIM, J.S. 4537	RUBERTI, R.F. 4953*	SATOH, H. 4923*, 4924*, 4968*
RIBACCHI, R. 4371	RUBIES PRAT, J. 4978*	SATOH, T. 4395
RICE, J.M. 4444	RUBIN, H. 4558	SAURG, F.M. 4379
RICH, M.A. 4645	RUBIN, P. 4356*	SAVAGE, E.W. 4331*
RICHARDSON, H.L. 4379	RUBINSTEIN, L.J. 4498*	SAVOST'YANOV, G.A. 4528
RICHARDSON, M.F. 4379	RUBTSOVA, G.V. 4840	SCALES, R.W. 4668
RICHES, A.C. 4772*	RUDALI, G. 4390	SCHACHTSCHABEL, D.O. 4901*
RICHMAN, A.V. 4724*	RUDOLPH, E. 4730*	SCHADE, S. 4765*
RICKARD, K.A. 4325*	RUMACK, B. 4659	SCHAEFER, W. 4521
RIGGS, J.L. 4608*	RUNSLAHTI, E. 4627, 4637	SCHALTEGGER, H. 4441
RITOS, A. 4682	RYDELL, R.F. 4430	SCHANTZ, A. 4934*

SCHARFF, M.D. 4705*	SETLOW, R.B. 4496*	SIMMONS, R.L. 4682
SCHEN, R.J. 4720*	SFWALL, W. 4934*	SIMMS, E.S. 4677
SCHER, C.D. 4526	SHAAR, C.J. 4455*	SIMCNS, M.J. 4683
SCHERSTEN, T. 4930*	SHAH, S.A. 4480*	SIMONS, P.J. 4534
SCHEVING, L.F. 4863	SHANK, R.C. 4418	SIMS, P. 4445
SCHIFFER, D. 4459*	SHANMUGARATNAM, K. 4683	SINGER, S.J. 4915*
SCHIFFER, Z. 4446	SHAPOT, V.S. 4845	SINGH, S. 4623, 4685
SCHIMPF, S. 4659	SHARP, P.A. 4546	SINGH, S.P. 4876*
SCHLOSS, G.T. 4504	SHCHERBINSKAYA, A.M. 4396	SINHA, S.N. 4955*
SCHMAUJ, R. 4818	SHEARER, R.W. 4800*	SINKOVICS, J.G. 4701
SCHNEIDER, R. 4827*	SHEARER, W.T. 4751*	SIRISINHA, S. 4677
SCHNEIDERMAN, M.A. 4301	SHEININ, R. 4587*	SJOEGREN, H.O. 4612, 4649, 4671
SCHOLES, V.E. 4939*	SHEPPARD, J.R. 4916*	SKROCHOWSKA, M. 4602*
SCHORR, I. 4853	SHIMKIN, M.B. 4828*	SMITH, C.A. 4546
SCHREIBER, H. 4404	SHIMOSATO, Y. 4811	SMITH, G.H. 4577
SCHROEDER, J. 4869	SHINKAI, K. 4942*	SMITH, H.S. 4526
SCHUELLER, E.F. 4837*	SHIOTSUKA, R.N. 4863	SMITH, J.A. 4351*, 4813
SCHULZ, M.D. 4933*	SHIRATO, E. 4701	SMITH, J.G., JR. 4919*
SCHUMAN, B.M. 4891*	SHIVELY, J.N. 4584*	SMITH, J.M. 4394, 4437
SCHWARTZ, R.S. 4628	SHIVERS, B.R. 4668	SMITH, J.W. 4691
SCHWEPPF, J.S. 4375	SHOFF, W.H. 4750*	SMITH, M.C. 4700
SCHLICK, F.M. 4523	SHOHAM, J. 4613	SMITH, R.D. 4572
SCOTT, T.M. 4544	SHOYAB, M. 4860	SMITH, R.K. 4572
SEEGER, R.C. 4744*	SHUANGSHOTI, S. 4959*	SMITH, T.C. 4484*
SEID, T. 4693	SHYAMALA, G. 4406	SMITH, W.E. 4425
SEIFERTOVA, M. 4466*	SICCARDI, F.J. 4672	SMITHERS, D.W. 4359*
SELMANN, M. 4716*	SIEGEL, B.V. 4559	SMORON, G.L. 4500*
SELKIRK, J.K. 4424, 4445	SIEGLER, R. 4794	SMUCKLER, E.A. 4800*
SEND, F. 4505	SIGEL, M.M. 4531	SMYK, B. 4446
SEPPALA, M. 4627, 4637	SILVERBERG, S.G. 4927*	SNELL, K.C. 4883*
SERPICK, A. 4659	SIMMONS, E.L. 4492	SNODGRASS, M.J. 4618

SOHIER, R. 4663	STJERNHOLM, R.L. 4706*	SWARTZ, M. 4902*
SOILER DRADORS, M. 4978*	STOCK, N.D. 4735*	SWEeley, C.C. 4778*
SOLONAR, W.K. 4966*	STOKINGER, H.E. 4403	SYDNOR, K.L. 4365
SORENSEN, G.D. 4951*	STOLER, B. 4659	SYDORYK, Y.F.P. 4440
SORM, F. 4466*	STONE, D. 4695	SYDOW, G. 4442
SOTHERN, R.B. 4863	STRICKLAND, R.G. 4781	SZMIGIEL, Z. 4708*
SPAHN, G.F. 4553	STRZINEK, R.A. 4939*	SZWAGRZYK, E. 4810
SPAHN, G.J. 4665	STUART, J. 4949*	SZYROKI, L. 4447
SPENGLER, G.A. 4706*	STURBS, M. 4857	TABAR, L. 4805*
SPIEGELBERG, H.L. 4699	SUGAHARA, T. 4494	TAI, H.T. 4546
SPITIER, L.F. 4652	SUGANO, H. 4452*, 4576	TAJIMA, T. 4811
SPOHN, W.H. 4617	SUGAR, R. 4622	TAKAHASHI, T. 4555
SPORN, M.H. 4394, 4437	SUGIHARA, S. 4372, 4385	TAKAHASHI, Y. 4922*, 4987*
SPRATT, J.S., JR. 4822	SUGIMOTO, H. 4740*	TAKENAKA, S. 4471*
SPRINGER, G.F. 4764*	SUGIMOTO, T. 4415	TAKEUCHI, J. 4852, 4899*
SRIVASTAVA, R.T.S. 4571	SUIT, H.D. 4686	TAKIZAWA, K. 4576
ST-ARNEAULT, G. 4653, 4719*	SULITZELAU, D. 4620	TAKIZAWA, S. 4382, 4422
STARINSKY, C. 4793	SULLIVAN, K.A. 4688	TALAL, N. 4803*
STAFFORD, M.A. 4867	SULLIVAN, P.D. 4809	TALERMAN, A. 4935*
STAMPFER, M. 4967*	SUMIF, H. 4376	TAMACI, I. 4497*
STANTON, M.F. 4383	SUN, C.N. 4560	TAMBOURIN, P.E. 4503
STARKE, W.R. 4926*	SUNDERMAN, F.W., JR. 4377	TAN, H.K. 4970*
STEDMAN, R.L. 4408	SUZUKI, F. 4458*, 4470*	TANABE, S. 4713*
STEINBERG, A.D. 4553	SUZUKI, F. 4494	TANAKA, K.R. 4917*
STENGER, R.J. 4451*	SUZUKI, M. 4745*, 4748*	TANAKA, T. 4746*
STEPHENSON, J.R. 4533, 4535	SUZUKI, S. 4745*, 4748*	TANI, E. 4852, 4985*
STEPLAWSKI, J. 4315	SUZUKI, T. 4892*	TAPPEINER, G. 4684
STEVENS, R.H. 4709*	SVEDMYR, E.A.J. 4623	TARKKANEN, J. 4797*
STEWART, J.K. 4731*	SVORODA, D.J. 4954*	TASHJIAN, A.H., JR. 4847
STILLMAN, R.M. 4496*	SWAIN, A.P. 4408	TAURASO, N.M. 4724*
STITH, W.J. 4861	SWANBECK, G. 4313	TAYLOR, D.O.N. 4513, 4608*

TAYLOR, G.	TOYNE, P.H.	VAN HAAGEN, A.
4731*	4364	4510
TCHEN, T.T.	TRAININ, Z.	VAN RIJSSEL, TH.G.
4871	4717*	4489
TEMIN, H.M.	TROLL, W.	VAN SCOTT, E.J.
4511	4368, 4434	4940*
TEMPLETON, A.C.	TRUJILLO, J.M.	VAN SLYCK, E.J.
4814, 4818, 4890*, 4988*	4514	4891*
TENNANT, R.W.	TSUBOTA, T.	VAN SCMEREN, H.
4618	4595*, 4974*	4510
TERAYAMA, H.	TSUBURA, F.	VECCHIONE, R.
4415	4384	4561
TERRACINI, B.	TSUCHIYA, T.	VENNART, G.P.
4456*	4497*	4911*
TEVETHIA, S.S.	TSUGAWA, S.	VERNIE, L.N.
4582*	4693	4393
THACKRAH, T.	TSUJI, K.	VERONESI, U.
4411	4722*	4675
THEILEN, G.H.	TSURUD, T.	VESELY, J.
4524	4923*, 4924*	4466*
THOMAS, M.	TSUTSUI, Y.	VESSELINOVITCH, S.D.
4656	4388	4412, 4492
THOMAS, D.R.	TUMILOWICZ, J.J.	VESSEY, M.P.
4772*	4850	4824
THOMAS, K.	TUOMINEN, F.W.	VIETTI, T.J.
4795*	4585*	4352*
THOMPSON, F.B.	TURNER, H.C.	VILLA-KOMAROFF, L.
4896*	4665	4583*
THONIER, M.	TURUSOV, V.	VINCENT, M.M.
4642	4456*	4724*
THORNELI, F.W.	TYNDALL, R.L.	VINOGRAD, J.
4701	4530	4546
THUMM, K.	TYRRELL, S.	VIZA, D.
4367	4538	4622
THUST, R.	UCHIDA, K.	VLAHAKIS, G.
4856	4892*	4577
TILLACK, T.W.	UCHIYAMA, C.	VCEIKCV, V.L.
4743*	4975*	4866
TING, R.C.	UHLIR, K.	VOGEL, C.L.
4603*, 4676, 4687	4848	4644, 4657, 4882*
ING, S.M.	UKITA, T.	VOGELPOEL, L.
4485*	4923*, 4924*, 4968*	4912*
TODARO, G.J.	ULRICH, K.	VON BOEHMER, H.
4523	4629	4696
TODD, C.W.	UNDERDOWN, B.J.	VON KLEIST, S.
4648, 4689	4753*	4624, 4755*
TODD, R.	UNGAR, B.	VORNOVITSKAYA, G.I.
4622	4781	4845
TODGNELLA, S.	URBACH, F.	VOTRIN, I.I.
4712*	4812	4840
OKAJI, G.	UYS, C.J.	VUOPIC, P.
4432	4912*	4627
OKUNAGA, T.	VAAGE, J.	WADA, A.
4746*	4673, 4681	4987*
OKUFEN, R.	VADLAMUDI, S.	WADELL, G.
4594*	4679	4563
OMATIS, L.	VAN DEN BORGHE, H.	WAGES, B.
4456*	4502	4970*
OMII, S.	VAN DER NOORDAA, J.	WAGHE, M.A.
4462*	4510	4731*
OMITA, Y.	VAN FURTHER, R.	WAGNER, H.
4924*	4690	4667

WAGNER, J.C. 4303	WEINBERG, R.A. 4539	WOLFF, G.L. 4836*, 5000*
WAHL, P.N. 4828*	WEINER, L.P. 4517	WOLKE, R.E. 4506
WAHLBERG, J.F. 4475*	WFENZLER, S. 4448	WOLLOCH, Y. 4982*
WAITE, R.G. 4996*	WEISBROT, I.M. 4793	WOO, J. 4711*
WAKFFIFID, J.ST.J. 4431	WEISBURGER, J.H. 4626, 4732*	WOOD, R. 4918*
WALBROOMERS, J.M.M. 4510	WEISS, D.W. 4620	WOOD, S., JR. 4962*
WALBORG, F.F., JR. 4864	WEISS, M.C. 4849	WOLF, A. 4584*
WALBURG, H.E., JR. 4999*	WEISS, R.B. 4937*	WORANCOJ, U. 4884*
WALKER, T.R. 4781	WELLINGS, S.R. 4804*	WRAY, V.L. 4557
WALLACE, W.C. 4379	WENDLING, F. 4503	WRAY, V.P. 4864
WALLING, M.J. 4556	WESSELY, Z. 4435	WRENCH, C. 4383
WALLIS, V.J. 4666	WESTON, B.J. 4666	WRIGHT, R.G. 4592*
WANG, T.Y. 4362	WHFATLEY, D.N. 4414	WUNDERLICH, J.R. 4674
WANG, J.L. 4737*	WHERRETT, J.R. 4587*	WYNDER, E.L. 4478*
WANG, T.Y. 4841	WHITE, J.E. 4827*	YABE, Y. 4579*
WARMAAR, S.O. 4539	WHITLOCK, J.P. 4443	YAGI, Y. 4704
WARNER, G.A. 4671	WHITTEY, H.O. 4668	YAKULIS, V. 4765*, 4766*
WARTOVAARA, J. 4797*	WIBLIN, C.N. 4562	YAM, L.T. 4950*
WARZOK, R. 4856	WICKER, R. 4568	YAMAGUCHI, N. 4589*
WATANABE, H. 4936*	WIFNER, N. 4998*	YAMAMOTO, N. 4395, 4419
WATANABE, M. 4388, 4986*	WILDER, G.P. 4442	YAMAMOTO, R.S. 4389, 4732*
WATANABE, S. 4811	WILKINSON, T. 4325*	YAMAMOTO, T. 4589*, 4816
WATANABE, T. 4704	WILLIAMS, G.M. 4389, 4626	YAMAMURA, Y. 4384, 4922*
WATSON, F.S. 4668	WILLIAMSON, A.R. 4709*	YAMASAKI, T. 4382
WATSON, F.R. 4822	WILSON, J.S.P. 4350*	YAMASHITA, H. 4722*
WATSON, J. 4656, 4868	WINDOUR, E. 4539	YANG, M.G. 4330*
WAYMIRF, J.C. 4998*	WOGAN, G.N. 4418	YAP, E.H. 4683
WEER, M. 4448	WOHLENBERG, C. 4581*	YARRINGTON, C.T., JR. 4358*
WEER, T.F. 4943*	WOLKE, P.A. 4865	YASUKAWA, S. 4453*
WEER, G. 4857, 4989*	WOLF, G. 4378	YATES, V.J. 4506
WEILAND, L.H. 4889*	WOLFE, L.G. 4532, 4572	YAZDI, E. 4425

EVICH. P.P.
4808
NGEESWARAN. G.
4587*
OHN. D.S.
4710*
OKOTA. Y.
4361. 4372. 4385
OKUYAMA. T.
4721*
INKERS. A.J.
4358*
ISHIKURA. H.
4567
J. L.C.
4943*
J. M.
4683
KAS. J.M.
4618
MKIVS'KA. T.M.
4440
CARIAN. S.A.
4695
JDEL. S.
4794
RZYCKI. D.
4602*
VADA. J.
4771*
AR. B.
4650. 4655
IGER. F.
4381
R. M.
4982*
UBANOVA. A.A.
4845
EGLER. J.L.
4657. 4786. 4789
EVE. F.J.
4380
RONI. A.
4341*

2-ACETYLAMINOFLOURENE
URINARY BLADDER CARCINOGENESIS,
HAMSTER (4376)

ADENOCARCINOMA
COLON, MULTIPLE PRIMARY CANCER,
FAMILIAL STUDY (4902)*
RENAL, VIRAL ETIOLOGY, FROG, REVIEW
(4343)*
THYROID, MICROSCOPIC LUNG METASTASIS,
AUTOPSY STUDY, HUMAN (4987)*
UTERINE BODY, INTRAUTERINE CONTRA-
CEPTIVE DEVICE, CASE REPORT (4495)*
UTERINE CERVIX, CASE REPORTS (4793)

ADENOMA
C-CELL THYROID, CALCITONIN ACTIVITY,
HUMAN (4874)*
FOLLICULAR, THYROID, ULTRASTRUCTURE,
HUMAN (4910)*
GLYCOGEN-RICH, PAROTID GLAND, CASE
REPORT (4898)*
PAROTID CLEAR-CELL, POSSIBLE
MYOEPIHELIAL ORIGIN, CASE REPORT
(4797)*
STOMACH, ARGENTAFFIN CELLS, HUMAN
(4936)*

ADRENAL
FUNCTION, CANCER, EVOLUTION, HUMAN
(4971)*
TUMOR CELL CULTURES, PYRIDINE
NUCLEOTIDES, MOUSE (4913)*

ADRENAL GLAND
7,12-DIMETHYLBENZ(A)ANTHRACENE, LIVER,
CARBON TETRACHLORIDE, RAT (4414)

AFLATOXIN
B1, LIVER MICROSOMAL METABOLISM,
SALMONELLA TYPHIMURIUM (4386)
HUMAN LIVER CANCER, INCIDENCE,
THAILAND (4418)
NUCLEIC ACID, NUCLEAR PROTEIN,
SYNTHESIS, LIVER, RAT (4374)

AGE
RADIATION DOSE, FRACTIONATION,
TUMORIGENESIS, MOUSE (4492)
TUMOR INCIDENCE, FAST NEUTRON
RADIATION, RAT (4491)

AGING
NONCYCLING CELLS, MODEL (4919)*

ALKYLATING AGENT
MUSTARD GAS, INTERSTRAND DNA CROSS-
LINKING, HELA CELLS (4397)

5 ALPHA-DIHYDROTESTOSTERONE
METABOLISM, PROSTATE CARCINOMA,
ESTROGEN, HUMAN (4854)

ALPHA FETOPROTEIN
HEPATOCELLULAR CARCINOMA, DIAGNOSIS,
UGANDAN PATIENTS (4644)
LIVER CARCINOGENESIS, 3'-METHYL-4-
DIMETHYLAMINOAZOBENZENE, RAT (4626)
PRIMARY LIVER CANCER, INCIDENCE, HUMAN
(4723)*
RADIOIMMUNOASSAY
PRIMARY AND SECONDARY LIVER CANCER
HUMAN (4627)
SERUM, HUMAN (4637)

AMINO ACID
HISTIDINE, TRANSPORT SYSTEM,
S37 ASCITES TUMOR CELLS (4897)*

ANAL CANAL
LEIOMYOMA, CASE REPORT (4955)*

ANEMIA
AREGENERATIVE, LEUKEMIA, BONE MARROW,
HUMAN (4783)

ANTHANTHRENE
DERIVATIVES, SKIN CARCINOGENESIS,
MOUSE (4405)

ANTIBODY
AGGLUTINATION, RIROSOMAL SUBUNITS,
ANTISERA, NOVIKOFF ASCITES HEPATOMA,
RAT (4617)
ANTINUCLEAR, SUPPRESSION, RAUSCHER
LEUKEMIA VIRUS, MOUSE (4559)
COLD-ANTIBODIES, YOSHIDA HEPATOMA,
BIPHASIC REACTION, RAT SERUM (4696)
EPSTEIN BARR VIRUS
BURKITT'S LYMPHOMA, AMERICAN
PATIENTS (4630)
IMMUNOFLOURESCENCE LOSER PRIMATES
(4654)
FORMATION, CLONAL NATURE,
POLY-O-ACETYL-D-SERINE, POLY-D-
ALANINE (4739)*
HERPESVIRUS, SERUM, HUMAN (4691)
HUMORAL IMMUNE RESPONSE, 3-METHYL-
CHOLANTHRENE, MOUSE (4363)
INHIBITION OF SPLEEN CELL PROLIFERA-
TION, CHICKEN (4756)*
9H VIRUS, GROWTH PATTERN, HEPATITIS,
LIVER, RAT (4544)
OAT CELL SURFACE ANTIGEN, PULMONARY
CANCER PATIENTS (4693)
PLAQUE FORMATION, SPLEEN, MYELOMA,
MOUSE (4704)
PRECIPITATING, C-TYPE VIRUS INTERNAL
ANTIGEN, BOVINE LYMPHOSARCOMA,
CATTLE (4763)*
PRODUCTION, C-TYPE VIRUS, RAT (4614)

ANTIGEN
ADENOVIRUS-12-INDUCED TUMOR CELLS,
HAMSTER (4710)*
AUSTRALIA, HEPATOCELLULAR CARCINOMA,

HUMAN (4683), (4813)
 AVIAN MYELOBLASTOSIS VIRUS, VIRAL
 ENVELOPE (4570)
 BOVINE TYPE C VIRUS, MURINE AND
 FELINE LEUKEMIA VIRUSES, ANTIGENIC
 COMPARISON (4651)
 CARCINOEMBRYONIC
 CANCER PATIENTS (4737)
 COLON, STOMACH, TUMOR, HUMAN
 (4664)
 COLON TUMOR, DIFFERENTIATION,
 HUMAN (4684)
 DIGESTIVE TRACT CANCER, HUMAN
 (4689)
 RADIOIMMUNE ASSAY (4648)
 CELL-SURFACE, GROSS LEUKEMIA VIRUS,
 SUPPRESSION, MOUSE (4694)
 LONAL CELLS, 3-METHYLCHOLANTHRENE,
 MOUSE (4401)
 OLON CARCINOMA, SALT EXTRACTED,
 EVALUATION OF TUMOR IMMUNITY, HUMAN
 (4749)*
 COMPLEMENT-FIXING, BURKITT'S LYMPHOMA,
 SERUM, HUMAN (4663)
 CROSSREACTING, GLYCOPROTEIN, CARCINO-
 EMBRYONIC ANTIGEN, TISSUE EXTRACTS,
 HUMAN (4755)*
 PSTEIN-BARR VIRUS, LYMPHOID CELL,
 HUMAN (4635)
 ORMATION, POLYOMA VIRUS, INHIBITOR,
 MOUSE (4567)
 ORSSMAN GLYCOLIPID, HEMATOSIDE
 SYNTHESIS, CONTACT-DEPENDENT
 ENHANCEMENT, NIL CELLS (4773)*
 CROSS VIRUS, MURINE LEUKEMIA VIRUS,
 HISTOCOMPATIBILITY, MYELOMA CELL
 LINE, MOUSE (4615)
 GROUP-SPECIFIC
 C-TYPE VIRUS, SPONTANEOUS NEOPLASM
 MOUSE (4665)
 TYPE-SPECIFIC, LEUKEMIA, FRIEND
 VIRUS, MAZURENKO VIRUS, RAUSCHER
 VIRUS, MOUSE (4631)
 -A, LOSS, OVARIAN ADENOCARCINOMA,
 CASE REPORT (4722)*
 2, FRIEND LEUKEMIA VIRUS, REGRESSION
 MOUSE (4645)
 RPES SIMPLEX VIRUS, CAPSID,
 ENVELOPE, SOLUBLE, CROSS-REACTIVITY
 (4647)
 MAN LEUKEMIA ASSOCIATED, DETECTION,
 LEUKEMIC SERUM, NORMAL EMBRYOS
 (4622)
 BRID, SV40-TRANSFORMED CELL,
 CHROMOSOME, MOUSE, RAT (4510)

LYMPHOBLASTIC LEUKEMIC CELLS,
 HYDROCORTISONE, IN VITRO (4736)*
 MACROPHAGE-BOUND, IMMUNOGENICITY
 (4744)*
 MEMBRANE
 COLONIC CARCINOMA, NON-TUMORAL
 COLONIC MUCOSA, NEW ISOLATION
 METHOD, HUMAN (4743)*
 DETECTION, EPSTEIN-BARR VIRUS-
 ASSOCIATED, RADIOIODINE-LABELED
 ANTIBODY TEST (4660)
 MURINE LEUKEMIA VIRUS, CELLULAR,
 LEUKEMIA CELL, MYELOMA CELL, MOUSE
 (4555)
 OAT CELL SURFACE, ANTIBODY, PULMONARY
 CANCER PATIENTS (4693)
 PATTERN, TUMOR, ROUS SARCOMA VIRUS,
 HAMSTER (4502)
 RABBIT GAMMA-GLOBULIN, IMMUNOLOGICAL
 TOLERANCE, WHOLE BODY IRRADIATION,
 MOUSE (4497)*
 RNA TUMOR VIRUS, IMMUNITY, MOUSE
 (4618)
 SARCOMA VIRUS, LEUKEMIA VIRUS,
 PRODUCTION, HYBRID CELL, HAMSTER,
 MOUSE (4565)
 SARCOMA-SPECIFIC, AUTOLOGOUS SERA,
 CYTOTOXICITY, HUMAN (4669)
 SKIN REACTION, CARCINOEMBRYONIC,
 INTESTINE, CANCER, HUMAN (4697)
 SPLEEN CELL, DEFECTIVE PROLIFERATIVE
 RESPONSE, AGAMMAGLOBULINEMIC
 CHICKENS (4757)*
 SPONTANEOUS TRANSFORMATION, MOUSE CELL
 (4629)
 SURFACE MEMBRANE, DELETION, HEPATOMA,
 4-DIMETHYLAMINOAZOBENZENE, RAT
 (4678)
 SV40 T SUPPRESSION, 5-BROMO-2-DEOXY-
 URIDINE TREATMENT, TRANSFORMED
 HAMSTER CELLS (4750)*
 TUMOR
 ADENOVIRUS 12, TUMORIGENICITY,
 TRANSFORMED CELL, HAMSTER (4519)
 FIBROSARCOMA, MIGRATION INHIBITION
 MOUSE (4673)
 SYNTHESIS, SV40 TEMPERATURE-
 SENSITIVE MUTANT, MOUSE (4526)
 TUMOR ASSOCIATED
 BREAST CARCINOMA, HUMAN (4675)
 HARVEY MURINE SARCOMA VIRUS,
 HAMSTER (4676)
 PULMONARY NEOPLASMS, CLINICAL
 STUDY (4729)*
 TUMOR-SPECIFIC

- CARCINOEMBRYONIC, IMMUNOLOGY (4730)*
- MALIGNANT MELANOMA, HAMSTER (4652)
- TUMOR-SPECIFIC TRANSPLANTATION, MYELOMA PROTEIN, MOUSE (4677)
- UREA, SKIN, HYPERPLASIA, TUMOR, MOUSE (4692)
- VIRION SURFACE, ADENOVIRUS (4563)
- WHITE BLOOD CELL, CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN (4620)
- ANTIGENICITY
- LEUKEMIA CELLS, DRUG-RESISTANCE, MOUSE (4679)
- MAMMARY TUMORS, MOUSE (4681)
- ANTILYMPHOCYTE SERUM
- IMMUNOSUPPRESSIVE POTENCY, TUMOR ALLOGRAFT GROWTH (4772)*
- ANTIMETABOLITE
- 5-FLUOROURACIL, THYMIDYLATE BIOSYNTHESIS, LEUKEMIA, MOUSE (4439)
- ARABINOSYL CYTOSINE
- TOLERANCE, LEUKEMIA, CIRCADIAN RHYTHM, MOUSE (4863)
- ASBESTOS
- LUNG CANCER, OCCUPATIONAL HAZARD, EPIDEMIOLOGY, REVIEW (4303)
- ASCITES
- EHRlich TUMOR CELLS
- ADENOSINE TRIPHOSPHATE ACTIVITY, NACE CONTENT OF CULTURE MEDIUM (4901)*
- LANTHANUM-INDUCED ALTERATIONS, CELLULAR ELECTROLYTES, MEMBRANE POTENTIAL (4484)*
- TUMORS, CELL CULTURE, ULTRASTRUCTURE, MOUSE (4972)*
- ASCITES TUMOR
- EHRlich CARCINOMA, RESISTANCE
- INDUCTION, RABBIT IMMUNE SERUM, MOUSE (4661)
- INHIBITION, CARBOHYDRATE COMBINED WITH IMMUNIZATION, MOUSE (4727)*
- ASIATICOSIDE
- CANTHARIDIN, 3-METHYLCHOLANTHRENE, SKIN, RETICULOSES, MOUSE (4391)
- ATOMIC BOMB
- SURVIVORS, SALIVARY GLAND TUMORS, REVIEW (4337)*
- AUSTRALIAN ANTIGEN
- HEPATOCELLULAR CARCINOMA, HUMAN (4813)
- 5-AZACYTIDINE
- LIVER REGENERATION, METABOLIC ALTERATIONS, ENHANCED DNA SYNTHESIS, RAT (4466)*
- BACILLUS CALMETTE-GUERIN
- HEPATOCELLULAR CARCINOMA, VACCINE IMMUNITY, GUINEA PIG (4655)
- BENZ(A)ANTHRACENE
- ARYL HYDROCARBON HYDROXYLASE, CELL HYBRID, MOUSE, HAMSTER, HUMAN (4409)
- ARYL HYDROCARBON HYDROXYLASE STIMULATION, HUMAN LYMPHOCYTES (4443)
- BENZENE
- INDUCED HYPOPLASTIC ANEMIA, ACUTE LEUKEMIA DEVELOPMENT, CASE REPORT (4473)*
- BENZENE HEXACHLORIDE
- HEPATOMA DEVELOPMENT, MOUSE (4462)*
- BENZO(A)PYRENE
- HEPATOTOXICITY, CARBON TETRACHLORIDE, RAT (4451)*
- LUNG, LIVER, METAL DISTRIBUTION, MICROSOMAL ENZYMES, RAT (4403)
- METABOLISM, VITAMIN A-INDUCED MODIFICATION, CELL CULTURES, HAMSTER (4362)
- TRACHEOBRONCHIAL EPITHELIUM, ULTRASTRUCTURAL CHANGES, HAMSTER (4437)
- BLADDER
- CARCINOMA, HUMAN, REVIEW (4323)*
- BLADDER CANCER
- INDUCTION, N-METHYL-N-NITROSOUREA, HISTOLOGY, RAT (4431)
- BLOOD
- DIMETHYLAMINOSTILBENE, KINETICS, RAT (4427)
- BLOOD GROUP
- GRAVITZ TUMOR, KIDNEY, HUMAN (4848)
- BONE
- AVASCULAR NECROSIS, CUSHING'S SYNDROME
- CARCINOID-ISLET CELL TUMOR, PANCREAS
- CASE REPORT (4893)*
- OSTEOSARCOMA, VIRAL ETIOLOGY, IMMUNOLOGICAL EVIDENCE, HUMAN (4515)
- BONE MARROW
- AREGENERATIVE ANEMIA, LEUKEMIA, HUMAN (4783)
- CELL STIMULATION, COLONY FORMATION, CELL FACTOR CHARACTERIZATION, MOUSE (4868)
- CYTOPLASMIC BUDS, HEMATOLOGIC NEOPLASMS, HUMAN (4917)*
- LIPID GRANULOMAS, CLINICAL STUDY (4961)*
- SEGMENTED NEUTROPHILS, MORPHOLOGIC ABNORMALITIES, TUMOR BEARING ANIMALS (4878)*
- TUMOR, BURKITT'S LYMPHOMA, HUMAN (4786)
- BOWEL

HEMANGIOMATOSIS, HISTOLOGY, CASE
REPORT (4906)*

BOWEN'S DISEASE
HODGKIN'S DISEASE-ASSOCIATED, PALM,
CASE REPORT (4926)*

BRACKEN FERN
LYMPHATIC LEUKEMIA, LUNG TUMOR, MOUSE
(4387)

BRAIN
CEREBRAL TUMORS, IMMUNOLOGICAL STUDY,
CELLS, HUMAN (4640)
MEDULLOBLASTOMA, CELL NUCLEUS, ULTRA-
STRUCTURE, HUMAN (4852)
SV40-LIKE VIRUS, HUMAN (4517)
TUBERCULOMAS, INCIDENCE, INDIA (4872)*
TUMOR, X-RAY EXPOSURE, MONKEY (4498)*
TUMOR INDUCTION, N-NITROSOBUTYLUREA,
RAT (4422)

REAST
CANCER
DISSEMINATION, DERMAL LYMPHATICS,
HUMAN (4805)*
ELASTOSIS, CLINICAL STUDY (4929)*
TRYPTOPHAN METABOLISM, HUMAN
(4920)*

CARCINOMA
ESTROGEN REPLACEMENT THERAPY,
WOMEN (4450)*
HETEROTRANSPLANTATION, CELL LINE,
HUMAN (4769)*
SIMULTANEOUS BILATERAL, MALE, CASE
REPORT (4982)*
TUMOR-ASSOCIATED ANTIGEN
HUMAN (4675)
LEVELS, HUMAN (4775)*

PAGET'S DISEASE, MALE, CASE REPORT
(4979)*

PRIMARY OPERABLE CANCER, MAXIMUM
DIAMETER, METASTATIC AXILLARY LYMPH
NODES, STATISTICAL STUDY (4855)

REAST CANCER
MINIMAL, HUMAN, REVIEW (4307)

BROMODEOXYURIDINE
C-TYPE VIRUS INDUCTION, CLONAL CELL
LINES, MOUSE (4523)

BROMO-2-DEOXYURIDINE
SV40 T ANTIGEN SUPPRESSION,
TRANSFORMED HAMSTER CELLS (4750)*

IRKITT'S LYMPHOMA
ANTIBODIES TO EPSTEIN-BARR VIRUS,
AMERICAN PATIENTS (4630)
BONE MARROW INVOLVEMENT, HUMAN (4786)
COLONY INHIBITION, EFFECTOR CELL,
HUMAN (4685)
COMPLEMENT-FIXING ANTIBODY, SERUM,
HUMAN (4663)

EPSTEIN-BARR VIRUS, HERPESVIRUS
SAIMIRI, H. SAIMIRI LYMPHOMA, REVIEW
(4320)

HERPESVIRUS, ANTIGENIC RELATIONSHIPS,
MAREK'S DISEASE, INFECTIOUS BOVINE
RHINOTRACHEITIS (4611)

IMMUNOGLOBULIN SYNTHESIS, HUMAN (4690)
LEUKOCYTE, EFFECTOR CELL ACTIVITY,
HUMAN (4623)

NASOPHARYNX, HUMAN, REVIEW (4332)*
RELAPSE PATTERNS, UGANDA (4789)
SOMATIC CELL HYBRID, EPSTEIN-BARR
VIRUS, RESCUE, 5-IODODEOXYURIDINE
(4536)

BUTYL(3-CARBOXYPROPYL)NITROSOAMINE
URINARY BLADDER TUMOR INDUCTION,
RAT (4470)*

BUTYL(4-HYDROXYBUTYL)NITROSOAMINE
METABOLISM, RAT (4458)*

CADMIUM
TESTES, CARCINOGENESIS, RAT (4423)
SOLUBILITY, SERUM, MUSCLE (4448)

CALCIUM CHROMATE
LUNG TUMOR INCIDENCE, MOUSE (4413)

CANCER
INCIDENCE TRENDS, 1935-1965,
CONNECTICUT (4809)
LIVER, ALPHA-FETOPROTEIN IMMUNO-
FLUORESCENCE, HUMAN (4713)*
PRONENESS, AGE, MONTH OF BIRTH,
STATISTICAL STUDY (4807)
RADIATION-INDUCED, HUMAN, REVIEW
(4329)*
VIRUS THEORIES, RESEARCH (4610)*

CANCER REGISTRY
BIAS, UGANDA (4814)

CANCEROGENESIS
DIMETHYLBENZ(A)ANTHRACENE, PROGESTER-
ONE, DNA SYNTHESIS, MAMMARY GLAND,
RAT (4364)

CANTHARIDIN
ASIATICOSIDE, 3-METHYLCHOLANTHRENE,
SKIN, RETICULOSES, MOUSE (4391)

CARBON TETRACHLORIDE
HEPATOTOXICITY, BENZO(A)PYRENE
PRETREATMENT, RAT (4451)*
LIVER, 7,12-DIMETHYLBENZ(A)ANTHRACENE,
ADRENAL GLAND, RAT (4414)
LUNG, LIVER, METAL DISTRIBUTION,
MICROSOMAL ENZYMES, RAT (4403)

CARCINOEMBRYONIC ANTIGEN
COLON, STOMACH, TUMOR, HUMAN (4664)
COLONIC TUMOR, DIFFERENTIATION, HUMAN
(4684)

- ISOLATION, DIGESTIVE TRACT CANCER, HUMAN (4689)
 RADIOIMMUNE ASSAY (4646)
 SKIN REACTIVE ANTIGEN, INTESTINE, CANCER, HUMAN (4697)
- CARCINOGENESIS
 CONTROL, ACTIVATED MACROPHAGES, MOUSE (4984)*
 DIMETHYLBENZANTHRACENE, RAT (4365)
 INFORMATION THEORETICAL MODEL, TRANSFORMATION, CELL (4441)
 SQUAMOUS CELL CARCINOMA, 3-METHYLCHOLANTHRENE, LUNG, RAT (4404)
 THEORY, METABOLIC PATHWAYS, REVIEW (4326)*
 URETHANE, MOUSE (4412)
 VIRAL, REVIEW (4339)*
- CARCINOGENICITY
 4-NITROQUINOLINE 1-OXIDE, MICROBIAL ASSAY, SALMONELLA TYPHIMURIUM (4419)
 PARTICULATE POLLUTANTS, NEW YORK CITY, MOUSE (4366)
- CATABOLISM
 GAMMA G IMMUNOGLOBULIN, MYELOMA PROTEIN, HUMAN, MONKEY (4699)
- CELL
 ARGENTAFFIN, ADENOMA OF STOMACH, HUMAN (4936)*
 BEHAVIOR MODULATION, SUBSTRATUM, FIBROBLASTIC AND LEUKEMIC CELL LINES, MOUSE (4895)*
 DIFFERENTIATION, RAUSCHER LEUKEMIA VIRUS, HEMOCYANIN, MOUSE (4680)
 EHRlich ASCITES TUMOR, ADENOSINE TRIPHOSPHATASE ACTIVITY, NACE CONTENT OF CULTURE MEDIUM (4901)*
 GROWTH, TUMOR, CONCAVALIN A AGGLUTININABILITY (4721)*
 HAIRY, RETICULOENDOTHELIOSIS, ULTRA-STRUCTURE, HUMAN (4950)*
 INTERCELLULAR JUNCTIONS, NORMAL AND MALIGNANT CELLS, REVIEW (4310)
 LYMPHOBLASTOID, MOTILITY, SHAPE, HUMAN (4974)*
 RECOMBINATION OF CELL LINES, ROTATION CULTURE, HUMAN (4886)*
 SURFACE, HEPATOMA, ANTIBODY TREATMENT, ELECTROPHORESIS, RAT (4711)*
 SYNCYTIIUM FORMATION, XC SARCOMA CELLS, MURINE ENDOCRINE CARCINOMA CELLS, MECHANISM (4598)*
- CELL CYCLE
 NONCYCLING CELLS, AGING, MODEL (4919)*
 ROUS SARCOMA VIRUS, ACTIVATION, CHICKEN (4511)
- CENTRAL NERVOUS SYSTEM
 LEUKEMIA, CYTOCENTRIFUGATION, CASE REPORTS (4947)*
 NEOPLASMS
 EPIDEMIOLOGY, MINNESOTA (4820)
 FAMILIAL OCCURRENCE, POLAND (4815)
 SARCOMA, MORPHOLOGY, RAT (4856)
 TUMORS, INCIDENCE, AFRICA (4953)*
- CERVIX
 CANCER, EPIDEMIOLOGY OF SURVIVAL, NEW YORK (4837)*
 CARCINOMA, TRYPTOPHAN METABOLISM, HUMAN (4920)*
 3-METHYLCHOLANTHRENE, ESTROGEN, MOUSE (4370)
 MICROINVASIVE CARCINOMA, HUMAN, REVIEW (4331)*
 VERRUCOUS CARCINOMA, CASE REPORT (4914)*
- CERVIX UTERI
 PRIMARY MALIGNANT LYMPHOMA, CASE REPORT (4879)*
- CHEMICAL CARCINOGEN
 CYTOTOXICITY, TRANSFORMATION, CHROMOSOME BREAKAGE, ARYL HYDROCARBON HYDROXYLASE (4433)
 MUTAGENICITY, NEUROSPORA CRASSA (4468)*
 NUCLEAR PROTEIN, BINDING, LIVER, RAT (4375)
- CHEMOECTOMA
 GLOMUS JUGULARE, MIDDLE EAR, HUMAN (4933)*
- CHILDREN
 CHILDREN, CLINICAL STUDY (4960)*
- CHOLESTEROL
 LIVER, MORRIS HEPATOMA, ENZYME REGULATION, RAT (4851)
 SYNTHESIS, N-2-FLUORENYLACETAMIDE, LIVER, RAT (4782)
- CHONDROITINSULFATE
 GROWTH, SOLID EHRlich ASCITES TUMOR, MOUSE (4899)*
- CHROMATIN
 WALKER TUMOR, TRANSCRIPTIONAL TRANSFORMATION, NONHISTONE PROTEINS, LIVER, RAT (4841)
- CHROMOSOME
 ABERRATION, CARCINOGENESIS, REVIEW (4317)
 BREAKAGE, TRANSFORMATION, CYTOTOXICITY
 CHEMICAL CARCINOGEN, ARYL HYDROCARBON HYDROXYLASE (4433)
 C- AND G- BANDING PATTERNS, RAT (4884)*

DOUBLE-MINUTES, ORIGIN, ROUS SARCOMA, RAT (4601)*

HYBRID, SV40-TRANSFORMED CELL, ANTIGEN MOUSE, RAT (4510)

ISOCHROMOSOME 17, IDENTIFICATION, MYELOID LEUKEMIA, HUMAN (4980)*

XY-GONADAL DYSGENESIS, SV40 INFECTION, SUSCEPTIBILITY, HUMAN (4514)

IRRHOIS

DIMETHYLNITROSAMINE-INDUCED, LIVER REGENERATION, HEPATIC COLLAGEN DEPOSITION, RAT (4479)*

LONE

3-METHYLCHOLANTHRENE, TRANSFORMED CELL ANTIGENICITY, MOUSE (4401)

MYELOMA CELLS, RARE VARIANT DETECTION, MOUSE (4705)*

OLON

ADENOCARCINOMA, MULTIPLE PRIMARY CANCER, FAMILIAL STUDY (4902)*

CARCINOMA

CARCINOEMBRYONIC ANTIGEN, DIFFERENTIATION, HUMAN (4684)

LYMPHOCYTE CYTOTOXICITY, HUMAN (4698)

NON-TUMORAL MUCOSA, MEMBRANE ANTIGENS, NEW ISOLATION METHOD, HUMAN (4743)*

TUMOR-ASSOCIATED ANTIGEN LEVELS, HUMAN (4775)*

POLYP, IMMUNOFLOUORESCENCE, HUMAN (4624)

SIMULATED CARCINOMA, IMMUNOLOGICAL ROLE OF REGIONAL LYMPH NODES, RABBIT (4742)*

TUMOR, CARCINOEMBRYONIC ANTIGEN, HUMAN (4664)

CANCAVALIN A

AGGLUTININABILITY, GROWTH, CULTURED TUMOR CELLS (4721)*

BINDING, AGGLUTININ, LIVER, ASCITES HEPATOMA-NUCLEI, RAT (4968)*

BINDING TO SURFACE MEMBRANE, NORMAL AND TRANSFORMED CELLS (4613)

LYMPHOMA, DNA SYNTHESIS, AGGLUTINATION MOUSE (4646)

MEMBRANE BINDING SITE, TUMOR CELL (4864)

RECEPTOR SITE, SV40, TRANSFORMATION, HAMSTER (4568)

CONTRACEPTIVE

INTRAUTERINE DEVICE, ADENOCARCINOMA OF UTERINE BODY, CASE REPORT (4495)*

MAMMARY CARCINOGENESIS, GESTAGENS, MALE AND FEMALE MICE (4390)

CRANIOPHARYNGIOMA

INTRACRANIAL TUMORS, INCIDENCE, UGANDA (4839)*

RATHKE-POUCH TUMORS, CHILDREN, KRAKOW (4810)

CROTON OIL

INDUCED SKIN TUMORIGENESIS, INHIBITION BY STEROID HORMONES, MOUSE (4368)

CUSHING'S SYNDROME

ACTH-PRODUCING THYMIC TUMOR, CASE REPORT (4912)*

AVASCULAR NECROSIS OF BONE, CARCINOID ISLET CELL TUMOR, PANCREAS, CASE REPORT (4893)*

CYCASIN

CARCINOGENESIS, RESEARCH BIBLIOGRAPHY (4330)*

TUMOR INDUCTION, B-GLUCOSIDASE MODULATION, PREWEANLING RATS (4416)

CYCLAMATE

DIET, TOXIC RESPONSE, RAT (4379)

CYTOLIPIN R

CERAMIDE TETRAHEXOSIDE HAPTEN, LYMPHOSARCOMA, RAT (4778)*

CYTOSINE ARABINOSIDE

SKIN GRAFT REJECTION, MOUSE (4662)

CYTOTOXICITY

CHEMICAL CARCINOGEN, CHROMOSOME BREAKAGE, TRANSFORMATION, ARYL HYDROCARBON HYDROXYLASE (4433)

DEPLETION, SPLEEN CELL, ALLOGENEIC TUMOR CELL, MOUSE (4616)

IMMUNE REACTION, LYMPHOID CELL, LYMPHOMA, GROSS VIRUS, RAT (4621)

LYMPHOCYTE, BLOCKING, TUMOR ELUATE, HUMAN (4671)

SPLEEN CELL, LYMPH NODE CELL, SUPPRESSION, ASCITES TUMOR, MOUSE (4752)*

TUMOR CELLS, SPLEEN, MOUSE (4761)*

DAELS TUMOR

TRANSPLANTABLE, CULTIVATION, GUINEA PIG (4946)*

DDT

METABOLITE STORAGE LEVELS, TISSUES, MOUSE (4456)*

DIBUTYRYL CYCLIC ADENOSINE MONOPHOSPHATE SULFATED ACID MUCOPOLYSACCHARIDE SYNTHESIS, TRANSFORMED FIBROBLASTS (4508)

TYROSINE AMINOTRANSFERASE ACTIVITY, YOSHIDA SARCOMA, RAT (4986)*

DIET

AFLATOXINS, HUMAN LIVER CANCER, INCIDENCE, THAILAND (4418)

- ALCOHOLIC DRINKS, CANCER OF THE
ESOPHAGUS, EAST AFRICA (4454)*
CYCLAMATES, TOXIC RESPONSE, RAT (4379)
PHENYLALANINE DEFICIENCY, MAMMARY
TUMOR VIRUS ACTIVITY, MOUSE (4606)*
DIETHYLNITROSAMINE
INDUCED PURPLE ADENINE MUTANTS,
GENETIC CHARACTERIZATION, NEUROSPORA
CRASSA (4483)*
DIETHYL PYROCARBONATE
URETHANE, BEVERAGE, ENVIRONMENTAL
HAZARD (4428)
DIETHYLSTILBESTROL
CARCINOGENESIS, CHILDREN, REVIEW
(4342)*
DIFFERENTIATION
COLON TUMOR, CARCINOEMBRYONIC ANTIGEN,
HUMAN (4684)
DIGESTIVE TRACT
CANCER, CARCINOEMBRYONIC ANTIGEN,
HUMAN (4689)
4-DIMETHYLAMINOAZOBENZENE
HEPATOCARCINOGENESIS, LIVER LIPID
METABOLISM, RAT (4440)
HEPATOMA, SURFACE MEMBRANE ANTIGEN
DELETION, RAT (4678)
N,N-DIMETHYLAMINOAZOBENZENE
LIVER, ADENOSINE TRIPHOSPHATASE, RAT
(4784)
P-DIMETHYLAMINOAZOBENZENE
LIVER TUMORIGENESIS, PAPAIN, RAT
(4432)
DIMETHYLAMINOSTILBENE
KINETICS, BLOOD, RAT (4427)
DIMETHYLBENZANTHRACENE
CARCINOGENESIS, RAT (4365)
DIMETHYLBENZ(A)ANTHRACENE
CARCINOGENESIS, DNA SYNTHESIS, MAMMARY
GLAND, RAT (4364)
7,12-DIMETHYLBENZANTHRACENE
INDUCED MAMMARY TUMORS, GROWTH
INHIBITION BY ERGOCORNINE, RAT
(4455)*
7,12-DIMETHYLBENZ(A)ANTHRACENE
ADRENAL GLAND, CARBON TETRACHLORIDE,
LIVER, RAT (4414)
DNA BINDING, DNA SYNTHESIS INHIBITION,
PREREPLICATIVE PHASE, REGENERATING
RAT LIVER (4400)
HERPES SIMPLEX VIRUS, INFECTED CELL,
DNA SYNTHESIS, RABBIT (4520)
SV40
TRANSFORMATION INHIBITION, MOUSE
(4504)
TUMOR, LACTATE AND MALATE DEHYDRO-
GENASES, HAMSTER (4582)*
1,2-DIMETHYLHYDRAZINE
COLON DNA, EQUILIBRIUM CENTRIFUGATION,
MOUSE (4417)
DIMETHYLNITROSAMINE
CIRRHOSIS, LIVER REGENERATION,
HEPATIC COLLAGEN DEPOSITION, RAT
(4479)*
FIBROBLAST ALTERATIONS, KIDNEY, RAT
(4398)
HEPATOCARCINOGENIC EFFECTS, HEWT
(4467)*
LIVER, RIBOSOME, MONOMER, RAT (4393)
PHORBOL, LUNG CARCINOGENESIS, HEPATOMA
MOUSE (4392)
DNA
BINDING, SYNTHESIS INHIBITION,
7,12-DIMETHYLBENZ(A)ANTHRACENE,
PREREPLICATIVE PHASE, REGENERATING
RAT LIVER (4400)
BREAKAGE REPAIR, 4-HYDROXYAMINO-
QUINOLINE 1-OXIDE, RADIATION,
MAMMALIAN CELL (4494)
CHAIN ELONGATION, XERODERMA
PIGMENTOSUM, UV IRRADIATION, HUMAN
(4496)*
COLON, 1,2-DIMETHYLHYDRAZINE,
EQUILIBRIUM CENTRIFUGATION, MOUSE
(4417)
DNA-PROTEIN COMPLEX, ADENOVIRUS 12,
HAMSTER CELL (4529)
HYBRIDIZATION, HERPES VIRUS, TYPES
1 AND 2, GENETIC RELATEDNESS (4548)
INTERSTRAND CROSS-LINKING, MUSTARD
GAS ALKYLATION, HELA CELLS (4397)
MAMMARY TUMOR, GRAFT REJECTION, CELL
DEBRIS TREATMENT, RAT (4695)
METHYLATION OF GUANINE, METHYL
METHANESULPHONATE, ALKYLATING
MUTAGENS (4480)*
POLYMERASE, PURIFICATION FROM NUCLEAR
MEMBRANE-CHROMATIN FRACTION,
PROPERTIES, ASCITES HEPATOMA CELLS
(4924)*
POLYMERASE, PURIFICATION FROM SOLUBLE
FRACTION, PROPERTIES, ASCITES
HEPATOMA CELLS (4923)*
REPAIR, BOUND CARCINOGEN REMOVAL,
NONDIVIDING LYMPHOCYTES, HUMAN
(4410)
REPAIR, LYMPHOCYTE, 4-NITROQUINOLINE-
1-OXIDE, HUMAN (4426)
REPLICATION, NUCLEAR MEMBRANE,
LEUKEMIA CELLS (4975)*
SEQUENCE HETEROGENEITY, SV40 (4546)

SYNTHESIS

CANCER CELLS (4903)*
 CHRONIC MYELOGENOUS LEUKEMIA CELLS
 FOLATE BINDING FACTOR, HUMAN
 (4969)*
 DIMETHYLBENZ(A)ANTHRACENE,
 PROGESTERONE, CARCINOGENESIS,
 MAMMARY GLAND, RAT (4364)
 7,12-DIMETHYLBENA(Z)ANTHRACENE,
 HERPES SIMPLEX VIRUS, INFECTED
 CELL, RABBIT (4520)
 INDUCTION, MAREK'S DISEASE VIRUS,
 ONCOGENICITY, BIRD (4586)*
 LIVER REGENERATION, METABOLIC
 ALTERATIONS, 5-AZACYTIDINE
 TREATED RATS (4466)*
 MURINE SARCOMA VIRUS REPLICATION,
 SV40, EMBRYO CELLS, MOUSE (4534)
 SV40, ETHIDIUM BROMIDE, MONKEY
 (4566)
 VIRAL, CANCER CELL, MOLECULAR
 HYBRIDIZATION, REVIEW (4311)
 VISCOSITY AT ELEVATED TEMPERATURES,
 4-NITROQUINOLINE 1-OXIDE (4471)*
 EHRLICH ASCITES
 TUMOR CELLS, ADENOSINE TRIPHOSPHATE
 ACTIVITY, NACE CONTENT OF CULTURE
 MEDIUM (4901)*
 EHRLICH ASCITES TUMOR
 GROWTH, POLYAMINE AND NUCLEIC ACID
 CONCENTRATIONS, LIVER, MOUSE (4870)
 METABOLITE ACTIVATION, GLYCINE
 ACCUMULATION, MOUSE (4956)*
 ELECTROPHORESIS
 VIRAL RNA, LEUKEMIA, MOUSE (4580)*
 ENDOCRINE GLAND
 HORMONE SECRETION, CANCER CELL, HUMAN,
 REVIEW (4319)
 TUMOR, ADENYL CYCLASE RESPONSE,
 HORMONE, HUMAN (4853)
 ENDOMETRIUM
 ADENOCARCINOMA, ADENOSQUAMOUS
 CARCINOMA, CLINICO-PATHOLOGIC STUDY
 (4927)*
 ENVIRONMENT
 SKIN CANCER OCCURRENCE, ATMOSPHERIC
 FACTORS, HUMAN (4447)
 SOIL, CANCER PREDISPOSITION, REVIEW
 (4318)
 ENVIRONMENTAL HAZARD
 DIETHYL PYROCARBONATE, URETHANE,
 BEVERAGE (4428)
 ENZYME
 ACID PHOSPHATASE AND CATHEPSIN D
 ACTIVITY, MALIGNANT TUMOR, MUSCLE

TISSUE, CLINICAL STUDY (4930)*
 ADENOSINE TRIPHOSPHATASE
 N,N-DIMETHYLAMINOAZOBENZENE, RAT
 (4784)
 MOUSE, MAMMARY TUMOR VIRUS-
 ASSOCIATED, ULTRASTRUCTURAL
 CYTOCHEMISTRY (4604)*
 ADENOSINE TRIPHOSPHATASE ACTIVITY,
 NACE CONTENT OF CULTURE MEDIUM,
 EHRLICH ASCITES TUMOR CELLS (4901)*
 ADENYL CYCLASE, HORMONE, ENDOCRINE
 TUMOR, HUMAN (4853)
 ALDOLASE, HEPATOMA CELL, RAT (4849)
 ALKALINE PHOSPHATASE, PLACENTAL-TYPE,
 RADIOIMMUNOASSAY, HUMAN (4770)*
 ALKALINE PHOSPHATASE VARIANT,
 HEPATOCELLULAR CARCINOMA, SERA,
 HUMAN (4922)*
 ARYL HYDROCARBON HYDROXYLASE
 BENZ(A)ANTHRACENE, CELL HYBRID,
 MOUSE HAMSTER, HUMAN (4409)
 CHEMICAL CARCINOGEN, TRANSFORMA-
 TION, CYTOTOXICITY, CHROMOSOME
 BREAKAGE (4433)
 STIMULATION, BENZ(A)ANTHRACENE,
 MITOGEN, HUMAN LYMPHOCYTES
 (4443)
 ASPARTATE TRANSAMINASE, CONCEN-
 TRATIONS, GROWTH RATE, FETAL, ADULT
 AND NEOPLASTIC TISSUE, RAT (4791)
 ATP-SULFURYLASE, ENZYME-SUBSTRATE
 COMPLEXES, MASTOCYTOMA, MOUSE (4860)
 BETA-HYDROXY-BETA-METHYLGLUTARYL
 COENZYME A REDUCTASE, LIVER, MORRIS
 HEPATOMA, CHOLESTEROL, RAT (4851)
 BRANCHED CHAIN AMINO ACID TRANSAMINASE
 ISOZYMES, CANCER CELLS, LIVER, RAT
 (4859)
 COLLAGENASE, CARCINOMA CELLS, RABBIT
 (4962)*
 CYCLIC 3',5'-NUCLEOTIDE PHOSPHO-
 DIESTERASES, NOVIKOFF RAT HEPATOMA,
 MOUSE L AND HELA CELLS (4869)
 DETECTION, 4-NITROQUINOLINE 1-OXIDE,
 MICROBIAL ASSAY, SALMONELLA
 TYPHIMURIUM (4419)
 DNA POLYMERASE, PURIFICATION FROM
 SOLUBLE FRACTION, PROPERTIES,
 ASCITES HEPATOMA CELLS (4923)*
 DNA POLYMERASE, PURIFICATION FROM
 NUCLEAR MEMBRANE-CHROMATIN FRACTION,
 PROPERTIES, ASCITES HEPATOMA CELLS
 (4924)*
 ENDONUCLEASE, SV40 VIRIONS-ASSOCIATED,
 CHARACTERIZATION (4596)*

- FETAL THYMIDINE KINASE, TUMORS, HUMAN (4867)
- GLYCOLYTIC, LUNG CANCER, INCREASED ACTIVITY, HUMAN (4442)
- GLYCOSYL TRANSFERASE, CELL MEMBRANE, VIRAL TRANSFORMATION (4552)
- GLYOXALASE I, PURIFICATION, CHARACTERIZATION, LYMPHOSARCOMA, LIVER, MOUSE (4939)*
- LACTATE DEHYDROGENASE
LEUKEMIA, HEPATOMA, HUMAN, RAT (4845)
- MALATE DEHYDROGENASE, SV40, 7,12-DIMETHYLBENZ(A)ANTHRACENE-INDUCED, TUMOR, HAMSTER (4582)*
- MICROSOMAL, LUNG, LIVER,
BENZO(A)PYRENE, PHENOBARBITAL,
CARBON TETRACHLORIDE, RAT (4403)
- L-ORNITHINE CARBAMYL TRANSFERASE ACTIVITY, HEPATOMA, ORNITHINE METABOLISM, LIVER, RAT (4989)*
- PHENYLALANINE AMMONIA-LYASE, DNA SYNTHESIS INHIBITION, LEUKOCYTES, LEUKEMIA PATIENTS (4861)
- PROTOCOLLAGEN PROLINE HYDROXYLASE, HEPATOCELLULAR CARCINOMA, UGANDANS (4882)*
- RIBONUCLEASE, FOCAL LOSS OF ACTIVITY, PRENEOPLASTIC LIVER, RAT (4780)
- RIBONUCLEASE-SENSITIVE DNA POLYMERASE ACTIVITY, DNA-DIRECTED POLYMERASE, TISSUE CULTURE CELL LINES, HUMAN (4571)
- RNA-DEPENDENT DNA POLYMERASE, AVIAN MYELOBLASTOSIS VIRUS, STIMULATING FACTOR (4551)
- RNA POLYMERASE, TRANSCRIPTION, NUCLEOLUS, LIVER, RAT (4925)*
- TRNA N2-GUANINE DIMETHYLASE, TUMORS, LIVER, KIDNEY, RAT (4862)
- TYROSINASE
ANTISERUM, MELANOMA, MOUSE (4714)*
MELANOMA CELL (4871)
- TYROSINE AMINOTRANSFERASE, INDUCTION VARIATION, HTC CELL CLONES (4896)*
- TYROSINE HYDROXYLASE, ACTIVITY REGULATION, NEUROBLASTOMA CELLS, MOUSE (4998)*
- EPIDEMIOLOGY
CANCER TRENDS, 1935-1965, CONNECTICUT (4809)
- EPIDIDYMIS
PRIMARY TUMORS, HUMAN (4952)*
- EPITHELIOMA
SMALLPOX VACCINATION SITE, CASE REPORT (4715)*
- EPITHELIUM
CELL DIFFERENTIATION, VITAMIN A, MODE OF ACTION (4487)*
- EMBRYONAL LUNG TISSUE, PRETUMOR CHANGES, NITROSOMETHYLUREA, MOUSE (4438)
- EPITHELIAL ATYPIA, BETEL QUID INDUCEMENT, BUCCAL MUCOSA, BARBOONS (4477)*
- GROWTH, MAMMARY GLAND, HUMAN (4940)*
- ORAL TUMOR, HUMAN, ULTRASTRUCTURE (4785)
- TRACHEAL, BIOCHEMICAL AND MORPHOLOGIC EXAMINATIONS, HAMSTER (4394)
- TRACHFOBRONCHIAL, BENZO(A)PYRENE, ULTRASTRUCTURAL CHANGES, HAMSTER (4437)
- EPOXIDES
POLYCYCLIC HYDROCARBON, TRANSFORMATION HAMSTER CELL (4445)
- ERGOCORNINE
MAMMARY TUMOR GROWTH INHIBITION, RAT (4455)*
- ERYTHROBLASTOSIS
MALIGNANT, CYTOCHEMISTRY, HUMAN, REVIEW (4344)*
- ERYTHROCYTE
FRIEND VIRUS, POLYCYTHEMIA, MOUSE (4533)
- LABELED, INSECT TRANSFER, CIRCULATING TUMOR CELLS (4865)
- PLASMA MEMBRANE, FELINE C-TYPE VIRUS REPLICATION (4608)*
- ESOPHAGUS
CANCER
ALCOHOLIC DRINK, EAST AFRICA (4454)*, (4825)*
- EPIDEMIOLOGY, INTERNATIONAL (4833)*
- TUMORS, N-NITROSOPIPERIDINE, HISTO-PATHOLOGY, ULTRASTRUCTURE, RAT (4385)
- 3H-ESTRADIOL
ACCUMULATION, TESTES, PITUITARY GLAND, MOUSE (4373)
- ESTROGEN
5 ALPHA-DIHYDROTESTOSTERONE, METABOLISM, PROSTATE CARCINOMA, HUMAN (4854)
- CERVIX, 3-METHYLCHOLANTHRENE, MOUSE (4370)
- LONG-TERM ADMINISTRATION, MAMMARY CANCER, WOMEN (4449)*
- MAMMARY TISSUE, BENIGN CONDITION,

HUMAN (4429)
 3-METHYLCHOLANTHRENE, UTERUS,
 MAMMARY GLAND, CASTRATION, MOUSE
 (4435)
 REPLACEMENT THERAPY, BREAST CARCINOMA,
 WOMEN (4450)*
 VAGINAL CANCER, VAGINAL DEVELOPMENT,
 WOMEN (4464)*
 THIDIUM BROMIDE
 DNA SYNTHESIS, SV40, MONKEY (4566)
 THIOMINE
 HEPATOCARCINOGENESIS, HISTOPATHOL-
 OGICAL STUDY, RAT (4361)
 THYLNITROSUREA
 INDUCED NEURINOMA, HISTOCHEMISTRY,
 TISSUE CULTURE, RAT (4459)*
 TIOLOGY
 NEOPLASIA, MYCOTOXINS, ANIMALS, MAN
 (4446)
 OSTEOSARCOMA, IMMUNOLOGICAL EVIDENCE,
 VIRUS, HUMAN (4515)
 SQUAMOUS CELL SKIN CANCER, HUMAN,
 REVIEW (4313)
 STOMACH TUMORS, N-NITROSO COMPOUNDS,
 HUMAN, REVIEW (4302)
 VIRAL, RENAL ADENOCARCINOMA, FROG,
 REVIEW (4343)*
 VIRAL CANCER THEORIES, RESEARCH
 (4610)*
 IBRIN
 FIBRINOLYTIC ACTIVATORS, TUMORS,
 HUMAN (4983)*
 IBRINOGEN
 DISTRIBUTION, LUNG CANCER, AUTORADIO-
 GRAPHIC STUDY, RABBIT (4384)
 IBROADENOMA
 MAMMARY, PROGESTERONE, ESTROGEN, RAT
 (4420)
 IBROBLAST
 ALTERATIONS, DIMETHYLNITROSAMINE,
 KIDNEY, RAT (4398)
 POLYOMA VIRUS-TRANSFORMED, GLYCO-
 SPHINGOLIPIDS, MOUSE (4587)*
 TRANSFORMATION, SULFATED ACID MUCO-
 POLYSACCHARIDE SYNTHESIS, DIBUTYRYL
 CYCLIC ADENOSINE MONOPHOSPHATE
 (4508)
 TUMOR-FORMING ACTIVITY, MOUSE,
 HAMSTER (4792)
 IBROMA
 SPONTANEOUS DISSEMINATED, POXVIRUS,
 SQUIRREL (4584)*
 IBROSARCOMA
 LARYNX, CASE REPORT (4957)*
 METHYLCHOLANTHRENE-INDUCED
 GROWTH, MYCOBACTERIUM BOVIS,
 NEURAMINIDASE-TREATED CELLS,
 COMPARATIVE EFFECT, MOUSE (4682)
 IRRADIATION, IMMUNE STATUS, MOUSE
 (4686)
 3-METHYLCHOLANTHRENE-INDUCED, CELI.
 LINE ESTABLISHMENT, RAT (4465)*
 FLUORANTHENE
 CIGARETTE SMOKE, FORMATION BY
 PYROLYSIS, TUMOR-INITIATING
 ACTIVITY (4478)*
 2-FLUORENYLACETAMIDE
 HEPATOCARCINOGENESIS, HYPOPHYSECTOMY,
 HISTOPATHOLOGICAL STUDY, RAT (4361)
 N-2-FLUORENYLACETAMIDE
 HEPATOCELLULAR CARCINOMAS, HEPATIC
 NODULES, PLASMA PROTEIN SYNTHESIS,
 LIVER, RAT (4402)
 HEPATOMA INDUCTION, CELL LOSS AND
 PROLIFERATION, LIVER, RAT (4434)
 LIVER, CHOLESTEROL SYNTHESIS, RAT
 (4782)
 METABOLISM, CARCINOGENESIS, LIVER, RAT
 (4430)
 2,7-FLUORENYLBISACETAMIDE
 BILE-DUCT CELL PROLIFERATION, FEMALE
 MICE (4453)*
 FLUORIDE
 LUNG CANCER, HUMAN, REVIEW (4353)*
 STEEL INDUSTRY, LUNG CANCER, INCIDENCE
 CANADA (4823)
 5-FLUOROURACIL
 ANTIMETABOLITE, THYMIDYLATE BIOSYNTH-
 SIS, LEUKEMIA, MOUSE (4439)
 FOCUS FORMATION
 FELINE SARCOMA VIRUS, HELPER ACTIVITY,
 MARMOSSET CELL, CAT CELL (4532)
 GALLBLADDER
 CARCINOMA, INCIDENCE, CALIFORNIA
 (4829)*
 LYMPHOCYTIC LYMPHOSARCOMA, CASE REPORT
 (4891)*
 GASTRITIS
 STOMACH CARCINOMA, CASE REPORTS (4781)
 GASTROINTESTINAL TRACT
 MALIGNANCIES, ABSENCE OF CIRCULATING
 ANTIBODIES TO CARCINOEMBRYONIC
 ANTIGEN, HUMAN (4625)
 GENE
 DEREPRESSION, RNA, PRIMARY HEPATOMAS,
 RAT (4800)*
 EXPRESSION CONTROL MECHANISMS, TRANS-
 SCRIPTONAL LEVEL, REVIEW (4346)*
 GENETICS
 GENE EXPRESSION CONTROL MECHANISMS,

- TRANSCRIPTIONAL LEVEL, REVIEW
(4346)*
- GERMINOMA
MEDIASITINAL, PATHOLOGY, HUMAN (4934)*
- GLUCAGON
TYROSINE AMINOTRANSFERASE ACTIVITY,
YOSHIDA SARCOMA, RAT (4986)*
- GLUCOSE
METABOLISM
INCORPORATION, NOVIKOFF HEPATOMA
CELLS, RAT (4900)*
RCUS SARCOMA VIRUS, TRANSFORMED
CELL, CHICK EMBRYO (4558)
- B-GLUCOSIDASE
MODULATION, CYCASIN-INDUCED TUMORS,
PREWEANLING RATS (4416)
- GLUTAMINE
OXIDATIVE METABOLISM, MALIGNANT CELLS,
RAT (4844)
- GLYCINE
ACCUMULATION, METABOLITE ACTIVATION,
EHRlich ASCITES TUMOR, MOUSE (4956)*
- GLYCOGEN
UTILIZATION, HEPATOMA GROWTH, LIVER,
RAT (4894)*
- GLYCOPROTEIN
ANTI HUMAN BLOOD GROUP N AGGLUTININ,
TUMOR CELL, MOUSE (4764)*
CROSSREACTING ANTIGEN, CARCINO-
EMBRYONIC ANTIGEN, TISSUE EXTRACTS,
HUMAN (4755)*
SYNTHESIS, VITAMIN A, SKIN TUMORS,
HUMAN (4378)
- GONAD
CANCER, INCIDENCE, QUAAUG (4808)
NEOPLASM, GONADUBLASTOMA-RELATED,
CASE REPORT (4935)*
- GRAFT-VERSUS-HOST REACTION
MALIGNANT LYMPHOMA, IMMUNOLOGIC
INDUCTION, GENETIC FACTORS (4628)
NEOPLASIA, KARYOTYPE, MOUSE (4658)
- GRANULOMA
ADJUVANT-INDUCED, IMMUNOSUPPRESSION,
MOUSE (4636)
CENTRAL GIANT-CELL, CASE REPORTS
(4877)*
LIPID, BONE MARROW, CLINICAL STUDY
(4961)*
- GROWTH
EPITHELIUM, MAMMARY GLAND, HUMAN
(4940)*
FIBROSARCOMA
ENHANCEMENT, IGG2 FC REGION,
MOUSE (4668)
METHYLCHOLANTHRENE-INDUCED,
MYCOBACTERIUM BOVIS AND
NEURAMINIDASE-TREATED CELLS,
COMPARATIVE EFFECT, MOUSE (4682)
- HEPATOMA
ETHER-LIPID LEVELS, ALPHA-GLYCEROL
PHOSPHATE DEHYDROGENASE ACTIVITY
CULTURED CELLS, RAT (4838)*
GLYCOGEN UTILIZATION, LIVER, RAT
(4894)*
INHIBITION, MAMMARY TUMOR, ERGOCORININE
RAT (4455)*
LEUKEMIA CELL LINE, PROTEIN-FREE
MEDIUM, HUMAN (4963)*
MAMMARY CARCINOMA, HUMAN (4822)
POLYOMA TUMOR, FACILITATION, BLOCKING
SERUM, TUMOR ELUATE, RAT (4649)
SARCOMA, GENOTYPE-DEPENDENT MODIFICA-
TION, CASTRATED MICE (4836)*
SOLID EHRlich ASCITES TUMOR,
CHONDROITINSULFATE, MOUSE (4899)*
TUMOR
BIOLOGICAL ENERGY, REVIFW (4316)
POLYAMINE AND NUCLEIC ACID CONCEN-
TRATIONS, EHRlich ASCITES
CARCINOMA, CELLS, LIVER, MOUSE
(4870)
RATE ENHANCEMENT, INTERFERON
INDUCERS (4599)*
WOUND TUMOR VIRUS, VECTOR CELL
MONOLAYERS, PLANTS (4609)*
- HELA CELLS
INTERSTRAND DNA CROSS-LINKING, MUSTARD
GAS ALKYLATION (4397)
SENDAI VIRUS INFECTION, 4-NITROQUINO-
LINE 1-OXIDE TREATMENT, REPAIR
MECHANISM (4395)
- HEMANGIOENDOTHELIOMA
LEG, METALLIC FIXATION OF TIBIA,
CASE REPORT (4488)*
THOROTRAST, LEUKEMIA, PORTUGAL (4490)
- HEMANGIOMATOSIS
SMALL AND LARGE BOWEL, HISTOLOGY,
CASE REPORT (4906)*
- HEMANGIOPERICYTOMA
NASAL CAVITY, CASE REPORT, NIGERIA
(4876)*
- HEMATOPOIETIC CELL
PROLIFERATION, LETHALLY IRRADIATED
MICE (4501)*
- HEMOCYANIN
RAUSCHER LEUKEMIA VIRUS, INFECTED
CELL DIFFERENTIATION, MOUSE (4680)
- HEPATOCARCINOGENESIS
DIMETHYLNITROSAMINE, NEWT (4467)*
HYPOPHYSECTOMY, HISTOPATHOLOGICAL

STUDY, RAT (4361)
 KARYOKINESIS AND NUCLEAR STRUCTURE,
 NITROSOMORPHOLINE, HEPATOCYTES, RAT
 (4472)*

PATOCELLULAR CARCINOMA
 AUTOPSY STUDY, NIGERIANS, REVIEW
 (4351)*

PATOMA
 ALDOLASE, HYBRID CELL, RAT (4849)
 BENZENE HEXACHLORIDE, MOUSE (4462)*
 CELL SURFACE, ANTIBODY TREATMENT,
 ELECTROPHORESIS, RAT (4711)*
 ENZYME, RAT (4845)
 GROWTH, GLYCOGEN UTILIZATION, LIVER,
 RAT (4894)*
 LUNG CARCINOGENESIS, DIMETHYLNITROS-
 AMINE, PHORBOL, MOUSE (4392)
 METABOLISM, LIVER, ISCHEMIA, RAT
 (4857)
 MORRIS, ENZYME REGULATION, CHOLESTEROL
 RAT (4851)
 NOVIKOFF CELLS, GLUCOSE INCORPORATION,
 METABOLISM, RAT (4900)*
 L-ORNITHINE CARBANYL TRANSFERASE
 ACTIVITY, ORNITHINE METABOLISM,
 LIVER, RAT (4989)*
 PROTEINS, IMMUNOELECTROPHORESIS, RAT
 (4732)*
 SURFACE MEMBRANE ANTIGEN DELETION,
 4-DIMETHYLAMINOAZOBENZENE, RAT
 (4678)
 THOROTRAST-INDUCED, CASE REPORT
 (4500)*
 YOSHIDA, COLD-ANTIBODIES, CYTOTOXIC
 REACTION, RAT SERUM (4696)

TEROTRANSPLANTATION
 HUMAN PROSTATIC ADENOMA CELLS
 NONIMMUNOSUPPRESSED HAMSTERS (4724)*

STIOCYTOSIS
 MALIGNANT, CUTANEOUS INVOLVEMENT,
 EOSINOPHILIA, CASE REPORT (4990)*

UGKIN'S DISEASE
 BIOSTATISTICAL AND EPIDEMIOLOGICAL
 FACTORS, REVIEW (4359)*
 BOWEN'S DISEASE OF THE PALM
 ASSOCIATED, CASE REPORT (4926)*
 LYMPHOCYTE SURFACE IMMUNOGLOBULINS,
 HUMAN (4712)*
 POST-MORTEM FINDINGS, UGANDANS (4988)*

RMONE
 5 ALPHA-DIHYDROTESTOSTERONE, METABOL-
 ISM, PROSTATE CARCINOMA, ESTROGEN,
 HUMAN (4854)
 ENDOCRINE TUMOR, ADENYL CYCLASE
 RESPONSE, HUMAN (4853)

ESTRADIOL BINDING SITE, MAMMARY TUMOR,
 MOUSE (4406)
 3H-ESTRADIOL ACCUMULATION, TESTES AND
 PITUITARY GLAND, MOUSE (4373)
 ESTROGEN
 LONG-TERM ADMINISTRATION, MAMMARY
 CANCER, WOMEN (4449)*
 MAMMARY FIBROADENOMA, RAT (4420)
 VAGINAL CANCER, VAGINAL
 DEVELOPMENT, WOMEN (4464)*
 ESTROGEN REPLACEMENT THERAPY, BREAST
 CARCINOMA, WOMEN (4450)*
 OVARIAN, MAMMARY TUMORIGENESIS,
 N-NITROSOBUTYLUREA, RAT (4382)
 PROGESTERONE, MAMMARY FIBROADENOMA,
 RAT (4420)
 SECRETION, CANCER CELL, HUMAN, REVIEW
 (4319)
 STEROID, SKIN TUMORIGENESIS INHIBITION
 CROTON OIL, MOUSE (4368)
 TESTOSTERONE, MAMMARY GLAND CANCER,
 ETIOLOGY, HUMAN (4858)

HYBRID
 HEPATOMA CELL, ALDOLASE, RAT (4849)
 SV40-TRANSFORMED CELL, ANTIGENICITY,
 CHROMOSOME, MOUSE, RAT (4510)

HYBRID CELL
 SARCOMA VIRUS, LEUKEMIA VIRUS,
 PRODUCTION, ANTIGENS, HAMSTER, MOUSE
 (4565)

HYBRIDIZATION
 DNA, VIRUS, REVIEW (4311)

HYDRAZINE SULFATE
 LUNG AND MAMMARY GLAND TUMORS,
 PREGNANT AND PSEUDOPREGNANT MICE
 (4476)*
 LUNG TUMORS, C-TYPE PARTICLES, ULTRA-
 STRUCTURE, MOUSE (4371)

HYDROCORTISONE
 TYROSINE AMINOTRANSFERASE ACTIVITY,
 YOSHIDA SARCOMA, RAT (4986)*
 4-HYDROXYAMINOQUINOLINE-1-OXIDE
 DNA BREAKAGE, REPAIR, MAMMALIAN CELL
 (4494)
 MUTATION SUPPRESSOR, E. COLI (4482)*
 3-HYDROXYANTHRANILIC ACID
 URINARY EXCRETION, GLUCURONIDE,
 SULFURIC ESTER, HUMAN, RAT, GUINEA
 PIG (4388)
 N-HYDROXY-2-FLUORENYLACETAMIDE
 RNA POLYMERASE INHIBITION, LIVER, RAT
 (4380)
 8-HYDROXYQUINOLINE
 SIDEROSIS, IRON, NEOPLASTIC AND
 PRENEOPLASTIC LESIONS, LIVER, RAT

(4389)
HYPERPLASIA
INDUCTION, SALIVARY GLAND ISOGRAFTS,
MOUSE (4463)*
ISLETS OF LANGERHANS, CONGENITAL
NEUROBLASTOMA, INFANT, CASE REPORT
(4959)*
TUMOR, SKIN, UREA ANTIGEN, MOUSE
(4692)
HYPOGLYCEMIA
LYMPHOSARCOMA, METASTASIS TO GLUCOSE
CONTROL CENTER, CASE REPORT (4911)*
IMMUNITY
BREAST CARCINOMA, TUMOR-ASSOCIATED
ANTIGEN, HUMAN (4675)
BURKITT LYMPHOMA, COLONY INHIBITION,
EFFECTOR CELL, HUMAN (4685)
CELL, WILM'S TUMOR, NEUROBLASTOMA,
HUMAN (4731)*
CELL-MEDIATED ANTITUMOR, TUMOR GROWTH,
TUMOR RESECTION, IRRADIATED TUMOR
CELL, MOUSE (4642)
CELLULAR
HEPATOMA, MACROPHAGE MIGRATION,
GUINEA PIG (4650)
IMMUNE CYTOLYSIS, GUINEA PIG
(4774)*
CROSS PROTECTION, AVIAN SARCOMA VIRUS,
CHICKEN (4531)
CYTOTOXICITY, BLOCKING SERUM, TUMOR
ELUATE, POLYOMA VIRUS, RAT (4649)
CYTOTOXICITY REACTION, LYMPHOID CELL,
LYMPHOMA, GROSS VIRUS, RAT (4621)
CYTOTOXICITY SUPPRESSION, SPLEEN CELL,
LYMPH NODE CELL, ASCITES TUMOR,
MOUSE (4752)*
DELAYED CUTANEOUS HYPERSENSITIVITY,
MALIGNANT MELANOMA, AUTOLOGOUS TUMOR
EXTRACT, HUMAN (4657)
EFFECTOR CELL ACTIVITY, BURKITT
LYMPHOMA, LEUKOCYTE, HUMAN (4623)
EHRICH ASCITES CARCINOMA, RESISTANCE
INDUCTION, RABBIT IMMUNE SERUM,
MOUSE (4661)
GRAFT REJECTION, MAMMARY TUMOR, DNA
TREATMENT, CELL DEBRIS TREATMENT,
RAT (4695)
HOST, METHYLCHOLANTHRENE-INDUCED
SARCOMA, GUINEA PIG (4703)
HUMORAL, 3-METHYLCHOLANTHRENE, MOUSE
(4363)
IMMUNE REACTIVITY, AUTOLOGOUS BLAST
CELLS, LEUKEMIA PATIENTS (4643)
LYMPHOCYTE CYTOTOXICITY, COLON
CARCINOMA, HUMAN (4698)
MACROPHAGE MIGRATION, ALLOGENEIC TUMOR
ISOGENEIC TUMOR, MOUSE (4700)
MYELOMA PROTEIN, CELL SURFACE, MOUSE
(4702)
MYELOMA TUMOR, BALB/C MICE (4751)*
RAUSCHER LEUKEMIA VIRUS, TUMOR
RESISTANCE INDUCTION, ADULT MOUSE,
NEWBORN MOUSE (4687)
RNA TUMOR VIRUS ANTIGEN, MOUSE (4618)
TUMOR
BLOCKING EFFECT, COUNTERACTION,
POLYOMA VIRUS, RAT (4612)
CELL-MEDIATED, MEASUREMENT,
SOLUBLE TUMOR SPECIFIC ANTIGENS
(4619)
COLON CARCINOMA ANTIGEN, SALT
EXTRACTED, EVALUATION, HUMAN
(4749)*
TUMOR SPECIFIC, GROWTH SUPPRESSION,
MYCOBACTERIUM BOVIS INOCULATION,
MOUSE (4746)*
VACCINE BACILLUS CALMETTE-GUÉRIN,
HEPATOCELLULAR CARCINOMA, GUINEA PIG
(4655)
IMMUNIZATION
IN VITRO, THYMOCYTE, CYTOTOXICITY,
TUMOR PROTECTION, MOUSE (4667)
PASSIVE, LYMPHOMA, ANTISERA, MOUSE
(4701)
IMMUNODEPRESSION
ANTINUCLEAR ANTIBODY, INHIBITION,
RAUSCHER LEUKEMIA VIRUS, MOUSE
(4559)
IMMUNOELECTROPHORESIS
PROTEINS, LIVER AND HEPATOMA, RAT
(4732)*
IMMUNOFLOUORESCENCE
ALPHA-FETOPROTEIN, PRIMARY LIVER
NEOPLASM, HUMAN (4713)*
COLONIC POLYP, HUMAN (4624)
INTRACELLULAR MACROGLOBULIN, CHRONIC
LYMPHOCYTIC LEUKEMIA, HUMAN (4716)*
LYMPH NODES, LEUKEMIA, CATTLE (4717)*
IMMUNOGENICITY
ANTIGENS BOUND TO MACROPHAGES,
LYMPHOCYTES, THYMOCYTES AND
HEPATOMA CELLS (4744)*
LEUKEMIA, NEURAMINIDASE, MOUSE (4653)
IMMUNOGLOBULIN
GAMMA G, CATABOLISM, MYELOMA PROTEIN,
HUMAN, MONKEY (4699)
HEAVY CHAINS, SEQUENCE RELATIONSHIPS,
VARIOUS MAMMALIAN SPECIES (4754)*
IGG2 FC REGION, TUMOR ENHANCEMENT,
MOUSE (4668)

LEUKEMIC PATIENTS, CLINICAL STUDY (4708)*

LYMPHOCYTE SURFACE CHARACTERISTICS, PLASMACYTOMA, MOUSE (4765)*

HODGKIN'S DISEASE, HUMAN (4712)*

PAPAIN FRAGMENT, VH REGION, IGG3 MYELOMA PROTEIN, HUMAN (4738)*

SYNTHESIS, BURKITT'S LYMPHOMA, HUMAN (4690)

IMMUNOLOGY

CIRCULAR DICHROISM STUDY, HAPTEN INTERACTION, MYELOMA PROTEINS, ANTIBODIES, MOUSE (4753)*

HERPES SIMPLEX VIRUS, TYPES 1 AND 2 DIFFERENTIATION, IN VITRO (4581)*

IMMUNE DEFENSE AGAINST CANCER, TUMOR STUDIES, HUMAN (4636)

IMMUNE RESPONSE

EFFECT OF DRUGS, CYTOTOXICITY, TEST, MOUSE (4759)*

GENETIC CONTROL, ANTIBODY RESPONSE THYMECTOMY, MOUSE (4670)

TUMOR-BEARING MICE (4747)*

TUMOR CELL KILLING, KINETICS, MOUSE (4741)*

IMMUNOCOMPETENT CELL SEPARATION, HEMOPOIETIC CELL SUSPENSIONS, VELOCITY SEDIMENTATION, HUMAN AND MOUSE (4726)*

IMMUNOPROLIFERATIVE DISORDERS, LYMPHOCYTE TRANSFORMATION, PHYTO-HEMAGGLUTININ, HUMAN (4641)

IMMUNOTHERAPY, CANCERS (4725)*

LEUKEMIA

EFFECT OF VIBRIO CHOLERAE NEURAMINIDASE, IN VITRO (4719)*

MOUSE (4718)*

LYMPHOBLASTIC LEUKEMIA, HYDROCORTISONE IN VITRO (4736)*

PRIMARY IMMUNE RESPONSE, STIMULATION FACTOR, IN VITRO (4656)

REGIONAL LYMPH NODES, SIMULATED COLON CARCINOMA, RABBIT (4742)*

TUMOR CELL DETECTION, DEXTRAN, SHEEP RED BLOOD CELLS (4758)*

TUMOR SPECIFIC ANTIGENS, CARCINO-EMBRYONIC ANTIGEN, ALPHA-FETOPROTEIN (4730)*

IMMUNOSUPPRESSION

CELL-MEDIATED, SPLEEN CELLS, MOUSE (4752)*

GRANULOMA DEVELOPMENT ADJUVANT-INDUCED, MOUSE (4636)

IGG2 FC REGION, TUMOR ENHANCEMENT,

MOUSE (4668)

LEUKOCYTE MIGRATION, FRIEND LEUKEMIA VIRUS, MOUSE (4574)

IMMUNOTHERAPY

CANCER TREATMENT, HUMAN, REVIEW (4336)*

IMMUNOLOGY, CANCERS (4725)*

INDOLE

URINARY BLADDER TUMORIGENESIS, HAMSTER (4376)

INDUCTION

BLADDER CANCER, N-METHYL-N-NITROSOUREA HISTOLOGY, RAT (4431)

C-TYPE VIRUS, PROMODEOXYURIDINE, CLONAL CELL LINES, MOUSE (4523)

DNA SYNTHESIS, MAREK'S DISEASE VIRUS, ONCOGENICITY, BIRD (4586)*

HEPATOMA, N-2-FLUORENYLACETAMIDE, CELL LOSS AND PROLIFERATION, LIVER, RAT (4434)

HYPERPLASIA, SALIVARY GLAND ISOGRAFTS, MOUSE (4463)*

IMMUNOLOGIC, MALIGNANT LYMPHOMA, GENETIC FACTORS, GRAFT-VS-HOST MODEL (4628)

SPECIFIC TUMOR IMMUNITY, TUMOR GROWTH SUPPRESSION, MYCOBACTERIUM BOVIS INOCULATION, MOUSE (4746)*

TUMOR, BRAIN, KIDNEY, N-NITROSO-RUTYLUREA, RAT (4422)

TUMOR, FELINE SARCOMA VIRUS, MONKEY (4524)

URINARY BLADDER TUMOR, BUTYL(3-CARBOXYPROPYL)NITROSCAMIDE, RAT (4470)*

INFECTION

EPSTEIN-BARR VIRUS, LYMPHOBLASTOID CELL, HUMAN (4575)

MURINE LEUKEMIA VIRUS, FRIEND VIRUS, FRACTION, MOUSE CELL (4521)

SV40, TEMPERATURE-SENSITIVE MUTANT, MONKEY CELL (4542)

INFECTIOUS BOVINE RHINOTRACHEITIS

HERPESVIRUS, ANTIGENIC RELATIONSHIPS, MAREK'S DISEASE, BURKITT'S LYMPHOMA (4611)

INFECTIOUS MONONUCLEOSIS

ACUTE LEUKEMIA, SIMULTANEOUS OCCURRENCE, CASE REPORT (4545)

INTERFERON

ENHANCEMENT OF SARCOMA AND LEUKEMIA INDUCTION, MOUSE, RAT (4553)

INDUCERS, TUMOR GROWTH RATE ENHANCEMENT (4599)*

INTESTINE

- ANTIGEN, CANCER, CARCINOEMBRYONIC
ANTIGEN, HUMAN (4697)
LARGE, METACHONDROSUS CANCER, HUMAN,
REVIEW (4355)*
- IRON
NEOPLASTIC AND PRENEOPLASTIC LESIONS,
8-HYDROXYQUINOLINE-INDUCED SIDEROSIS
LIVER, RAT (4389)
- ISLET CELL TUMOR
PANCREAS, CUSHING'S SYNDROME,
AVASCULAR NECROSIS OF BONE, CASE
REPORT (4893)*
- JAAGSIEKTE
LYMPH NODE, SERUM PROTEIN, SHEEP
(4634)
- JAW
SYNOVIAL CHONDROMATOSIS, TEMPORO-
MANDIBULAR JOINT, CASE REPORTS
(4889)*
TUMORS, HUMAN (4873)*
- KAPOSI'S SARCOMA
POSTMORTEM FINDINGS, DISEASE PATTERNS,
WOMEN (4890)*
- KARYOTYPE
CHRONIC MYELOGENOUS LEUKEMIA,
CYTOLOGY, HUMAN (4842)
- KERATOCACANTHOMA
VITAMIN A, GLYCOPROTEIN SYNTHESIS,
HUMAN (4378)
- KIDNEY
FIBROBLAST ALTERATIONS, DIMETHYL-
NITROSAMINE, RAT (4398)
GRAWITZ TUMOR, BLOOD GROUPS, HUMAN
(4848)
PRIMARY LEIOMYOSARCOMA, CASE REPORT,
REVIEW (4338)*
RENAL ADENOCARCINOMA, VIRAL ETIOLOGY,
FROG, REVIEW (4343)*
RENAL FUNCTION, SERUM AND URINARY
PROTEINS, CHRONIC MYELOGENOUS
LEUKEMIA PATIENTS (4905)*
TUMOR, TRNA N2-GUANINE DIMETHYLASE,
RAT (4862)
TUMOR INDUCTION, N-NITROSOBUTYLUREA,
RAT (4422)
- LACTATION
MAMMARY TUMORIGENESIS, MOUSE (4846)
- LACTIC ACID
LUNG CANCER, GLYCOLYTIC ENZYMES, HUMAN
(4442)
- LANTHANUM
CELLULAR ELECTROLYTE AND MEMBRANE
POTENTIAL ALTERATIONS, EHRlich
ASCITES TUMOR CELLS (4484)*
- LARYNGOPHARYNX
MULTIPLE PRIMARY TUMORS, CLINICAL
STUDY (4795)*
- LARYNX
CANCER, CLINICAL STUDY (4904)*
CANCER SPREAD, HUMAN (4945)*
FIBROSARCOMA, CASE REPORT (4957)*
GIANT CELL TUMOR, CASE REPORT (4875)*
- LEG
HEMANGIOENDOTHELIOMA, METALLIC
FIXATION OF TIBIA, CASE REPORT
(4488)*
- LEIOMYOMA
ANAL CANAL, CASE REPORT (4955)*
- LEIOMYOSARCOMA
PRIMARY, KIDNEY, CASE REPORT, REVIEW
(4338)*
- LEUKEMIA
ABELSON VIRUS, MOUSE, RAT (4794)
- ACUTE
BENZENE-INDUCED HYPOPLASTIC
ANEMIA, CASE REPORT (4473)*
CHEMOTHERAPY, CLINICAL STUDY,
INFANTS (4958)*
CLINICAL STUDY, AUSTRALIA,
REVIEW (4325)*
INFECTIOUS MONONUCLEOSIS,
SIMULTANEOUS OCCURRENCE, CASE
REPORT (4545)
LYMPHOBlastic VIRUS-LIKE PARTICLES
LYMPHATIC CELL INCLUSIONS,
BONE MARROW, PERIPHERAL BLOOD,
HUMAN (4560)
MYELOGENOUS, LYMPHOSARCOMA, CASE
REPORT (4937)*
MYELOID, CRYPTOCOCCAL MENINGITIS
DISSOCIATED LOSS OF CELLULAR
IMMUNOLOGICAL FUNCTION, CASE
REPORT (4777)*
PHYTOHEMAGGLUTININ, CELL TYPE,
HUMAN, REVIEW (4357)*
PROMYELOCYTIC, ULTRASTRUCTURE,
HUMAN (4970)*
ARABINOSYL CYTOSINE TOLERANCE,
CIRCADIAN RHYTHM, MOUSE (4863)
AREGENERATIVE ANEMIA, BONE MARROW,
HUMAN (4783)
CENTRAL NERVOUS SYSTEM, CYTO-
CENTRIFUGATION, CASE REPORTS (4947)*
CHILDREN, CLINICAL STUDY (4960)*
CHRONIC LYMPHOCYTIC
BLASTIC TRANSFORMATION, LYMPHOCYTE
CULTURES, HUMAN (4639)
INTRACELLULAR M/CROGLOBULIN, HUMAN
(4716)*
TRANSIENT LYMPHOTOXIC SERUM FACTOR

CASE REPORT (4706)*
 WHITE BLOOD CELL, ANTIGENICITY,
 HUMAN (4620)
 CHRONIC MYELOGENOUS
 KARYOTYPE, CYTOLOGY, HUMAN (4842)
 SERUM AND URINARY PROTEINS,
 RENAL FUNCTION, CLINICAL STUDY
 (4905)*
 CONGENITAL, MONGOLISM, CASE REPORT
 (4909)*
 DISORDERED LEUKOCYTE PROLIFERATION,
 HUMAN (4949)*
 DRUG-RESISTANT SUBLINE, INCREASED
 ANTIGENICITY, MOUSE (4679)
 EPIDEMIOLOGY, BUENOS AIRES PROVINCE
 (4819)
 GROSS VIRUS, CELL-SURFACE ANTIGEN,
 SUPPRESSION, MOUSE (4694)
 GROUP-SPECIFIC ANTIGEN, TYPE-SPECIFIC
 ANTIGEN, FRIEND VIRUS, MAZURENKO
 VIRUS, RAUSCHER VIRUS, MOUSE (4631)
 GROWTH OF CELL LINE, PROTEIN-FREE
 MEDIUM, HUMAN (4963)*
 IMMUNE REACTIVITY, AUTOLOGOUS BLAST
 CELLS, PATIENTS (4643)
 IMMUNITY, LYMPHOCYTE CYTOLYSIS, MOUSE
 (4688)
 IMMUNOFLOURESCENCE, LYMPH NODES,
 SPLEEN, CATTLE (4717)*
 IMMUNOGENICITY
 EFFECT OF VIBRIO CHOLERAE
 NEURAMINIDASE, IN VITRO (4719)*
 MOUSE (4718)*
 NEURAMINIDASE, MOUSE (4653)
 LACTATE DEHYDROGENASE, HEPATOMA, HUMAN
 RAT (4845)
 LYMPHATIC
 INFLUENZA VIRUS, INTRA-ARTICULAR
 INOCULATION, MOUSE (4602)*
 LUNG TUMOR, BRACKEN FERN, MOUSE
 (4387)
 LYMPHOBLASTIC, CELLULAR ANTIGENS,
 HYDROCORTISONE, IN VITRO (4736)*
 LYMPHOCYTE CYTOTOXICITY, IDENTICAL
 TWIN, HUMAN (4674)
 LYMPHOID CELL, NORMAL, HUMAN, REVIEW
 (4306)
 MURINE, VIRUS, ROUS MOUSE CELL LINE
 (4589)*
 MURINE SARCOMA VIRUS INDUCTION,
 ENHANCEMENT BY INTERFERON INDUCERS,
 MOUSE, RAT (4553)
 MURINE VIRUS ANTIGEN, CELLULAR ANTIGEN
 MYELOMA CELL, MOUSE (4555)
 MYELOGENOUS, ABNORMAL CATALASE ANTIGEN

NORMAL ANTIGEN DELETION, LEUKOCYTES,
 HUMAN (4768)*
 MYELOID, ISOCHROMOSOME 17 IDENTIFICA-
 TION, HUMAN (4980)*
 N-NITROSOBUTYLUREA, RAT, VIRUS (4505)
 PRELEUKEMIC CHRONIC GRANULOCYTIC,
 LIGHT-CHAIN DISEASE, SIDEROBLASTIC
 ANEMIA, CASE REPORT (4796)*
 RAUSCHER VIRUS, RNA-DIRECTED DNA
 POLYMERASE INHIBITION, CYTOSINE
 ARABINOSIDE TRIPHOSPHATE (4585)*
 REGRESSION, H-2 ANTIGEN, FRIEND VIRUS,
 MOUSE (4645)
 SKIN ALTERATION, ALLOGRAFT HYPOTHESIS,
 MOUSE (4512)
 THOROTRAST, HEMANGIOENDOTHELIOMA,
 PORTUGAL (4490)
 THYMIDYLATE BIOSYNTHESIS,
 5-FLUOROURACIL, MOUSE (4439)
 TONSILLECTOMY, CHILDREN, REVIEW
 (4328)*
 TYPE C VIRUS, SEROLOGICAL DETECTION,
 BOVINE CULTURES (4735)*
 LEUKOCYTE
 DISORDERED PROLIFERATION, LEUKEMIA,
 HUMAN (4949)*
 LIP
 CANCER
 HUMAN, REVIEW (4358)*
 RISK, HUMAN, REVIEW (4350)*
 LIPID
 EMBRYONIC, TUMOR, BRAIN, HEART, LIVER,
 CHICK (4918)*
 GRANULOMAS, BONE MARROW, CLINICAL
 STUDY (4961)*
 METABOLISM, LIVER, 4-DIMETHYLAMINOAZO-
 BENZENE, RAT (4440)
 LIVER
 CANCER
 DIETARY AFLATOXINS, INCIDENCE,
 THAILAND (4418)
 PRIMARY AND SECONDARY, ALPHA-
 FETOPROTEIN RADIOIMMUNOASSAY,
 HUMAN (4627)
 CARBON TETRACHLORIDE,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 ADRENAL GLAND, RAT (4414)
 CARCINOGENESIS, 3'-METHYL-4-DIMETHYL-
 AMINOAZOBENZENE, ALPHA-FETOPROTEIN,
 RAT (4626)
 CHOLESTEROL SYNTHESIS, N-2-FLUORENYL-
 ACETAMIDE, RAT (4782)
 N,N-DIMETHYLAMINOAZOBENZENE,
 ADENOSINE TRIPHOSPHATASE, RAT (4784)
 ENZYME REGULATION, MORRIS HEPATOMA,

- CHOLESTEROL, RAT (4851)
 N-2-FLUORENYLACETAMIDE, METABOLISM,
 RAT (4430)
 HEPATIC CANCER, MULTIENZYME COMPLEX,
 SERUM HUMAN (4942)*
 HEPATIC ENZYME ACTIVITIES, CASTRATION,
 SARCOMA 37 GROWTH, MOUSE (5000)*
 HEPATOCARCINOGENESIS
 DIMETHYLNITROSAMINE, NEWT (4467)*
 ENZYME HISTOCHEMISTRY, RADIO-
 AUTOGRAPHY, RAT (4452)*
 KARYOKINESIS AND NUCLEAR STRUCTURE
 NITROSOMORPHOLINE HEPATOCYTES,
 RAT (4472)*
 LIPID METABOLISM, 4-DIMETHYLAMINO-
 AZOBENZENE, RAT (4440)
 HEPATOCELLULAR CARCINOMA
 ALKALINE PHOSPHATASE VARIANT, SERA
 HUMAN (4922)*
 AUSTRALIA ANTIGEN, HUMAN
 (4683), (4813)
 AUTOPSY STUDY, NIGERIANS, REVIEW
 (4351)*
 DIAGNOSIS, ALPHA-FETOPROTEIN,
 UGANDAN PATIENTS (4644)
 IMMUNITY, BACILLUS CALMETTE-GUERIN
 VACCINE, GUINEA PIG (4655)
 PROTOCOLLAGEN PROLINE HYDROXYLASE,
 UGANDANS (4882)*
 HEPATOMA
 CELLULAR IMMUNITY, MACROPHAGE
 MIGRATION, GUINEA PIG (4650)
 PROTEINS; IMMUNOELECTROPHORESIS,
 RAT (4732)*
 SURFACE MEMBRANE ANTIGEN DELETION,
 4-DIMETHYLAMINOAZOBENZENE,
 RAT (4678)
 THIOTRAST-INDUCED, CASE REPORT
 (4500)*
 HEPATOMA DEVELOPMENT, BENZENE
 HEXACHLORIDE, MOUSE (4462)*
 HEPATOTOXICITY, CARBON TETRACHLORIDE,
 BENZO(A)PYRENE PRETREATMENT, RAT
 (4451)*
 IRON, NEOPLASTIC AND PRENEOPLASTIC
 LESIONS, 8-HYDROXYQUINOLINE-INDUCED
 SIDEROSIS, RAT (4389)
 METABOLISM, HEPATOMA, ISCHEMIA, RAT
 (4857)
 METAL DISTRIBUTION, MICROSOMAL ENZYME,
 PHENOBARBITAL, BENZO(A)PYRENE,
 CARBON TETRACHLORIDE, RAT (4403)
 NEOPLASM, ALPHA-FETOPROTEIN, HUMAN
 (4713)*
 9H VIRUS GROWTH, ANTIBODY, HEPATITIS,
 RAT (4544)
 NOVIKOFF HEPATOMA, AGGLUTINATION,
 ANTIBODY, RIROSOMAL SUBUNITS,
 ANTISERA, RAT (4617)
 PATHOLOGIC CHANGES, 1,10-PHENANTHRO-
 LINE, ETHIONINE FED RATS (4461)*
 PRIMARY CANCER
 ALPHA-FETOPROTEIN, INCIDENCE,
 HUMAN (4723)*
 POLYCTHAEMIA VERA TREATMENT,
 RADIOACTIVE PHOSPHORUS, CASE
 REPORT (4499)*
 PRIMARY LIVER-CELL CARCINOMA, HUMAN,
 REVIEW (4324)*
 REGENERATION
 COLLAGEN DEPOSITION, DIMETHYL-
 NITROSAMINE-INDUCED CIRRHOSIS,
 RAT (4479)*
 METABOLIC ALTERATIONS, ENHANCED
 DNA SYNTHESIS, 5-AZACYTIDINE-
 TREATED RATS (4466)*
 RIROSOME MONOMER, DIMETHYLNITROSAMINE,
 RAT (4393)
 TUMOR, TRNA N2-GUANINE DIMETHYLASE,
 RAT (4862)
 TUMORIGENESIS, P-DIMETHYLAMINOAZO-
 BENZENE, PAPAIN, RAT (4432)
 LUNG
 BRONCHOGENIC CARCINOMA
 ENDOSCOPIC LOCALIZATION, CASE
 REPORTS (492A)*
 METASTASIS, CASE REPORT (4887)*
 CANCER
 ALLERGIES, HUMAN (4762)*
 ASBESTOS, OCCUPATIONAL HAZARD,
 EPIDEMIOLOGY, REVIEW (4303)
 FIBRINOGEN LOCALIZATION, AUTO-
 RADIOGRAPHIC STUDY, RABBIT
 (4384)
 FLUORIDE, HUMAN, REVIEW (4353)*
 FLUORIDE LEVELS, OCCUPATIONAL
 HAZARD, STEEL INDUSTRY, CANADA
 (4823)
 MORTALITY, INCIDENCE, DIAGNOSIS
 AND TREATMENT, INTERNATIONAL,
 REVIEW (4301)
 CARCINOGENESIS
 DIMETHYLNITROSAMINE, PHORROL,
 HEPATOMA, MOUSE (4392)
 3-METHYLCHOLANTHRENE, RAT (4404)
 CARCINOMA
 GLYCOLYTIC ENZYMES, LACTIC ACID
 FORMATION, HUMAN (4442)
 JAAGSIEKTE, LYMPH NODE, SERUM
 PROTEIN, SHEEP (4634)

SMALL-CELL (OAT-CELL); OSTEOBLASTIC METASTASIS; CASE REPORT (4888)*
CELL TRANSFORMATION; URETHANE, INFLUENZA VIRUS, HUMAN EMBRYO (4396)
EPIDERMAL CARCINOMA, CIGARETTE SMOKE CONDENSATE, RAT (4383)
EPITHELIUM, 3-METHYLCHOLANTHRENE, VITAMIN A, MOUSE (4425)
METAL DISTRIBUTION, MICROSOMAL ENZYMES PHENOBARBITAL, BENZO(A)PYRENE, CARBON TETRACHLORIDE, RAT (4403)
PULMONARY NEOPLASMS, TUMOR ASSOCIATED ANTIGENS, CLINICAL STUDY (4729)*
TUMOR
HYDRAZINE SULFATE, PREGNANT AND PSEUDOPREGNANT MICE (4476)*
INCIDENCE, CALCIUM CHROMATE DUST, INFLUENZA VIRUS, X-RADIATION, MOUSE (4413)
TUMOR LYMPHATIC LEUKEMIA, BRACKEN FERN, MOUSE (4387)
LYMPH NODE
CELLS, ANTI-GROWTH EFFECT, EHRICH CANCER, MOUSE (4779)*
CYTOTOXICITY, SPLEEN CELL, SUPPRESSION ASCITES TUMOR, MOUSE (4752)*
IMMUNOLOGICAL ROLE, SIMULATED COLON CARCINOMA, RABBIT (4742)*
JAAGSIEKTE, SHEEP (4634)
REACTION, RAUSCHER LEUKEMIA VIRUS, LACTIC DEHYDROGENASE VIRUS, MOUSE (4530)
SKIN GRAFT, LYMPHOMA GRAFT, RESPONSE, MITOSIS, MOUSE (4666)
LYMPHATICS
DERMAL, BREAST CANCER DISSEMINATION, HUMAN (4805)*
DISSEMINATION OF CANCER CELLS, EHRICH CARCINOMA, MOUSE (4806)*
LYMPHOBLASTOID CELL
EPSTEIN-BARR VIRUS, INFECTION, HUMAN (4575)
ESTABLISHMENT OF CELL LINES, PERIPHERAL BLOOD, LYMPH NODE, JAPANESE PATIENTS (4595)*
SHAPE, MOTILITY, HUMAN (4974)*
LYMPHOCYTE
CYTOTOXICITY
BLOCKING, TUMOR ELUATE, HUMAN (4671)
LEUKEMIA, IDENTICAL TWIN, HUMAN (4674)
IMMUNE CYTOLYSIS, LEUKEMIA CELL, MOUSE (4688)
SENSITIZATION, ADVANCED CANCER, HUMAN (4734)*
SPLEEN, PHYTOHEMAGGLUTININ RESPONSE, IMPAIRMENT, MAREK'S DISEASE, CHICKEN (4672)
THYMUS-DERIVED, ROSETTE-FORMATION, LYMPHOID CELL LINES, HUMAN (4948)*
TRANSFORMATION, PHYTOHEMAGGLUTININ, IMMUNOPROLIFERATIVE DISORDERS, HUMAN (4641)
URIDINE-3H, ACETATE 14C INCORPORATION, NORMAL AND LEUKEMIC INDIVIDUALS (4996)*
LYMPHOCYTOMA
GIANT FOLLICULAR, IMMUNOGLOBULIN FORMATION, NEOPLASMIC DISTURBANCES, SPLEEN, CASE REPORT (4632)
LYMPHOID CELLS
EPSTEIN-BARR VIRUS, ANTIGENS, HUMAN (4635)
LEUKEMIA, NORMAL, HUMAN, REVIEW (4306)
LEUKOCYTE MIGRATION, IMMUNOSUPPRESSION FRIEND LEUKEMIA VIRUS, MOUSE (4574)
LYMPHOID NEOPLASIA
PATHOGENESIS, IMMUNOLOGIC CELL PATHWAYS, CAT (4788)
LYMPHOMA
CHEMICAL INDUCTION, REGRESSION, MOUSE (4444)
DNA SYNTHESIS, AGGLUTINATION, PHYTOHEMAGGLUTININ, CONCAVALIN A, MOUSE (4646)
EPIDEMIOLOGY, BUENOS AIRES PROVINCE (4821)
FRIEND VIRUS-INDUCED, CHEMOIMMUNOTHERAPY (4605)*
GRAFT, LYMPH NODE RESPONSE, MITOSIS, MOUSE (4666)
GROSS VIRUS, CELLULAR IMMUNITY, RAT (4621)
IMMUNOTHERAPY RESPONSE, TUMOR ANTIGENICITY, MOUSE (4633)
MALIGNANT, IMMUNOLOGIC INDUCTION, GENETIC FACTORS, GRAFT-VS-HOST MODEL (4628)
PASSIVE IMMUNIZATION, ANTISERA, MOUSE (4701)
PRIMARY MALIGNANT, CERVIX UTERI, CASE REPORT (4879)*
LYMPHOPROLIFERATIVE DISEASE
IMMUNOELECTROPHORESIS, SERUM, HUMAN (4720)*
LYMPHOSARCOMA
ACUTE MYELOGENOUS LEUKEMIA, CASE REPORT (4937)*

BLASTIC TRANSFORMATION, PHA-STIMULATED
 CULTURES, LYMPHOCYTES, HUMAN (4843)
 LYMPHOCYTIC, GALLBLADDER, CASE REPORT
 (4891)*
 METASTASIS TO GLUCOSE CONTROL CENTER,
 HYPOGLYCEMIA, CASE REPORT (4911)*
 MACROPHAGE
 CONTROL OF CARCINOGENESIS, MOUSE
 (4984)*
 MIGRATION
 ALLOGENEIC TUMOR, ISOGENEIC TUMOR,
 MOUSE (4700)
 HEPATOMA, CELLULAR IMMUNITY,
 GUINEA PIG (4650)
 MIGRATION INHIBITION, TUMOR ANTIGEN,
 FIBROSARCOMA, MOUSE (4673)
 MALIGNANT MELANOMA
 DELAYED CUTANEOUS HYPERSENSITIVITY,
 AUTOLOGOUS TUMOR EXTRACT, HUMAN
 (4657)
 MORPHOGENESIS, HUMAN (4787)
 SURFACE MEMBRANE IMMUNOFLOUORESCENCE,
 SPECIFICITY, HUMAN (4726)*
 TUMOR SPECIFIC ANTIGEN, HAMSTER (4652)
 MAMMARY GLAND
 BENIGN CONDITION, ESTROGEN, HUMAN
 (4429)
 CANCER
 LONG-TERM ESTROGEN ADMINISTRATION,
 WOMEN (4449)*
 TESTOSTERONE, ETIOLOGICAL FACTOR,
 HUMAN (4858)
 CARCINOGENESIS, CONTRACEPTIVES,
 GESTAGENS, MALE AND FEMALE MICE
 (4390)
 CARCINOMA
 GRAFT REJECTION, DNA TREATMENT,
 CELL DEBRIS TREATMENT, RAT
 (4695)
 GROWTH, HUMAN (4822)
 LACK OF ANTIGENICITY, MOUSE (4681)
 TRANSPLANTATION, RADIATION
 RESPONSE, MOUSE (4493)
 EPITHELIAL CELL CULTURE, NEW METHOD,
 HUMAN (4885)*
 EPITHELIUM, GROWTH, HUMAN (4940)*
 FIBROADENOMA, PROGESTERONE, ESTROGEN,
 RAT (4420)
 3-METHYLCHOLANTHRENE, ESTROGEN,
 CASTRATION, MOUSE (4435)
 MINIMAL BREAST CANCER, HUMAN, REVIEW
 (4307)
 NEOPLASTIC TRANSFORMATION, HORMONES,
 CASLIN AND HISTONE SYNTHESIS,
 MOUSE (4799)*
 NORMAL, DYSPLASTIC, HYPERPLASTIC,
 NEOPLASTIC TISSUES, ORGAN CULTURE,
 HUMAN (4804)*
 SERIALY TRANSPLANTED TUMOR, TISSUE
 CULTURE-ADAPTED DERIVATIVE,
 CHARACTERISTICS, MOUSE (4964)*
 SPONTANEOUS TUMOR INCIDENCE
 ACCELERATION, HEAT-DENATURED TUMOR
 INJECTION, MOUSE (4938)*
 TUMOR
 C57BL/M AND C57BL/HE MICE (4577)
 ESTRADIOL BINDING SITE, MOUSE
 (4406)
 HYDRAZINE SULFATE, PREGNANT AND
 PSEUDOPREGNANT MICE (4476)*
 MASON-PFIZER VIRUS, MONKEY (4522)
 ULTRASTRUCTURE, HUMAN (4850)
 TUMOR CELLS, TISSUE CULTURE STUDIES,
 MOUSE (4597)*
 TUMORIGENESIS
 N-NITROSODIBUTYLUREA, OVARIAN
 HORMONES, RAT (4382)
 PITUITARY ISOGRAFT, PREGNANCY,
 LACTATION, MOUSE (4846)
 MAREK'S DISEASE
 HERPESVIRUS, ANTIGENIC RELATIONSHIPS,
 INFECTIOUS BOVINE RHINOTRACHEITIS,
 BURKITT'S LYMPHOMA (4611)
 PERIPHERAL NERVE LESIONS, ULTRA-
 STRUCTURE, FOWL (4592)*
 SPLEEN LYMPHOCYTE, PHYTOHEMAGGLUTININ
 RESPONSE, IMPAIRMENT, CHICKEN (4672)
 VIRUS, ONCOGENICITY, DNA SYNTHESIS,
 BIRD (4586)*
 MASTOCYTOMA
 ATP-SULFURYLASE, ENZYME-SUBSTRATE
 COMPLEXED, MOUSE (4860)
 MEDULLOBLASTOMA
 CELL NUCLEUS, ULTRASTRUCTURE, HUMAN
 (4852)
 MYELIN FIGURES, CYTOPLASMIC MEMBRANES,
 HUMAN (4985)*
 TISSUE CULTURE, ULTRASTRUCTURE, CASE
 REPORTS (490A)*
 MELANOMA
 CELL, TYROSINASE (4871)
 FAMILIAL, NON-BLOOD RELATED
 INDIVIDUALS (4835)*
 TYROSINASE ANTISERUM, PREPARATION,
 MOUSE (4714)*
 MEMBRANE
 BIOSYNTHESIS, SACCHARIDE RESIDUE
 DISTRIBUTION, MYELOMA-CELL
 HOMOGENATE (4915)*
 NUCLEAR, DNA REPLICATION, LEUKEMIA

CELLS (4975)*
TUMOR CELL, BINDING SITE, CONCAVALIN
A, WHEAT GERM AGGLUTININ (4864)
MESOTHELIOMA
MALIGNANT, CHILDREN, CASE REPORTS
(4486)*
PERITONEAL, CASE REPORT (4978)*
METABOLISM
BENZO(A)PYRENE, VITAMIN A-INDUCED
MODIFICATION, CELL CULTURES, HAMSTER
(4362)
BUTYL(4-HYDROXYBUTYL)NITROSOAMINE, RAT
(4458)*
GLUCOSE, ROUS SARCOMA VIRUS, TRANS-
FORMED CELL, CHICK EMBRYO (4558)
LIVER, HEPATOMA, ISCHEMIA, RAT (4857)
NUCLEIC ACID, TUMOR AND NORMAL
TISSUES, LIVER, RAT (4880)*
ORNITHINE, HEPATOMA, LIVER, RAT
(4989)*
OXIDATIVE, GLUTAMINE, MALIGNANT CELLS,
RAT (4844)
POLYCYCLIC AROMATIC HYDROCARBON,
PROSTATE CELL, MOUSE (4424)
TRYPTOPHAN, BREAST CANCER, CARCINOMA
OF THE CERVIX, HUMAN (4920)*
TRYPTOPHAN, VITAMIN B6, NICOTINAMIDE,
ADMINISTRATION, HODGKIN'S DISEASE
PATIENTS (4921)*
ETAL
CARCINOGEN, NICKEL, CADMIUM,
SOLUBILITY, SERUM, MUSCLE (4448)
DRINKING WATER, CANCER MORTALITY
(4436)
TISSUE DISTRIBUTION, LUNG, LIVER,
PHENOBARBITAL, BENZO(A)PYRENE,
CARBON TETRACHLORIDE, RAT (4403)
ETASTASIS
HUMAN TUMOR IMPLANTS, THYMECTOMIZED
HAMSTERS (4733)*
LUNG, THYROID ADENOCARCINOMA, AUTOPSY
STUDY, HUMAN (4987)*
OSTEOBLASTIC, SMALL-CELL(OAT-CELL)
CARCINOMA, LUNG, CASE REPORT (4888)*
PRIMARY BRONCHOGENIC CARCINOMA, CASE
REPORT (4887)*
ETHYLAZOXYMETHANOL ACETATE
ACTIVATION, PHYSOSTIGMINE, SERUM
FACTOR, HELA CELLS (4411)
ETHYLCHOLANTHRENE
FIBROSARCOMA
GROWTH, MYCOBACTERIUM BOVIS,
NEURAMINIDASE-TREATED CELLS,
COMPARATIVE EFFECT, MOUSE (4682)
IRRADIATION, IMMUNE STATUS, MOUSE
(4686)
SARCOMA, HOST IMMUNITY, GUINEA PIG
(4703)
3-METHYLCHOLANTHRENE
CANTHARIDIN, ASIATICOSIDE, SKIN,
RETICULOSES, MOUSE (4391)
CARCINOGENESIS, SQUAMOUS CELL
CARCINOMA, LUNG, RAT (4404)
CLONAL CELLS, ANTIGENICITY, MOUSE
(4401)
FIBROSARCOMA, CELL LINE ESTABLISHMENT,
RAT (4465)*
HUMORAL IMMUNE RESPONSE, MOUSE (4363)
LUNG TISSUE, VITAMIN A, MOUSE (4425)
SV40, TRANSFORMATION INHIBITION, MOUSE
(4504)
UTERINE CERVIX, ESTROGEN, MOUSE (4370)
3'-METHYL-4-DIMETHYLAMINOAZOBENZENE
HEPATOCARCINOGENESIS, HYPOPHYSECTOMY,
HISTOPATHOLOGICAL STUDY, RAT (4361)
LIVER CARCINOGENESIS, ALPHA-FETOPRO-
TEIN, RAT (4626)
METHYL METHANE SULFONATE
DNA METHYLATION OF GUANINE,
ALKYLATING MUTAGENS (4480)*
N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
MUTAGENESIS, CROWN-GALL TUMOR INDUC-
TION, AGROBACTERIUM TUMEFACIENS
(4421)
N-METHYL-N-NITROSOUREA
BLADDER CANCER INDUCTION, HISTOLOGY,
RAT (4431)
MITOGEN
ARYL HYDROCARBON HYDROXYLASE
STIMULATION, HUMAN LYMPHOCYTES
(4443)
MITOSIS
LYMPH NODE RESPONSE, LYMPHOMA GRAFT,
MOUSE (4666)
MORPHOLOGY
CENTRAL NERVOUS SYSTEM, SARCOMA, RAT
(4856)
SPONTANEOUS TUMORS, INCIDENCE, HAMSTER
(4579)*
MORTALITY
CANCER, COMPARISON, BLACK AND WHITE
POPULATION, UNITED STATES (4827)*
DRINKING WATER, TRACE METAL (4436)
OCCUPATION, CANCER, ENGLAND, REVIEW
(4308)
MOUTH
EPIDERMOID CARCINOMA, HUMAN, REVIEW
(4327)*
TUMOR, EPITHELIUM, HUMAN ULTRA-
STRUCTURE (4785)

MUSCLE
CARCINOGENESIS, NICKEL SULFIDE, HUMAN,
REVIEW (4348)*
SKELETAL, PRIMARY TUMORS, HUMAN,
REVIEW (4349)*

MUTAGEN
NITROSOPIPERAZINES, SALMONELLA
TYPHIMURIUM, HOST-MEDIATED ASSAY,
MOUSE (4381)

MUTAGENICITY
CHEMICAL CARCINOGENS, NEUROSPORA
CRASSA (4468)*

MUTATION
N-METHYL-N'-NITRO-N-NITROSOGUANIDINE,
CROWN-GALL TUMOR INDUCTION, AGROBAC-
TERIUM TUMEFACIENS (4421)
PURPLE ADENINE MUTANTS,
DIETHYLNITROSAMINE-INDUCED, GENETIC
CHARACTERIZATION, NEUROSPORA CRASSA
(4463)*
SUPPRESSOR, 4-NITROQUINOLINE 1-OXIDE,
4-HYDROXYAMINOQUINOLINE 1-OXIDE,
E. COLI (4482)*
SV40 TEMPERATURE SENSITIVE MUTANT,
TRANSFORMATION, T ANTIGEN SYNTHESIS,
MOUSE (4526)
TEMPERATURE-SENSITIVE, SV40, MONKEY
CELL (4542)
TEMPERATURE-SENSITIVE MUTANT, KIRSTEN
MURINE SARCOMA VIRUS, MOUSE (4535)

MYCOBACTERIUM BOVIS
VACCINE, HEPATOCELLULAR CARCINOMA,
IMMUNITY, GUINEA PIG (4655)

MYCOTOXIN
NEOPLASIA, ETIOLOGY, ANIMALS, MAN
(4446)

MYELOMA
ANTIBODY, PLAQUE FORMATION, SPLEEN,
MOUSE (4704)
CELL LINE, GROSS VIRUS, MURINE
LEUKEMIA VIRUS, ANTIGENS,
HISTOCOMPATIBILITY ANTIGENS, MOUSE
(4615)
CELLS
IGG-SPECIFIC RNA, MOUSE (4709)*
INTRANUCLEAR INCLUSION BODIES,
ULTRASTRUCTURE, HUMAN (4740)*
LONG TERM CELL CULTURE, MORPHOLOGIC
AND FUNCTIONAL CHARACTERISTICS,
MOUSE (4951)*
MULTIPLE, ANTI-IMMUNOGLOBULINS, HUMAN
(4776)*
MURINE VIRUS ANTIGEN, CELLULAR
ANTIGEN, LEUKEMIA CELL, MOUSE (4555)
PROTEIN

GAMMA G IMMUNOGLOBULIN, CATA-
BOLISM, HUMAN, MONKEY (4699)
IMMUNE REACTION, CELL SURFACE,
MOUSE (4702)
TUMOR-SPECIFIC TRANSPLANTATION
ANTIGEN, MOUSE (4677)
TUMOR, IMMUNITY, BALB/C MICE (4751)*
2-NAPHTHYLAMINE
URINARY BLADDER TUMORS, DOSE-RESPONSE
RELATIONSHIPS, DOG (4469)*
NASAL CAVITY
HEMANGIOPERICYTOMA, CASE REPORT,
NIGERIA (4876)*
NASOPHARYNGEAL CANCER
EPIDEMIOLOGY, ETIOLOGY, INTERNATIONAL
(4832)*
NASOPHARYNGEAL CARCINOMA
HISTOLOGICAL FEATURES, INCIDENCE,
UGANDA (4818)
HUMAN, REVIEW (4356)*
PATHOLOGIC CLASSIFICATION, FINE
STRUCTURE, HUMAN (4954)*
NASOPHARYNX
BURKITT'S LYMPHOMA, HUMAN, REVIEW
(4332)*
NEOPLASIA
KARYOTYPE ANALYSIS, GRAFT-VERSUS-HOST
REACTION, MOUSE (4658)
LYMPHOID, PATHOGENESIS, IMMUNOLOGIC
CELL PATHWAYS, CAT (4788)
NEOPLASM
ADVANCED MALIGNANCY, LYMPHOCYTE
SENSITIZATION, HUMAN (4734)*
CENTRAL NERVOUS SYSTEM
EPIDEMIOLOGY, MINNESOTA (4820)
FAMILIAL OCCURRENCE, POLAND (4815)
GONADAL, GONADOBLASTOMA-RELATED,
CASE REPORT (4935)*
HEMATOLOGIC, CYTOPLASMIC BUDS, BONE
MARROW, HUMAN (4917)*
MULTIPLE PRIMARY MALIGNANT, RELATED
PROBLEMS, STATISTICS, AUTOPSY STUDY,
JAPAN (4811)
NEPHROBLASTOMA
WILM'S TUMOR, ULTRASTRUCTURE, HUMAN
(4973)*
NEURAMINIDASE
IMMUNOGENICITY, LEUKEMIA, MOUSE (4653)
NEURINOMA
ETHYLNITROSUREA-INDUCED, HISTOCHEMIS-
TRY, TISSUE CULTURE, RAT (4459)*
NEUROBLASTOMA
CONGENITAL, HYPERPLASIA, ISLETS OF
LANGERHANS, INFANT, CASE REPORT
(4959)*

MEMBRANE CHANGES, CYCLIC AMP-INDUCED
MORPHOLOGICAL DIFFERENTIATION, CELL
CULTURE, MOUSE (4916)*
PATHOLOGY, REVIEW (4321)

NICKEL
SOLUBILITY, SERUM, MUSCLE (4448)

NICKEL CARBONYL
CARCINOGENICITY, RAT (4377)

NICKEL SULFIDE
MUSCLE CARCINOGENESIS, HUMAN, REVIEW
(4348)*

NICOTINAMIDE
TRYPTOPHAN METABOLISM, VITAMIN B6
ADMINISTRATION, HODGKIN'S DISEASE
PATIENTS (4921)*

NITROFURANS
4-DIMETHYLAMINOAZOBENZENE, INDUCE,
CARCINOGENESIS, RAT (4369)

4-NITROQUINOLINE-1-OXIDE
ACTIVATING ENZYME DETECTION, MICROBIAL
ASSAY, SALMONELLA TYPHIMURIUM (4419)
DNA REPAIR, LYMPHOCYTE, HUMAN (4426)
MUTATION SUPPRESSOR, E. COLI (4482)*
RELATED CARCINOGENS, DNA VISCOSITY,
ELEVATED TEMPERATURES (4471)*

NITROSO COMPOUNDS
TUMORS, ENDOGENOUS FORMATION, STOMACH,
HUMAN, REVIEW (4302)

N-NITROSODUTYLUREA
LEUKEMIA, RAT, VIRUS (4505)
MAMMARY TUMORIGENESIS, OVARIAN
HORMONES, RAT (4382)
TUMOR INDUCTION, BRAIN, KIDNEY, RAT
(4422)

NITROSOMETHYLUREA
PRETUMOR CHANGES OF EPITHELIUM,
EMBRYONAL LUNG TISSUE, MOUSE (4438)

NITROSOMORPHOLINE
HEPATOCARCINOGENESIS, KARYOKINESIS AND
NUCLEAR STRUCTURE, HEPATOCYTES, RAT
(4472)*

NITROSOPIPERAZINE
MUTAGENICITY, SALMONELLA TYPHIMURIUM,
HOST-MEDIATED ASSAY, MOUSE (4381)

NITROSOPIPERIDINE
ESOPHAGEAL TUMORS, HISTOPATHOLOGY,
ULTRASTRUCTURE, RAT (4385)

NITROSOUREA
RNA POLYMERASE, POLYCYTIDYLATE
TEMPLATES (4460)*

NUCLEAR PROTEIN
CHEMICAL CARCINOGENS, BINDING, LIVER,
RAT (4375)

NUCLEIC ACID
CELLULAR MEMBRANE INTERACTION,

B-PROPIOLACTONE (4421)*
METABOLISM, TUMOR AND NORMAL TISSUES,
LIVER, RAT (4880)*

NUCLEOTIDE
PYRIDINE, ADRENAL TUMOR CELL CULTURES,
MOUSE (4913)*

OCCUPATIONAL HAZARD
ASBESTOS, LUNG CANCER, EPIDEMIOLOGY,
REVIEW (4303)
CANCER MORTALITY, ENGLAND, REVIEW
(4308)
CHEMICAL CARCINOGEN, ANIMAL STUDY,
REVIEW (4304)
LUNG CANCER, INCIDENCE, STEEL INDUSTRY
CANADA (4823)
WOOD DUST, CANCER, FOOT AND SHOE
INDUSTRY, REVIEW (4360)*

OIL
SCROTAL CANCER, PROPHYLACTIC
CONSIDERATIONS, CASE REPORT (4475)*

ONCOGENESIS
RNA VIRUSES, HOST GENOME, REVIEW
(4309)

OPTIC NERVE
TUMORS, HISTOPATHOLOGY (4881)*

ORAL CAVITY
CANCER, EPIDEMIOLOGY, INDIA (4834)*

OROPHARYNX
MULTIPLE PRIMARY TUMORS, CLINICAL
STUDY (4795)*

OSTEOSARCOMA
VIRAL ETIOLOGY, IMMUNOLOGICAL EVIDENCE
HUMAN (4515)

OVARY
ADENOCARCINOMA, HL-A ANTIGENIC LOSS,
CASE REPORT (4722)*

PAGET'S DISEASE
MALE BREAST, CASE REPORT (4979)*

PALATE
CARCINOMA, EPITHELIAL ATYPIA, HISTO-
CYTOLOGICAL STUDY, REVERSE SMOKERS,
INDIA (4407)

PANCREAS
C-TYPE VIRUS, NORMAL MOUSE (4569)
CARCINOID-ISLET CELL TUMOR, AVASCULAR
NECROSIS OF BONE, CUSHING'S SYNDROME
CASE REPORT (4893)*
CARCINOMA, UNCINATE PROCESS REGION,
CASE REPORTS (4892)*
NON BETA ISLET CELL CARCINOMA,
PATHOGENESIS, TREATMENT, HUMAN
(4798)*

PAPAIN
P-DIMETHYLAMINOAZOBENZENE, LIVER
TUMORIGENESIS, RAT (4432)

PAROTID
 GLYCOGEN-RICH ADENOMA, CASE REPORT
 (4898)*

PHARYNX
 EPIDERMAL CARCINOMA, HUMAN, REVIEW
 (4327)*

1,10-PHENANTHROLINE
 PATHOLOGIC CHANGES, LIVER, ETHIONINE
 FED RATS (4461)*

PHENOBARBITAL
 LUNG, LIVER, METAL DISTRIBUTION,
 MICROSOMAL ENZYMES, RAT (4403)

PHENYLALANINE
 DEFICIENCY, MAMMARY TUMOR VIRUS
 ACTIVITY, MOUSE (4606)*

PHEOCHROMOCYTOMA
 URINARY CATECHOLAMINES, CLINICAL STUDY
 (4995)*

PHORBOL
 DIMETHYLNITROSAMINE, LUNG CARCINO-
 GENESIS, HEPATOMA, MOUSE (4392)

PHOSPHATE
 INCREASE IN TUMORS, VITAMIN K1,
 SYNTHETIC SUBSTITUTES (4485)*

PHYSOSTIGMINE
 METHYLAZOXYMETHANOL ACETATE, ACTIVA-
 TION, SERUM FACTOR, HELA CELLS
 (4411)

PHYTOHEMAGGLUTININ
 ACUTE LEUKEMIA, CELL TYPE, HUMAN,
 REVIEW (4357)*

 LYMPHOMA, DNA SYNTHESIS, AGGLUTINATION
 MOUSE (4646)

 RESPONSE IMPAIRMENT, SPLEEN LYMPHOCYTE
 MARKER'S DISEASE, CHICKEN (4672)

PITUITARY
 ISOGRAFT, MAMMARY TUMORIGENESIS, MOUSE
 (4846)

 SPONTANEOUS TUMORS, CHARACTERIZATION,
 INCIDENCE, RAT (4965)*

PLASMA
 PROTEIN SYNTHESIS, HEPATOCELLULAR
 CARCINOMAS, HEPATIC NODULES,
 N-2-FLUORENYLACETAMIDE, LIVER, RAT
 (4402)

PLASMA MEMBRANE
 ELECTROCONDUCTIVITY CHANGES, EHRLICH
 ASCITES TUMOR CELLS, MITOTIC CYCLE,
 MOUSE (4866)

 ERYTHROCYTES, REPLICATION OF FELINE
 C-TYPE VIRUS (4608)*

 ISOLATION, CHARACTERIZATION,
 CARBOHYDRATE COMPOSITION, ONCOGENIC
 RNA VIRUS-CONVERTED, CHICK EMBRYO
 FIBROBLASTS (4557)

PLASMACYTOMA
 BENCE-JONES TYPE LIGHT CHAIN,
 SECRETION, MOUSE (4707)*

 POLYMER FORMATION, J CHAIN SYNTHESIS,
 MOUSE (4760)*

 RNA, SURFACE IMMUNOGLOBULINS,
 LYMPHOCYTES, MOUSE (4766)*

POLLUTION
 PARTICULATE POLLUTANTS, CARCINO-
 GENICITY, NEW YORK CITY, MOUSE
 (4366)

 POLYCYCLIC AROMATIC HYDROCARBON
 METABOLISM, PROSTATE CELL, MOUSE
 (4424)

 POLYCYCLIC HYDROCARBON
 EPOXIDE, TRANSFORMATION, HAMSTER CELL
 (4445)

 POLYPEPTIDE
 SV40, DEOXYRIBONUCLEOPROTEIN COMPLEX
 (4516)

POLYPS
 COLON, IMMUNOFLOUORESCENCE, HUMAN
 (4624)

PREGNANCY
 MAMMARY TUMORIGENESIS, MOUSE (4846)

PROGESTERONE
 CARCINOGENESIS, DNA SYNTHESIS, MAMMARY
 GLAND, RAT (4364)

PROLIFERATION
 BILE-DUCT CELLS,
 2,7-FLUORENYLBISACETAMIDE, FEMALE
 MICE (4453)*

 FETAL AND ADULT HEMATOPOIETIC CELLS,
 LETHALLY IRRADIATED MICE (4501)*

 MAST-CELL, UREMIA, SPLEEN, HUMAN
 (4801)*

 SPLEEN CELLS, INHIBITION, SPECIFIC
 ANTIBODY, CHICKEN (4756)*

B-PROPIOLACTONE
 NUCLEIC ACIDS, CELLULAR MEMBRANES,
 INTERACTION (4481)*

PROSTATE
 CARCINOMA
 5 ALPHA-DIHYDROTESTOSTERONE
 METABOLISM, ESTROGEN, HUMAN
 (4854)

 INCIDENCE, UNITED STATES (4831)*

PROTEIN
 ALPHA-FETOPROTEIN, HEPATOCELLULAR
 CARCINOMA, DIAGNOSIS, UGANDAN
 PATIENTS (4644)

 DYE-BINDING PATTERNS,
 2-METHYL-4-DIMETHYLAMINOAZOBENZENE,
 3-METHYL-4-DIMETHYLAMINOAZOBENZENE,
 LIVER, RAT (4415)

IMMUNOGLOBULINS, LEUKEMIC PATIENTS,
CLINICAL STUDY (4708)*

MYELOMA

CELL SURFACE, IMMUNE REACTION,
MOUSE (4702)

GAMMA G IMMUNOGLOBULIN, CATABOLISM
HUMAN, MONKEY (4699)

STRUCTURAL AND IMMUNOLOGICAL STUDY
HUMAN (4767)*

TUMOR-SPECIFIC TRANSPLANTATION
ANTIGEN, MOUSE (4677)

RIOSOMAL, PHOSPHORYLATION, SARCOMA
180 TUMOR CELLS, MOUSE (4994)*

SERUM, JAAGSIEKTE, SHEEP (4634)

SERUM AND URINARY, RENAL FUNCTION,
CHRONIC MYELOGENOUS LEUKEMIA
PATIENTS (4905)*

STRUCTURAL, ADENOVIRUS-ASSOCIATED
TYPE 3 (4525)

SV40, REVIEW (4335)*

SYNTHESIS, SERUM-MEDIATED STIMULATION,
EHRlich ASCITES TUMOR CELLS (4992)*

PROVIRUS THEORY

ROUS SARCOMA VIRUS, VIRAL GENOME
COPIES, TRANSFORMATION (4554)

PURINE

BIOSYNTHESIS

BURKITT LYMPHOMA CELLS, SPLEEN,
HUMAN (4907)*

REPRESSION, DEREPRESSION,
MAMMALIAN HEPATOMA CELLS (4993)*

RADIATION

DNA BREAKAGE, REPAIR, MAMMALIAN CELL
(4494)

DOSE FRACTIONATION, AGE, TUMORIGENESIS
MOUSE (4492)

FAST NEUTRON, TUMOR INCIDENCE, AGE,
RAT (4491)

INDUCED CANCER, HUMAN, REVIEW (4329)*

RESPONSE, MAMMARY CARCINOMA, TRANS-
PLANTATION, MOUSE (4493)

THOROTRAST, LEUKEMIA, HEMANGIO-
ENDOTHELIOMA, PORTUGAL (4490)

ULTRAVIOLET

DNA CHAIN ELONGATION, XERODERMA
PIGMENTOSUM, HUMAN (4496)*

SKIN CANCER, GEOGRAPHIC DISTRIGU-
TION, HUMAN (4812)

WHOLE BODY IRRADIATION, IMMUNOLOGICAL
TOLERANCE, GAMMA-GLOBULIN, MOUSE
(4497)*

X-RAY

LUNG TUMOR INCIDENCE, MOUSE (4413)

MECHANICAL IRRITATION, COCARCINO-
GENIC ACTION, INTRAMANDIBULAR

TISSUE, MOUSE (4489)

REGENERATION

LIVER, METABOLIC ALTERATIONS, ENHANCED
DNA SYNTHESIS, 5-AZACYTIDINE-TREATED
RAT (4466)*

REGRESSION

LYMPHOMA, MOUSE (4444)

SPONTANEOUS, MALIGNANT TUMORS, HUMAN,
REVIEW (4345)*

RETICULOENDOTHELIAL TUMOR

TRANSPLANTABLE, HISTOCHEMISTRY,
ULTRASTRUCTURE, RAT (4941)*

RETICULOENDOTHELIOSIS

HAIRY CELLS, ULTRASTRUCTURE, HUMAN
(4950)*

RETICULOSARCOMA

BLASTIC TRANSFORMATION, PHA-STIMULATED
CULTURES, LYMPHOCYTES, HUMAN (4843)

RETICULOSIS

SKIN, CANTHARIDIN, ASIATICOSIDE,
3-METHYLCHOLANTHRENE, MOUSE (4391)

RIBONUCLEASE

FOCAL LOSS OF ACTIVITY, PRENEOPLASTIC
LIVER, RAT (4780)

RIBOSOME

MONOMER, LIVER, DIMETHYLNITROSAMINE,
RAT (4393)

RNA

ACTIVITY, NORMAL AND TUMOR CELL
FUNCTIONS, REVIEW (4341)*

ASPARTYL-tRNA, ALTERATION, POLYOMA AND
SV40-TRANSFORMED CELLS (4603)*

CHROMATOGRAPHY, BURKITT LYMPHOMA,
INFECTIOUS MONONUCLEOSIS, EPSTEIN-
BARR VIRUS-TRANSFORMED LYMPHOBlasts
(4590)*

COMPLEMENTARITY, MESSENGER RNA,
NUCLEAR RNA, HELA CELLS (4967)*

ELECTROPHORETIC ANALYSIS, MOUSE
LEUKEMIA VIRUS (4580)*

GENE DEREPRESSION, PRIMARY HEPATOMAS,
RAT (4800)*

IGG-SPECIFIC, MYELOMA CELLS, MOUSE
(4709)*

MESSENGER, TRANSLATION, HISTONES,
CELL-FREE EXTRACT, ASCITES TUMOR,
MOUSE (4997)*

POLYMERASE

NITROSOUREAS, POLYCYTIDYLATE
TEMPLATES (4460)*

TRANSCRIPTION, NUCLEOLUS, LIVER,
RAT (4925)*

RIOSOMAL, POLYPYRIMIDINE FRAGMENTS,
NOVIKOFF ASCITES HEPATOMA, LIVER,
RAT (4944)*

- RIBOSOMAL SUBUNITS, REGULATED TRANSPORT, CELL-FREE SYSTEM, REGENERATING LIVER NUCLEI, RAT (4943)*
- SINGLE-STRANDED, REOVIRUS, CELL-FREE EXTRACTS, ASCITES TUMOR (4583)*
- SV40
ISOLATION, CHARACTERIZATION (4539)
TRANSCRIPTION, STRAND ORIENTATION, SSC-1 CELL (4541)
- SYNTHESIS
CELL NUCLEI, SARCOMA, LIVER, RAT (4840)
30-S NUCLEAR RIBONUCLEOPROTEIN COMPLEXES, ASCITES CELLS, MOUSE (4991)*
RESTRICTED ADENOVIRUS INFECTION, MONKEY CELLS (4547)
TUMOR VIRUS, ULTRASTRUCTURE, MORPHOLOGY, REVIEW (4334)*
- RNA POLYMERASE
INHIBITION, N-HYDROXY-2-FLUORENYL-ACETAMIDE, LIVER, RAT (4380)
- SALIVARY GLAND
TUMORS, ATOMIC BOMB SURVIVORS, REVIEW (4337)*
- SARCOMA
ALVEOLAR SOFT-PART, CASE REPORT (4966)*
ANTIGEN-DEFICIENT CELL VARIANTS, PRENEOPLASTIC FOREIGN BODY REACTION, MOUSE (4790)
GROWTH, GENOTYPE-DEPENDENT MODIFICATION, CASTRATED MICE (4836)*
GROWTH INHIBITION, REGIONAL LYMPH NODE AND SPLEEN CELL, MOUSE (4745)*
KAPOSI'S, POSTMORTEM FINDINGS, DISEASE PATTERNS, WOMEN (4890)*
LYMPHOCYTIC, VIRUS-LIKE PARTICLES, MOUSE (4594)*
METHYLCHOLANTHRENE-INDUCED, HOST IMMUNITY, GUINEA PIG (4703)
MURINE SARCOMA VIRUS INDUCTION, ENHANCEMENT BY INTERFERON INDUCERS, MOUSE, RAT (4553)
180 SOLID TUMOR, YEAST POLYSACCHARIDE TREATMENT, CARBON CLEARANCE ACTIVITY, MOUSE (4748)*
ROUS, ORIGIN OF DOUBLE-MINUTES, CHROMOSOME, RAT (4601)*
SPECIFIC ANTIGENS, AUTOLOGOUS SERA, CYTOTOXICITY, HUMAN (4669)
YOSHIDA, TYROSINE AMINOTRANSFERASE ACTIVITY, HORMONAL EFFECTS, RAT (4986)*
- SCROTUM
CANCER, OIL, PROPHYLACTIC CONSIDERATIONS, CASE REPORT (4475)*
EPITHELIOMA, CAUSATIVE FACTORS, SCOTLAND (4817)
- SEMINAL VESICLES
TUMORS, MASTOMYS (4863)*
- SERUM
ALPHA-FETOPROTEIN, LIVER CANCER, INCIDENCE, HUMAN (4723)*
IMMUNOELECTROPHORESIS, LYMPHOPLIFERATIVE DISEASE, HUMAN (4720)*
- SIDEROSIS
8-HYDROXYQUINOLINE, IRON, NEOPLASTIC AND PRENEOPLASTIC LESIONS, LIVER, RAT (4389)
- SINUS
HISTIOCYTOSIS, LYMPHADENOPATHY, ANALYSIS OF CASES (4932)*
- SJÖGREN'S SYNDROME
REGION TO MALIGNANT LYMPHOPROLIFERATION, CASE REPORTS (4803)*
- SKIN
ALTERATION, GROSS LEUKEMIA, ALLOGRAFT, HYPOTHESIS, MOUSE (4512)
- CANCER
GEOGRAPHIC DISTRIBUTION, ULTRAVIOLET RADIATION, HUMAN (4812)
MUCOUS MEMBRANE, PRECANCEROUS BENIGN LESIONS, HUMAN, REVIEW (4354)*
SQUAMOUS CELL, ETIOLOGY, HUMAN REVIEW (4313)
CANCER OCCURRENCE, ATMOSPHERIC FACTORS HUMAN (4447)
CARCINOGENESIS, ANTHANTHRENE DERIVATIVE, MOUSE (4405)
DELAYED CUTANEOUS HYPERSENSITIVITY, AUTOLOGOUS TUMOR EXTRACT, MALIGNANT MELANOMA, HUMAN (4657)
GRAFT, LYMPH NODE RESPONSE, MITOSIS, MOUSE (4666)
HYPERPLASIA, TUMOR, UREA ANTIGEN, MOUSE (4692)
INTERFOLLICULAR EPIDERMIS, TUMOR PROMOTION, 12-O-TETRADECANOYL-PHORBOL-13-ACETATE, MOUSE (4367)
MALIGNANT MELANOMA, MORPHOGENESIS, HUMAN (4787)
TUMORS, VITAMIN A, GLYCOPROTEIN SYNTHESIS, HUMAN (4378)
TUMORIGENESIS
CROTON OIL-INDUCED, INHIBITION BY STEROID HORMONES, MOUSE (4368)
3-METHYLCHOLANTHRENE, CANTHARIDIN,

ASIATICOSIDE, RETICULOSIS, MOUSE
(4391)

SKIN GRAFT

REJECTION, CYTOSINE ARABINOSIDE, MOUSE
(4662)

SOIL

CANCER PREDISPOSITION, REVIEW (4318)

SPHINGOMYELIN

BIOSYNTHESIS, SV40, TRANSFORMATION,
MOUSE (4549)

SPLEEN

CELL, CYTOTOXICITY DEPLETION,

ALLOGENEIC TUMOR CELL, MOUSE (4616)

CELL STIMULATION, ANTIGENIC RESPONSE,

CELL FACTOR CHARACTERIZATION, MOUSE
(4868)

COLONY FORMING UNIT, POLYCYTHEMIA

FRIEND VIRUS, MOUSE (4503)

CYTOTOXICITY, LYMPH NODE CELL,

SUPPRESSION, ASCITES TUMOR, MOUSE
(4752)*

GIANT FOLLICULAR LYMPHOCYTOMA,

IMMUNOGLOBULIN FORMATION, NEOPLASMIC
DISTURBANCES, CASE REPORT (4632)

STOMACH

ADENOMA, ARGENTAFFIN CELLS, HUMAN
(4936)*

CARCINOMA

ATROPHIC GASTRITIS, CASE REPORTS
(4781)

HUMAN, REVIEW (4322)*

GASTRIC CARCINOMA, HISTOLOGIC TYPES,

HIROSHIMA, NAGASAKI (4816)

TUMOR, CARCINOEMBRYONIC ANTIGEN, HUMAN
(4664)

SULFATED ACID MUCOPOLYSACCHARIDE

SYNTHESIS, DIBUTYRYL CYCLIC ADENOSINE
MONOPHOSPHATE, TRANSFORMED FIBRO-
BLASTS (4508)

SURVIVAL

CANCER OF THE CERVIX, EPIDEMIOLOGY,
NEW YORK (4837)*

STATISTICAL ANALYSIS, ANIMALS (4999)*

TESTES

CARCINOGENESIS, CADMIUM, RAT (4423)

MALIGNANT TUMORS, INCIDENCE, MORTALITY

WHITE POPULATION, UNITED STATES,

REVIEW (4333)*

TUMORS, MASTOMYS (4883)*

12-O-TETRADECANOYL-PHORBOL-13-ACETATE

SKIN TUMORIGENESIS, PROMOTION, INTER-

FOLLICULAR EPIDERMIS, MOUSE (4367)

THEOPHYLLINE

TYROSINE AMINOTRANSFERASE ACTIVITY,
YOSHIDA SARCOMA, RAT (4986)*

THIOCTRAST

INDUCED HEPATOMA, CASE REPORT (4500)*
LEUKEMIA, HEMANGIOENDOTHELIOMA,
PORTUGAL (4490)

THYMOCYTE

IN VITRO IMMUNIZATION, CYTOTOXICITY,
TUMOR PROTECTION, MOUSE (4667)

THYMUS

C-TYPE VIRUS, NORMAL MOUSE (4569)

ROLE IN LEUKEMOGENESIS, GROSS VIRUS,
RAT (4561)

THYMECTOMY, CANCER RISK (4824)

THYROID

ADENOCARCINOMA, MICROSCOPIC LUNG
METASTASIS, AUTOPSY STUDY, HUMAN
(4987)*

CANCER, FAMILIAL STUDIES (4847)

C-CELL ADENOMA, CALCITONIN ACTIVITY,
HUMAN (4874)*

FOLLICULAR ADENOMA, ULTRASTRUCTURE,
HUMAN (4910)*

HURTHLE CELL TUMORS, ULTRASTRUCTURE,
HUMAN (4931)*

TISSUE

COMPOSITION, NORMAL, NEOPLASTIC,
REVIEW (4314)

TOBACCO

CIGARETTE SMOKE, FLUORANTHENE CONTENT,
FORMATION BY PYROLYSIS, TUMOR-
INITIATING ACTIVITY (4478)*

CIGARETTE SMOKE CONDENSATE

EPIDERMAL CARCINOMA, LUNG, RAT
(4383)

SUBFRACTIONS, SOLVENT SEPARATION,
CARCINOGENESIS ASSAY (4408)

MOSAIC VIRUS, BRONCHOGENIC CARCINOMA,
SMOKERS (4538)*

REVERSE SMOKING, PALATE CARCINOMA,
EPITHELIAL ATYPIA, HISTOCYTOLOGICAL
STUDY, INDIA (4407)

TOXICITY

CYCLAMATES, DIFT, RAT (4379)

TRACHEA

EPITHELIUM, BIOCHEMICAL AND MORPHOLO-
GIC EXAMINATIONS, HAMSTER (4394)

TRANSFORMATION

ASCITIC, TUMOR VARIABILITY, HAMSTER
(4802)*

BLASTIC

LYMPHOCYTE CULTURES, CHRONIC
LYMPHOCYTIC LEUKEMIA, HUMAN
(4639)

LYMPHOCYTES, PHA-STIMULATED
CULTURES, LYMPHOSARCOMA,
RETICULOSARCOMA, HUMAN (4843)

- CELLULAR, SV40, SHEEP CELLS (4607)*
 CELLULAR, TEMPERATURE-DEPENDENT,
 BRYAN ROUS SARCOMA VIRUS INFECTION,
 CHICK EMBRYO CELLS (4540)
 CHROMOSOME BREAKAGE, CYTOTOXICITY,
 CHEMICAL CARCINOGEN, ARYL HYDRO-
 CARBON HYDROXYLASE (4433)
 FIBROBLAST, SULFATED ACID MUCOPOLY-
 SACCHARIDE SYNTHESIS, DIBUTYRYL
 CYCLIC ADENOSINE MONOPHOSPHATE
 (4508)
 INHIBITION, SV40, 7,12-DIMETHYLBENZ-
 (A)ANTHRACENE, 3-METHYLCHOLANTHRENE,
 MOUSE (4504)
 LUNG CELLS, URETHANE, INFLUENZA VIRUS,
 HUMAN EMBRYO (4396)
 LYMPHOCYTE, PHYTOHEMAGGLUTININ,
 IMMUNOPROLIFERATIVE DISORDERS, HUMAN
 (4641)
 MURINE SARCOMA VIRUS, GUINEA PIG
 EMBRYO CELLS (4537)
 NEOPLASTIC, HORSE AND BOVINE SERA,
 EMBRYO CELLS, MOUSE (4976)*
 NONPRODUCER BALB/3T3 CELLS, MURINE
 SARCOMA VIRUS, EPITHELIAL FEATURES
 (4600)*
 POLYCYCLIC HYDROCARBON, EPOXIDE,
 HAMSTER CELL (4445)
 ROUS SARCOMA VIRUS, VIRAL GENOME
 COPIES, PROVIRUS THEORY (4554)
 SPONTANEOUS, ANTIGENICITY, MOUSE CELL
 (4629)
 SPONTANEOUS NEOPLASTIC, INHIBITION,
 FETAL BOVINE SERUM, EMBRYO CELLS,
 MOUSE (4977)*
 SV40
 CONCAVALIN A RECEPTOR, HAMSTER
 (4568)
 HAMSTER CELL (4562)
 SPHINGOMYELIN BIOSYNTHESIS,
 MOUSE (4549)
 SV40 TEMPERATURE-SENSITIVE MUTANT,
 MOUSE CELL (4526)
 TRANSCRIPTIONAL, WALKER TUMOR
 CHROMATIN, NONHISTONE PROTEINS,
 LIVER, RAT (4841)
 TRANSHYDROGENASE
 CELL ACTIVITY, HEPATOMA, RAT (3997)
 TRANSPLACENTAL CARCINOGENESIS
 CHEMICAL, HUMAN, REVIEW (3630)*
 TRANSPLANTABILITY
 MAMMARY CARCINOMA CELL, SUBLINE,
 IMMUNOSUSCEPTIBILITY, MOUSE (3851)
 TRANSPLANTATION
 MAMMARY CARCINOMA, RADIATION RESPONSE,
 MOUSE (4493)
 TRYPTOPHAN
 METABOLISM
 BREAST CANCER, CARCINOMA OF CERVIX
 HUMAN (4920)*
 VITAMIN B6, NICOTINAMIDE ADMINIS-
 TRATION, HODGKIN'S DISEASE
 PATIENTS (4921)*
 TYROSINE METABOLITES, EPR SPECTRA
 (4474)*
 TUBERCULOMA
 BRAIN, INCIDENCE, INDIA (4872)*
 TUMOR
 BRAIN, X-RAY EXPOSURE, MONKEY (4498)*
 CELL, ADENOVIRUSES, RAT (4593)*
 CELL-FREE EXTRACTS, SINGLE STRANDED
 REOVIRUS RNA, IN VITRO (4583)*
 CELL GROWTH, CONCAVALIN A
 AGGLUTINABILITY (4721)*
 CROWN-GALL, INDUCTION, MUTATION,
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
 AGROBACTERIUM TUMEFACIENS (4421)
 ELUTION, LYMPHOCYTE CYTOTOXICITY,
 BLOCKING, HUMAN (4671)
 GROWTH SUPPRESSION, SPECIFIC TUMOR
 IMMUNITY INDUCTION, MYCOBACTERIUM
 BOVIS INOCULATION, MOUSE (4746)*
 IMPLANT METASTASES, THYMECTOMIZED
 HAMSTERS (4733)*
 MALIGNANT, SPONTANEOUS REGRESSION,
 HUMAN, REVIEW (4345)*
 PATHOLOGY, MURINE SARCOMA VIRUS,
 RODENT (4550)
 PROTECTION, THYMOCYTE, IN VITRO
 IMMUNIZATION, CYTOTOXICITY, MOUSE
 (4667)
 SPONTANEOUS, INCIDENCE, VIROLOGY,
 HAMSTER (4579)*
 TRANSPLANTABLE, POLYOMA VIRUS-INDUCED,
 MORPHOLOGY, BIOLOGICAL PROPERTIES
 (4578)*
 TWIN
 IDENTICAL, LYMPHOCYTE CYTOTOXICITY,
 LEUKEMIA, HUMAN (4674)
 TYROSINE METABOLITES
 TRYPTOPHAN, EPR SPECTRA (4474)*
 ULTRASTRUCTURE
 HERPES SIMPLEX VIRUS, VARICELLA-ZOSTER
 VIRUS (4591)*
 PERIPHERAL NERVE, MAREK'S DISEASE,
 FOWL (4592)*
 UREMIA
 MAST-CELL PROLIFERATION, SPLEEN, HUMAN
 (4801)*
 URETHANE

CARCINOGENESIS, MOUSE (4412)
 DIETHYL PYROCARBONATE, BEVERAGE,
 ENVIRONMENTAL HAZARD (4428)
 PROTEIN BIOSYNTHESIS, RADIOACTIVITY
 ASSAYS, RAT (4457)*
 RELATED CARBAMATES, TUMOR FORMATION,
 MOUSE (4399)
 TRANSFORMATION, LUNG CELLS, HUMAN
 EMBRYO (4396)
 URINARY BLADDER
 TUMOR INDUCTION,
 BUTYL(3-CARBOXYPROPYL)NITROSOAMINE,
 RAT (4470)*
 TUMORIGENESIS, 2-ACETYLAMINOFLUORENE,
 INDOLE, HAMSTER (4376)
 TUMORS, 2-NAPHTHYLAMINE, DOSE-RESPONSE
 RELATIONSHIPS, DOG (4469)*
 URINARY SYSTEM
 UNILATERAL URETER LIGATION, TUMOR
 DEVELOPMENT, N-BUTYL-N-(4-HYDROXY-
 BUTYL)-NITROSOAMINE, RAT (4372)
 UTERUS
 ADENOCARCINOMA, INTRAUTERINE
 CONTRACEPTIVE DEVICE, CASE REPORT
 (4495)*
 3-METHYLCHOLANTHRENE, ESTROGEN,
 CASTRATION, MOUSE (4435)
 UVEA
 ADENOCARCINOMA, CASE REPORTS (4793)
 CANCER
 INCIDENCE, DENMARK (4826)*
 PREVALENCE, DISTRIBUTION, INDIA
 (4828)*
 VACCINE
 BACILLUS CALMETTE-GUERIN, HEPATO-
 CELLULAR CARCINOMA, IMMUNITY,
 GUINEA PIG (4655)
 SMALLPOX, TUMOR, CASE REPORT (4715)*
 VAGINA
 CANCER, DEVELOPMENT, ESTROGEN, WOMEN
 (4464)*
 CARCINOMA, CHILDREN, REVIEW (4340)*
 VARICELLA-ZOSTER
 INFECTION, CANCER PATIENTS (4659)
 VIRUS
 ABELSON, LEUKEMIA, MOUSE, RAT (4794)
 ADENO-TYPE 12
 DNA-PROTEIN COMPLEX, HAMSTER CELL
 (4529)
 TUMOR ANTIGEN, TUMORIGENICITY,
 TRANSFORMED CELL, HAMSTER (4519)
 TUMOR CELLS
 ANTIGEN, HAMSTER (4710)*
 RAT (4593)*
 ADENOVIRUS, SURFACE ANTIGEN, VIRION
 (4563)
 ADENOVIRUS-ASSOCIATED TYPE 3,
 STRUCTURAL PROTEINS (4725)
 ADENOVIRUS INFECTION, CELL SURFACE
 CHANGES, EMBRYONIC KIDNEY CELLS,
 HUMAN (4547)
 AVIAN MYELOBLASTOSIS
 RNA-DEPENDENT DNA POLYMERASE,
 STIMULATING FACTOR (4551)
 VIRAL ENVELOPE, ANTIGEN (4570)
 AVIAN SARCOMA, CROSS PROTECTION,
 CHICKEN (4531)
 BOVINE TYPE C, MURINE AND FELINE
 LEUKEMIA VIRUSES, ANTIGENIC
 COMPARISON (4651)
 BRYAN ROUS SARCOMA, TEMPERATURE,
 DEPENDENT CELL TRANSFORMATION, CHICK
 EMBRYO CELLS (4540)
 BURKITT LYMPHOMA, INFECTIOUS MONO-
 NUCLEOSIS, EPSTEIN-BARR TRANSFORMED
 LYMPHOBLASTS, RNA CHROMATOGRAPHY
 (4590)*
 CANCER, HUMAN, REVIEW (4347)*
 CARCINOGENESIS, REVIEW (4339)*
 CHARACTERIZATION, ROUS MOUSE CELL LINE
 (4589)*
 CHICKEN EMBRYO LETHAL ORPHAN, SMALL
 PLAQUE VARIANT, INDUCED TUMORS,
 LIGHT AND ELECTRON MICROSCOPIC
 STUDIES (4506)
 C-TYPE
 ANTIBODY PRODUCTION, RAT (4614)
 GROUP-SPECIFIC ANTIGEN, SPON-
 TANEOUS NEOPLASM, MOUSE (4665)
 PANCREAS, THYMUS, NORMAL MOUSE
 (4569)
 C-TYPE INDUCTION, BROMODEOXYURIDINE,
 CLONAL CELL LINES, MOUSE (4523)
 C-TYPE PARTICLES
 LUNG TUMORS, HYDRAZINE SULFATE
 INDUCED, ULTRASTRUCTURE, MOUSE
 (4371)
 N-NITROSOBUTYLUREA, LEUKEMIA, RAT
 (4505)
 DNA, CANCER CELL, MOLECULAR HYBRIDIZA-
 TION, REVIEW (4311)
 EPSTEIN-BARR
 ANTIBODIES
 BURKITT'S LYMPHOMA, AMERICAN
 PATIENTS (4630)
 IMMUNOFLOUORESCENCE, LOWER
 PRIMATES (4654)
 ANTIGENS, LYMPHOID CELL, HUMAN
 (4635)
 HERPESVIRUS SAIMIRI, LYMPHOMA,

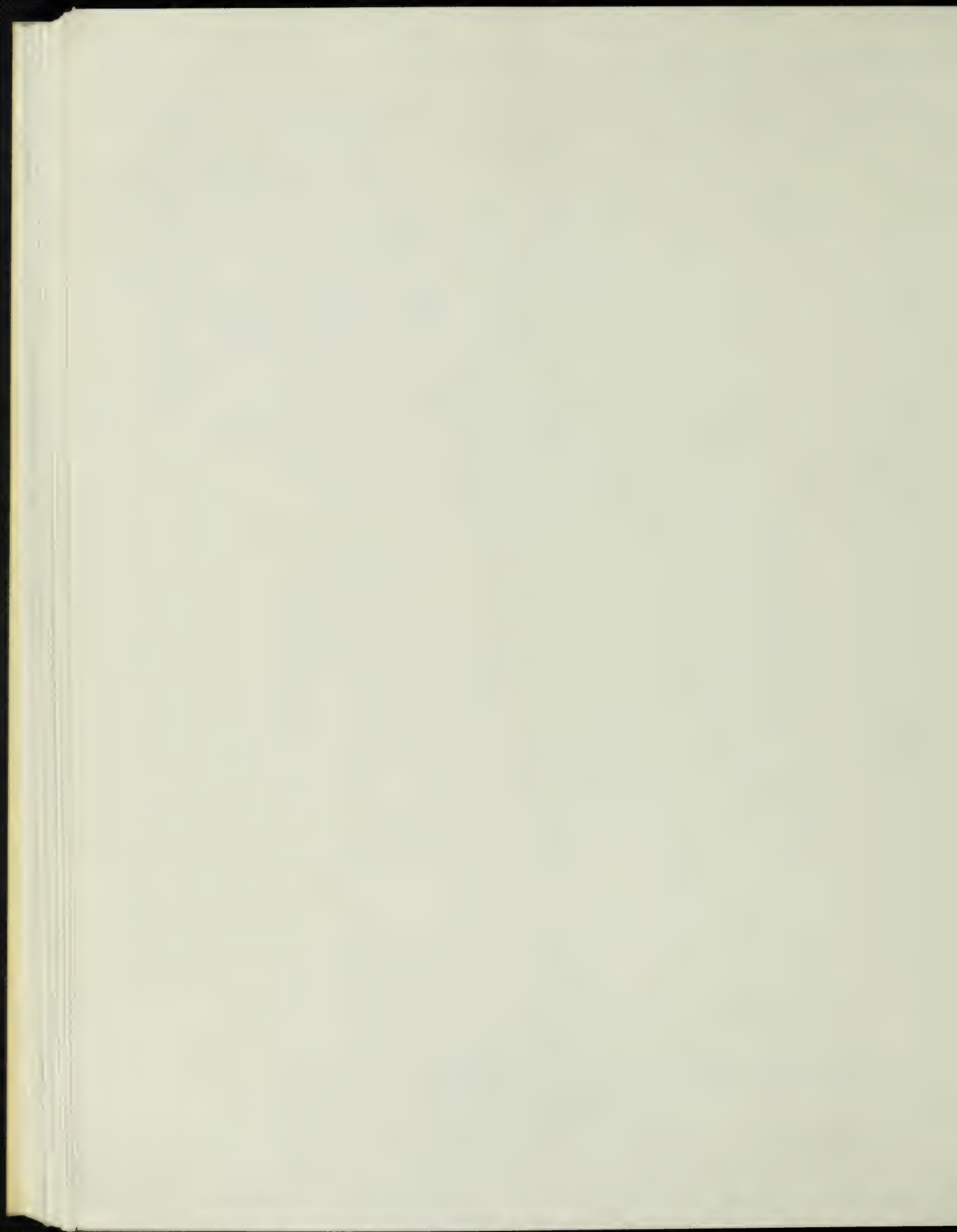
- REVIEW (4320)
INFECTION, LYMPHOBLASTOID CELL,
HUMAN (4575)
RESCUE, 5-IODODEOXYRUIDINE,
SOMATIC CELL HYBRID, BURKITT
LYMPHOBLASTOID CELLS (4536)
- VIRUS - CONTINUED
FELINE C-TYPE, REPLICATION, PLASMA
MEMBRANE, ERYTHROCYTES (4608)*
FELINE SARCOMA
FOCUS FORMATION, HELPER ACTIVITY,
MARMOSET CELL, CAT CELL (4552)
ONCOGENICITY, ANTIGEN, MARMOSET
(4572)
TUMOR INDUCTION, MONKEY (4524)
FRIEND, ERYTHROCYTE, POLYCYTHEMIA,
MOUSE (4533)
FRIEND LEUKEMIA
FRACTION, INFECTIVITY ENHANCEMENT,
MOUSE CELL (4521)
IMMUNOSUPPRESSION, LEUKOCYTE
MIGRATION, MOUSE (4574)
INHERITED SUSCEPTIBILITY, MOUSE
(4576)
REGRESSION, H-2 ANTIGEN, MOUSE
(4645)
FRIEND LEUKEMIA INFECTION, CIRCULATION
OF LYMPHOID CELLS, MOUSE (4507)
GROSS
LEUKEMIA, CELL-SURFACE ANTIGEN,
SUPPRESSION, MOUSE (4694)
LYMPHOMA, CELLULAR IMMUNITY, RAT
(4621)
MURINE LEUKEMIA, ANTIGENS, HISTO-
COMPATIBILITY ANTIGEN, MYELOMA
CELL LINE, MOUSE (4615)
THYMUS, LEUKEMOGENESIS, RAT (4561)
H PARTICLE, TUMOR, HAMSTER (4564)
HARVEY MURINE SARCOMA, TUMOR-
ASSOCIATED ANTIGEN, HAMSTER (4676)
HERPES
ANTIBODY, SERUM, HUMAN (4691)
INFECTION, MONKEY, REVIEW (4312)
HERPES SIMPLEX
CAPSID ANTIGEN, ENVELOPE ANTIGEN,
SOLUBLE ANTIGEN, CROSS-REACTIV-
ITY (4647)
INFECTED CELL, DNA SYNTHESIS,
7,12-DIMETHYLBENZ(A)ANTHRACENE,
RABBIT (4520)
TYPE 1 AND TYPE 2, GENETIC
RELATEDNESS, DNA-DNA HYBRIDIZA-
TION (4548)
TYPE 1 AND TYPE 2 DIFFERENTIATION,
IN VITRO (4581)*
- VARICELLA-ZOSTER, ULTRA STRUCTURE
(4591)*
HERPESVIRUS, ANTIGENIC RELATIONSHIPS,
INFECTIOUS BOVINE RHINOTRACHEITIS,
MAREK'S DISEASE, BURKITT'S LYMPHOMA
(4611)
HERPESVIRUS SAIMIRI, HYBRID CELL
LINES, MARMOSET-MOUSE (4538)
HUMAN ADENOVIRUS INFECTION, ENHANCE-
MENT BY SV40, MECHANISM, MONKEY
CELLS (4543)
INFLUENZA, LUNG TUMOR INCIDENCE, MOUSE
(4413)
- VIRUS - CONTINUED
KIRSTEN MURINE LEUKEMIA, TEMPERATURE
SENSITIVE MUTANT, MOUSE (4535)
LEUKEMIA, RNA, ELECTROPHORETIC
ANALYSIS, MOUSE (4580)*
LYMPHOCYTIC SARCOMA, C-TYPE PARTICLES,
MOUSE (4594)*
MAMMARY TUMOR, GLUCOSE OXIDATION,
MOUSE (4573)
MAMMARY TUMOR ACTIVITY, PHENYLALANINE
DEFICIENCY INFLUENCE, MOUSE (4606)*
MAREK'S DISEASE, ONCOGENICITY, DNA
SYNTHESIS, BIRD (4586)*
MASON-PFIZER, MAMMARY TUMOR, MONKEY
(4522)
MAZURENKO, FRIEND, RAUSCHER, LEUKEMIA,
GROUP-SPECIFIC ANTIGEN, TYPE-SPECI-
FIC ANTIGEN, MOUSE (4631)
MOLONEY SARCOMA, ANEMIA-INDUCING
VIRUS DERIVATIVE, RAT (4513)
MURINE LEUKEMIA, CELLULAR, ANTIGEN,
LEUKEMIA CELL, MYELOMA CELL, MOUSE
(4555)
MURINE SARCOMA
ROUS SARCOMA, POLYOMA, TRANSFORMA-
TION, CELL MEMBRANE, GLYCOSYL
TRANSFERASE (4552)
SARCOMA AND LEUKEMIA, INDUCTION,
ENHANCEMENT BY INTERFERON
INDUCERS, MOUSE, RAT (4553)
TRANSFORMATION
GUINEA PIG EMBRYO CELLS (4537)
NONPRODUCER BALB/3T3 CELLS,
EPITHELIAL FEATURES (4600)*
TUMOR INDUCTION, PATHOLOGY, RODENT
(4550)
9H, GROWTH PATTERN LIVER, HEPATITIS,
ANTIBODY, RAT (4544)
- VIRUS - CONTINUED
PAPILLOMA, WART, HUMAN (4509)
POLYCYTHEMIA FRIEND, COLONY FORMING
UNIT, SPLEEN, MOUSE (4503)

POLYOMA
 ANTIGEN FORMATION, INHIBITOR, MOUSE (4567)
 TRANSPLANTABLE TUMORS, MORPHOLOGY, BIOLOGICAL PROPERTIES (4578)*
 TUMOR GROWTH FACILITATION, BLOCKING SERUM, TUMOR ELUATE, RAT (4649)
 TUMOR IMMUNITY, BLOCKING EFFECT, COUNTERACTION, RAT (4612)
 POLYOMA-TRANSFORMED, FIBROBLASTS, GLYCOSPHINGOLIPIDS, MOUSE (4587)*
 POX, SPONTANEOUS DISSEMINATED FIBROMA, SQUIRREL (4584)*
 PROVIRUS, REVIEW (4305)
 RAUSCHER LEUKEMIA
 ANTINUCLEAR ANTIBODY FORMATION, SUPPRESSION, MOUSE (4559)
 DIFFERENTIATION, INFECTED CELL, HEMOCYANIN, MOUSE (4680)
 LACTIC DEHYDROGENASE, LYMPHATIC TISSUE RESPONSE, MOUSE (4530)
 RNA-DIRECTED DNA POLYMERASE INHIBITION, CYTOSINE ARABINOSIDE TRIPHOSPHATE (4585)*
 TUMOR RESISTANCE INDUCTION, ADULT MOUSE, NEWBORN MOUSE (4687)
 RESTRICTED ADENOVIRUS INFECTION, RNA SYNTHESIS, MONKEY CELLS (4527)
 RNA, HOST GENOME, ONCOGENESIS, REVIEW (4309)
 RNA TUMOR, ULTRASTRUCTURE, MORPHOLOGY, REVIEW (4334)*
 VIRUS - CONTINUED
 ROUS SARCOMA
 ABSORPTION BY RESISTANT CELLS, ELECTRON MICROSCOPE STUDY (4528)
 ACTIVATION, CELL CYCLE, CHICKEN (4511)
 RESCUE, TRANSFORMED CELL, RAT (4518)
 TRANSFORMATION, VIRAL GENOME COPIES, PROVIRUS THEORY (4554)
 TRANSFORMED CELL, GLUCOSE METABOLISM, CHICK EMBRYO (4558)
 TUMOR IMMUNOLOGY, HAMSTER (4502)
 SARCOMA, LEUKEMIA, PRODUCTION, ANTIGENS, HYBRID CELL, MOUSE, HAMSTER (4565)
 SIMIAN FOAMY, MASON-PFIZER, COMPARATIVE MORPHOLOGY, MONKEY (4556)
 SV40
 DNA, SEQUENCE HETEROGENEITY (4546)
 DNA SYNTHESIS
 ETHIDIUM BROMIDE, MONKEY (4566)
 MURINE SARCOMA VIRUS REPLICATION EMBRYO CELLS, MOUSE (4534)
 POLYPEPTIDES, DEOXYNUCLEOPROTEIN COMPLEX (4516)
 TEMPERATURE-SENSITIVE MUTANT, INFECTION, MONKEY CELL (4542)
 TRANSCRIPTION, STRAND ORIENTATION, BSC-1 CELL (4541)
 TRANSFORMATION
 CONCAVALIA A RECEPTOR, HAMSTER (4568)
 HAMSTER CELL (4562)
 INHIBITION, 7,12-DIMETHYLRENZ-(A)ANTHRACENE, 3-METHYLCHOLANTHRENE, MOUSE (4504)
 SHEEP CELLS (4607)*
 SPHINGOMYELIN BIOSYNTHESIS, MOUSE (4549)
 TUMOR, LACTATE AND MALATE DEHYDROGENASES, HAMSTER (4582)*
 XY-GONADAL DYSGENESIS, SUSCEPTIBILITY, HUMAN (4514)
 SV40 GENOME, TRANSFORMED MAMMALIAN CELLS, REVIEW (4315)
 SV40-LIKE, BRAIN, HUMAN (4517)
 SV40 PROTEINS, REVIEW (4335)*
 SV40 TEMPERATURE SENSITIVE MUTANT, TRANSFORMATION, T ANTIGEN SYNTHESIS, MOUSE (4526)
 SV40-TRANSFORMED CELL, HYBRID, ANTIGENICITY, CHROMOSOME, MOUSE, RAT (4510)
 TOBACCO MOSAIC, BRONCHOGENIC CARCINOMA PATHOGENESIS, SMOKERS (4588)*
 TYPE C, SEROLOGICAL DETECTION, LEUKEMIA, BOVINE CULTURES (4735)*
 VESICULAR STOMATITIS PSEUDO TYPES, EMBRYO CELLS, MOUSE (4771)*
 WOUND TUMOR, GROWTH, VECTOR CELL MONOLAYERS, PLANTS (4609)*
 VITAMIN A
 BENZO(A)PYRENE METABOLISM, MODIFICATION, CELL CULTURES, HAMSTER (4362)
 EPITHELIAL CELL DIFFERENTIATION, MODE OF ACTION (4487)*
 GLYCOPROTEIN SYNTHESIS, SKIN TUMORS, HUMAN (4378)
 3-METHYLCHOLANTHRENE, LUNG TISSUE, MOUSE (4425)
 VITAMIN B6
 TRYPTOPHAN METABOLISM, NICOTINAMIDE ADMINISTRATION, HODGKIN'S DISEASE PATIENTS (4921)*
 VITAMIN K1
 SYNTHETIC SUBSTITUTES, INCREASES IN

TUMOR NAD+ LEVELS (4485)*
 VULVA
 MALIGNANT DISEASE, CLINICAL STUDY
 (4981)*
 WART
 PAPILLOMA VIRUS, HUMAN (4509)
 WHEAT GERM AGGLUTININ
 MEMBRANE BINDING SITE, TUMOR CELL
 (4864)
 WHITE BLOOD CELL
 ANTIGENICITY, CHRONIC LYMPHOCYTIC
 LEUKEMIA, HUMAN (4620)
 WILM'S TUMOR
 BILATERAL, CASE REPORTS, REVIEW
 (4352)*
 CANCER PROGRESSION, EPIDEMIOLOGICAL
 STUDY, ENGLAND (4830)*
 CELLULAR IMMUNITY, NEUROBLASTOMA,
 HUMAN (4731)*
 NEPHROBLASTOMA, ULTRASTRUCTURE, HUMAN
 (4973)*
 WOOD DUST
 CANCER, OCCUPATIONAL HAZARD, BOOT AND
 SHOE INDUSTRY, REVIEW (4360)*

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CARCINOGENESIS ABSTRACTS

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Editor

Robert Love, M.D.
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Associate Editor

George P. Studzinski, M.D.
Jefferson Medical College, Philadelphia

NCI Staff Consultants

Elizabeth Weisburger, Ph.D.
Sidney Siegel, Ph.D.
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PREFACE

Carcinogenesis Abstracts is a publication of the National Cancer Institute. The journal serves as a vehicle through which current documentation of carcinogenesis research highlights are compiled, condensed, and disseminated on a regular basis. It represents an integral part of the Institute's program of fostering and supporting coordinated research into cancer etiology. Issues of *Carcinogenesis Abstracts* normally contain three-hundred-fifty abstracts and three-hundred-fifty citations (unaccompanied by corresponding abstracts). Abstracts and citations refer to the current scientific literature that describes the most significant carcinogenesis research carried on at the National Cancer Institute, other governmental agencies, and private institutions. *Carcinogenesis Abstracts* is intended to be a highly useful current awareness tool for scientists engaged in carcinogenesis research or related areas. The great number and diversity of publications relevant to carcinogenesis make imperative the availability of this service to investigators whose work requires that they keep abreast with current developments in the field.

Carcinogenesis Abstracts is normally published monthly. Volume X covers the scientific literature published from July 1971 through Dec 1972. A cumulative subject and author index for Volume X will be published shortly after the final regular issue. This journal is available free of charge to libraries and to individuals who have a professional interest in carcinogenesis. Requests for *Carcinogenesis Abstracts* from qualified individuals should include statements of their relationship to carcinogenesis research. All correspondence should be addressed as follows.

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NOTE

Journal names are abbreviated according to the list of abbreviations used by *Index Medicus*. For journals not covered by *Index Medicus*, the abbreviations (with some modifications) found in *World Medical Periodicals*, 3rd Edition, are used.

LANGUAGE ABBREVIATIONS

Afr.	Afrikaans	It.	Italian
Ar.	Arabic	Jap.	Japanese
Bul.	Bulgarian	Kor.	Korean
Ch.	Chinese	Latv.	Latvian
Cz.	Czech	Lith.	Lithuanian
Dan.	Danish	Nor.	Norwegian
Dut.	Dutch	Pol.	Polish
E.	English	Por.	Portuguese
Eston.	Estonian	Rum.	Rumanian
Fin.	Finnish	Rus.	Russian
Fl.	Flemish	Ser.	Serbo-Croatian
Fr.	French	Sl.	Slovak
Ger.	German	Sp.	Spanish
Gr.	Greek	Sw.	Swedish
Heb.	Hebrew	Th.	Thai
Hun.	Hungarian	Turk.	Turkish
Ic.	Icelandic	Uk.	Ukrainian
In.	Indonesian	Viet.	Vietnamese

ABBREVIATIONS USED IN ABSTRACTS

ACTH	adrenocorticotrophic hormone	mg	milligram(s)
ADP	adenosine diphosphate	min	minute(s)
AMP	adenosine monophosphate	ml	milliliter(s)
ATP	adenosine triphosphate	mm	millimeter(s)
C	degrees centigrade	MTD	maximum tolerated dose
cm	centimeter(s)	ng	nanogram (10^{-9})
CNS	central nervous system	pg	picogram (10^{-12})
cpm	counts per minute	p.o.	orally
DNA	deoxyribonucleic acid	ppm	parts per million
e.g.	for example	r	Roentgen
g	gram(s)	RBC	red blood cells (erythrocytes), red blood count
µg	microgram(s)	resp.	respectively
hr	hour(s)	Rev.	review (only in citations)
i.m.	intramuscular	RNA	ribonucleic acid
i.p.	intraperitoneal	s.c.	subcutaneous
IU	international unit(s)	sec	second(s)
i.v.	intravenous	U	unit(s)
kg	kilogram(s)	UV	ultraviolet
LD ₅₀	median lethal dose(s)	WBC	white blood cells (leukocytes), white blood count
m	meter(s)	wk	week(s)
M	molar	wt	weight
mEq	milliequivalent(s)	yr	year(s)
mM	millimolar		
µM	micromolar		
mC, µC	milli-, microcurie(s)		

CONTENTS

	Cross Reference Abbreviations	Abstracts, Citations	Page
REVIEW.....	(Rev).....	5001-5071	799
CHEMICAL CARCINOGENESIS.....	(Chem).....	5072-5196	809
PHYSICAL CARCINOGENESIS.....	(Phys).....	5197-5202	836
VIRAL CARCINOGENESIS.....	(Viral).....	5203-5289	838
IMMUNOLOGY.....	(Immun).....	5290-5397	855
PATHOGENESIS.....	(Path).....	5398-5408	874
EPIDEMIOLOGY AND BIOMETRY.....	(Epid-Biom).....	5409-5429	876
MISCELLANEOUS.....	(Misc).....	5430-5700	880
AUTHOR INDEX.....			i
SUBJECT INDEX.....			xix

- 5001 PRECANCEROUS STATES OF THE DIGESTIVE TRACT. (Fr.) Chevrel, B. (Hosp. St.-Antoine, Paris, France) and J.-P. Chevrel. *Vie Med* 39:4835-4844, 1971.

Data are presented on the incidence of stomach cancer occurring in the course of atrophic gastritis, Biermer's disease, hypertrophic gastritis, gastric polyposis and on incidence of cancerization of ulcers, hiatal hernias, and gastric stump following gastrectomy. In one series of 167 gastric cancers, 114 cases had concomitant atrophic gastritis. The incidence of gastric cancer in patients with Biermer's disease is three times that of stomach cancer in the general population. Of 257 patients with polyposis, 73 developed gastric cancer. Hypertrophic gastritis, characterized by chronic inflammation of the gastric mucosa, is more frequent in cancer patients than in patients with gastric or duodenal ulcers. In 167 gastric cancer cases, the mucous membrane was normal in only 31 cases. The incidence of cancerization of ulcers is between 0-20% but is difficult to evaluate because of the extent of neoplastic lesions which mask preexisting ulcers. Hiatal hernias frequently co-exist with cancer, with recent evidence suggesting that the hernia precedes the cancer. The incidence of cancer of the gastric stump following gastrectomy varies between 0.4-11%; this figure includes only cases where gastrectomy was performed to remove benign ulcers and where the cancer developed at least five yr following surgery. Methods of treating precancerous disorders of the digestive tract are indicated together with the prognosis. A hereditary predisposition is postulated in the case of Biermer's disease, atrophic gastritis, and polyposis. (No references)

- 5002 MEDICAL APPROACHES TO THE STANDARDIZATION OF CARCINOGENIC SUBSTANCES IN THE ATMOSPHERE. (Rus.) Yanysheva, N. Ya. (A.M. Marzeyev Sci. Res. Inst. Gen. Comm. Hyg., Kiev, USSR). *Gig Sanit* 37(1):90-93, 1972.

Problems of establishing standards for atmospheric carcinogens are reviewed. Such standards should be based on epidemiological data from industrial rather than from general populations; also, animal experiments are of major importance. As the determination of the harmfulness of and the significance of reactions involving carcinogenic substances is problematic, threshold values for such substances are of theoretical importance. Of the stages of the carcinogenic process prior to tumor development, the benign tumor stage is regarded as a specific indicator of the effect of carcinogenic substances. Since the conditions of atmospheric carcinogen action are by far different from those which promote skin cancer, the latter cannot be used as a criterion in atmospheric pollutant carcinogenicity evaluation. An animal lung cancer model adequate to the model of human lung cancer was obtained by intratracheal administration of hydrocarbons, which indicates the similarity of animal and human respiratory organs. Different factors facilitating the incorporation, deposition and elimination of atmospheric carcinogens in the organism (non-carcinogenic

pollutants, chemical substances increasing the solubility of carcinogenic substances, adsorbing agents and tissue and cell alterations caused by the above agents, all increasing the residence time of carcinogens in the organism) strongly influence the carcinogenic effect. Dose series, set up for the evaluation of the carcinogenic effect of the principal atmospheric hydrocarbons such as benzo(a)pyrene and benz(a)anthracene, revealed the carcinogenic effect of even small doses for large populations. Maximum allowable concentrations of carcinogenic substances in the atmosphere should be determined in animal tests, and by means of the probability theory and statistical studies of morbidity and mortality. (26 references)

- 5003 . MUTANTS OF ROUS SARCOMA VIRUS. (Fr.) Vigier, P. (Inst. Radium Biol., Orsay, France). *Bull Cancer (Paris)* 59(1):21-32, 1972.

The Rous sarcoma virus (RSV) is reviewed, including the nature of the viral genome, information for replication, and classes of mutants. It is postulated that its genome is replicated by DNA which directs the synthesis of RNA replicates for the production of the virus in permissive cells. The RSV carries transforming information which is apparently the same for *in vitro* and *in vivo* cells. The RSV mutants may be classified as: morphologic mutants, determining the specific structure of the transformed cells; defective mutants, either in their capacity for replication or in their power to transform cells; and conditional mutants, which include, on the one hand, mutants that have lost their transforming capacity (but not the capacity for replication) at a high temperature, and, on the other hand, mutants that have lost both capacities at a high temperature. It is suggested that the protein synthesis required for the production of the transformation, determines a modifiable alteration of the surface constituents of the cell, either in uncovering preexistent sites or in modifying their configuration or distribution. (37 references)

- 5004 ONCOGENIC VIRUSES--A REVIEW. (Ger.) Schäfer, W. (Max Planck Inst. Vir. Res. Tübingen, West Germany). *Zentralbl Bakteriol (orig)* 220:3-26, 1972.

Investigations over a 63-yr period on viral factors in oncogenesis are reviewed. Early findings demonstrating the transmissibility of chick leukemias, and even that of hen sarcomas, in filtrates were ignored for some time in favor of studies of the induction of tumors by chemical or physical means. It was only in the fifties that RNA- and DNA-containing leukemia virus tumors were described. The RNA viruses are described under the name of oncornavirus; the type of virus is designated as C- or B-particle; the hosts may be the hen, mouse, or cat; and the tumors may occur by natural infection or by induction of specific virus strains by inoculation. The DNA viruses are classified as herpes, papova and adeno viruses; the hosts include frog, hen, ape, mouse and humans (as well as other mammals). The formation of the various

viruses and their structural differences are described. In a description of the influence of tumor viruses on cells in tissue cultures, the SV40, the polyoma virus, and the C viruses are detailed. The oncogenic viruses in humans and the possibilities of immuno-prophylaxis and therapy are reviewed. (46 references)

- 5005 NEOPLASTIC ALTERATIONS OF CELLS *IN VITRO* BY CHEMICAL CARCINOGENS. (Ger.) Thust, R. (Med. Acad. Erfurt, East Germany) and T. Schramm. *Arch Geschwulstforsch* 39(3):249-263, 1972.

Studies of the mechanisms of cancer formation and investigations of cells, tissues and organ cultures for evidence of the carcinogenic properties of chemical substances are reviewed. The most important data are summarized in a table listing the chemical carcinogens tested, alterations *in vivo* or *in vitro*, the cell type, and the literature reference. On the basis of the experimental work described and observations of spontaneously altered cells, it becomes clear that morphological alteration is in no way identical with neoplastic alteration, which requires that the affected cells retain the property for the production of malignancy after transplantation to a histocompatible host. The conditions for organ cultures must be such that: the cells are not inclined to spontaneous alterations; the *in vitro* behavior is representative of the intact organism; and a variety of effects are seen in response to various carcinogens. Besides the morphologic and neoplastic alterations, the toxic effects of various carcinogens are mentioned. (48 references)

- 5006 THE ROLE OF TOBACCO IN RESPIRATORY PATHOLOGY. (Fr.) Chretien, J. (Intercommunal Hosp., Creteil, France), A. Hirsch, A. Harf and M. Thiebaut. *Rev Tuberc Pneumol (Paris)* 36(2):243-280, 1972.

Studies of chronic smokers, especially cigarette smokers, have revealed that this group presents the highest risks for bronchial cancer. The cytological characteristics of the bronchial epithelium closely associated with tobacco consumption are loss of ciliation of the epithelium, an increase in basal cells (global epithelial hyperplasia), and the appearance of nuclear anomalies. These transformations increase in intensity with increasing tobacco consumption. Experiments in animals have shown that tumors can be induced by application of tobacco condensates and that precancerous conditions in the tracheobronchial mucosa can be elicited by exposing animals to smoke inhalation. Extrapolation of such experimental results to human carcinogenesis is difficult, since the histology, anatomy, genetic factors, dosage, cofactors and other conditions are bound to differ from those of humans. Many investigators believe that the carcinogenic action of tobacco is a direct effect of aromatic polycyclic hydrocarbons and nitrosamines, but radioactive elements have also been implicated in this action. The mediator roles in the production of cancer have been attributed to enzymatic action,

immuno-depressive action, contaminants (insecticides, additives), alteration of the purification process (mucociliary clearance) and the modification in macrophages. Carcinogenic cofactors include radioactivity, in connection with certain occupations (metal industries and illuminating gas), exposure to asbestos, the urban atmosphere, viral infection, genetic or racial factors, and alcohol. The quality and mode of consumption are important considerations, although it is not clear why cigarettes are more hazardous than cigar or pipe smoking. The reduction of tar content and of specific carcinogens is currently being pursued. Repeated warnings of the harmful effects of tobacco are urged together with a campaign to discourage smoking among the young. (192 references)

- 5007 ON THE BIOCHEMISTRY OF CARCINOGENIC N-NITROSO-COMPOUNDS. (Ger.) Krliger, F.-W. (German Cancer Res. Ctr., Heidelberg, West Germany). *Aerztl Forsch* 26(6):197-202, 1972.

The carcinogenic properties of the N-nitroso-compounds are reviewed in connection with experimental cancer research. These compounds have a relatively simple structural formula and are easily synthesized. They have a marked organotropic action, as demonstrated with methylnitrosourea in the production of tumors in the central and peripheral nervous systems. They have been formed endogenously by a combination of secondary amines and nitrites. The extensive work which stemmed from Magee and Farber's application of the carcinogens to the formation of 7-methylguanine in the nucleic acids was concerned with the transference of a molecular group of a carcinogen to the genetic material. No connection between the alkylation of genetic material and carcinogenic effects could be established, although the toxic effect could be explained on a molecular basis. The possibility of a connection between carcinogenic and antineoplastic action, as seen in clinical chemotherapy, is discussed. (36 references)

- 5008 PHOSPHATE MEDIATION OF THE CRABTREE AND PASTEUR EFFECTS: DOES A CHANGE IN ENERGY METABOLISM ENHANCE THE POTENTIAL FOR MALIGNANCY? (E.) Koobs, D. H. (Loma Linda U. Sch. Med., Calif.). *Science* 178(4057):127-133, 1972.

Observations of mitochondria from cells evincing the Crabtree effect are reviewed, and the bearing of this effect on carcinogenesis is discussed. The Crabtree effect is a manifestation of respiratory inhibition in cells after the addition of glucose or another hexose capable of being phosphorylated by hexokinase. The phenomenon has been observed in malignant cells, including Ehrlich ascites cells. The Crabtree effect is usually accompanied by mitochondrial contraction and a decrease in the rate of glucose utilization occurring at the time of inhibition of respiration. Observations of the effect in mitochondria isolated from tumor cells are described. It has been

(5009-5012)

suggested that the Crabtree effect is based on competition between cells for phosphate. This, if true, might indicate that the Crabtree effect and the Pasteur effect (i.e., anaerobic glycolysis exceeds aerobic glycolysis) have the same mechanism. Both Pasteur and Crabtree effects may signalized changes in metabolic emphasis which may be associated with malignant change. (54 references)

5009 CHROMIUM AND NICKEL. (E.) Kazantzis, G. (Middlesex Hosp., London, England). *Ann Occup Hyg* 15:25-29, 1972.

Both chromium and nickel have been shown to have a limited but definite carcinogenic potential in man. Workers producing chromates and dichromates from the raw materials, chromite and chrome iron ore, have shown a 30-fold increase over the expected incidence of lung cancer. Calcium chromate has been implicated as at least one of the actively carcinogenic compounds. Although epithelial ulcerations have occurred in persons exposed to chromates or bichromates in industries where these compounds are used rather than manufactured, increased mortality from cancer has not been observed. However, no detailed epidemiological study of such workers has been performed. Nickel workers in England and South Wales were found to have a five times higher incidence of mortality from lung cancer and a 150 times higher incidence of mortality from nasal cancer than that experienced by the general male population. The mortality rates were highest among the process workers. Evidence also suggests that this risk is not experienced by workers who have only been employed in refineries modified to reduce exposure to nickel compounds. Experimental work has substantiated the carcinogenic effects of nickel. The less soluble nickel compounds show the highest carcinogenic potential while the soluble salts are nontumorigenic. Nickel carbonyl, a gaseous by-product of the refining process, has been shown to inhibit DNA-dependent RNA synthesis. Chromium compounds, in contrast to many nickel compounds, have a limited carcinogenic potential in experimental situations. (19 references)

5010 ETIOLOGY OF LUNG CANCER: REFLECTIONS ON TWO DECADES OF RESEARCH. (E.) Wynder, E. L. (Amer. Hlth. Fdn., New York, N.Y.). *Cancer* 30(5):1332-1339, 1972.

The evidence of the carcinogenicity of cigarette smoke for the human lung is reviewed and predictions concerning the future relationship between smoking and lung cancer are advanced. Evidence that cigarette smoke causes lung cancer in men includes (a) retrospective studies showing a dose-response relationship between number of cigarettes smoked and lung cancer risk; (b) the finding that lung cancer is correlated with smoking in population groups (e.g., religious groups which proscribe smoking have low lung cancer rates); (c) the fact that lung cancer risk declines among ex-smokers; and (d) the finding that identifiable carcinogens in cigarette smoke condensates cause skin tumors in laboratory animals. There is evidence that

smokers of filter cigarettes, cigarettes which are relatively low in tar, have a lower lung cancer risk than smokers of unfiltered cigarettes. It is predicted (a) that lung cancer among American white males will begin to decline due to reduced tar contents of cigarettes smoked; (b) that lung cancer will concentrate increasingly in the lower socioeconomic orders, since individuals in these strata quit smoking less frequently than those in higher strata; and (c) that tar contents of cigarettes will continue to be reduced by manufacturers, resulting in availability of decreasingly carcinogenic cigarettes. (43 references)

5011 GLYCOLYSIS, RESPIRATION, AND ANOMALOUS GENE EXPRESSION IN EXPERIMENTAL HEPATOMAS: G. H. A. CLOWES MEMORIAL LECTURE. (E.) Weinhouse, S. (Temple U. Sch. Med., Philadelphia, Pa.). *Cancer Res* 32(10):2007-2016, 1972.

Studies of the alteration of enzymes which determine metabolic processes in cancer cells are reviewed. Among the demonstrated molecular changes in Morris hepatomas are losses of enzymes which are under host regulation and which are geared to liver function (e.g., glucokinase, aldolase B). These enzymes are replaced in cancer cells by enzymes which are not under host regulation, and which are geared to the efficient utilization of metabolic fuels (e.g., hexokinase, aldolase A). It is suggested that the loss of regulatory enzymes is a key to the unbridled proliferation of cancer cells. Furthermore, progressive loss of regulatory enzymes as tumors become more undifferentiated may explain the observed increase in aerobic glycolysis in relatively anaplastic tumors. The role of genetic alterations in the changed pattern of enzyme function in tumor cells is briefly discussed. (94 references)

5012 AROMATIC AMINES: THE PRESENT STATUS OF THE PROBLEM. (E.) Veys, C. A. (British Rubber Manufacturers' Assoc., Birmingham). *Ann Occup Hyg* 15:11-15, 1972.

Data on the occupational hazards associated with aromatic amines, potent bladder carcinogens, are reviewed. The eight occupational categories in which increased bladder cancer incidence may be related to aromatic amine exposure are chemical and dyestuff industries; textile dyeing and printing; pigment manufacture; rubber and cable making; gas workers; laboratory workers; rodent control; and patent fuel, tar and pitch workers. As yet no safe exposure level has been established for aromatic amines. Two aromatic amines α -naphthylamine and β -naphthylamine are released by burning tobacco, and may cause the observed high incidence of bladder cancer in heavy cigarette smokers. Three carcinogenic aromatic amines that may present risks for laboratory and chemical workers are benzidine, *o*-tolidine and *o*-dianisidine. A report from the United States indicated an apparent excess of deaths from cancer of the pancreas and malignant lymphoma in members of

the American Chemical Society, but surprisingly few cases of urinary bladder cancer. In Britain, there has been no purposeful survey of bladder tumor incidence among aromatic amine-exposed chemical and laboratory workers. (18 references)

- 5013 PATHOGENESIS OF RADIATION-RELATED LEUKAEMIA AND LYMPHOMA: SPECULATIONS BASED PRIMARILY ON EXPERIENCE OF HIROSHIMA AND NAGASAKI. (E.) Anderson, R. E. (Atomic Bomb Casualty Comm., Hiroshima, Japan), H. Nishiyama, Y. Ii and K. Ishida. *Lancet* 7759:1060-1062, 1972.

Data on radiation induction of leukemia and lymphoma are briefly reviewed. Leukemia and lymphoma are closely related conditions but the prevalence of the two diseases in populations exposed to ionizing radiation is very different. Leukemia incidence is increased in radiologists, children exposed to diagnostic X-rays *in utero*, patients receiving radiotherapy for ankylosing spondylitis, radium workers and survivors of the bombings of Hiroshima and Nagasaki in 1945. Radiation-induced leukemia also occurs in a wide variety of laboratory animals. Increased prevalence of radiation-related lymphoma has been noted only in radiologists, Hiroshima survivors (not Nagasaki survivors) and ankylosing spondylitis patients. Moreover, mice exposed to ionizing radiation do not show increased lymphoma incidence. The difference in inducibility of leukemia and lymphoma by radiation suggests a difference in the pathogenesis of the two conditions; while leukemia may follow marrow hypoplasia, lymphoma may be more closely related to disruption of immunological homeostasis. (48 references)

- 5014 POTENTIAL CARCINOGENIC EFFECT OF CADMIUM IN ANIMALS AND MAN. (E.) Malcolm, D. (Chloride Electrical Storage Co., Ltd., Manchester, England). *Ann Occup Hyg* 15:33-36, 1972.

Previous experimental work has shown that s.c. administration of cadmium will produce malignant tumors (sarcomas) at the site of injection in male and female rats, and Leydig-cell hyperplasia and Leydig-cell tumors in male rats. Studies of British workers exposed to cadmium for 10 yr or longer revealed a significantly increased incidence of prostatic carcinoma; however, a specific survey of cadmium and/or nickel workers in other countries produced no confirmed cases of prostate carcinoma. Preliminary results from experiments in which C.B. hooded rats and Swiss mice received daily or weekly doses of cadmium sulfate either s.c. or by gastric intubation for two yr also indicate that cadmium is unlikely to be the cause of prostatic cancer or other internal cancers in man. Although Leydig cell tumors occurred, they were seen in both control and experimental animals. (15 references)

- 5015 THE ROLE OF VIRUSES IN MAMMARY CARCINOGENESIS. (Fr.) Hollmann, K. H. (Lab.

Cytopath., Broussais Hosp., Paris, France) and J. M. Verley. *Path Biol* 20(1-2):83-103, 1972.

Mouse mammary tumor viruses (MTV) are described and formation of A and B particles is illustrated. The five major polypeptides of the viruses are enumerated with their molecular weights, and a comparison is made between proteins and mouse leukemia viruses. MTV antigens and their analysis by immunofluorescence in cell cultures are described. The biological activity cycle of MTV, transmitted from the mother to her offspring by means of her milk, is outlined. The mode of absorption and primary replication *in vivo* is not known. Not all mice who receive the virus develop a mammary tumor; the oncogenic activity of the virus is conditioned by hormonal, genetic, and immunologic factors in the host. Tests for the detection of MTV are described and include the injection of noncellular extracts into newborn mice; nodulogenesis; the *in vitro* test of immunodiffusion; and the agglutination inhibition test. Replication of MTV *in vitro* is also described. Mammary tumors and leukemias are discussed in terms of relationships between B and C particles. Mammary tumors in the rat are described in terms of chemical, hormonal, and viral induction. Mammary tumors in monkeys and in humans are discussed, and the probabilities of a viral origin are argued. (272 references)

- 5016 A UNIFYING HYPOTHESIS CONCERNING THE NATURE OF MALIGNANT GROWTH. (E.) Holley, R. W. (Salk Inst., San Diego, Calif.). *Proc Nat Acad Sci USA* 69(10):2840-2841, 1972.

A theory is proposed according to which cell growth is regulated by availability in the cell of certain low molecular wt nutrients associated with cell growth. No additional "signal" to grow is needed if all these nutrients are present in sufficient concentrations within the cell. Selectivity of growth control could be achieved via transport systems at the cell surface membrane, systems which are in turn regulated by hormones or growth factors. Changes in uptake mechanisms caused by changes in the cell membrane would lead to abnormally high concentrations of critical growth nutrients inside cells, with the result that neoplastic growth is put underway. (21 references)

- 5017 RELATIONSHIP OF THE SELECTIVE METASTATIC BEHAVIOR OF TUMORS OF RETICULAR TISSUES TO THE MIGRATION PATTERN OF THEIR NORMAL CELLS OF ORIGIN. (E.) Pilgrim, H. I. (U. Utah Coll. Med., Salt Lake City). *J Nat Cancer Inst* 49(1):3-6, 1972.

Evidence supporting the hypothesis that selective metastasis of reticular tissue tumors is a vestige of the migration patterns of the tumors' normal cells of origin is briefly reviewed. According to this hypothesis, the selective metastatic preference

(5018-5022)

of tumors is a result of differential cell migration rather than of differential cell growth. For example, cells of a Hodgkin-like reticulum cell neoplasm implanted in the spleen (preferred site) tended to remain there, whereas cells implanted in the kidney (a nonpreferred site) tended to migrate out. Experiments have suggested that the tendency of lymphocytic tumors to produce leukemia is proportional to the circulating properties of the normal lymphocytic cells of origin. Evidence supporting the differential migration theory of selective metastasis has also been gathered in experiments with plasma cells and plasmacytomas, and in other work with reticulum cells and reticulum cell sarcomas. The value of transplantable reticular tumors as tools for studying the function of cells of the normal immune system is emphasized. (29 references)

- 5018 THE COMBINED EFFECTS OF SMOKING AND OCCUPATIONAL OR URBAN FACTORS IN RELATION TO LUNG CANCER. (E.) Waller, R. E. (St. Bartholomew's Hosp. Med. Coll., London, England). *Ann Occup Hyg* 15:67-71, 1972.

Studies attempting to relate lung cancer to cigarette smoking and occupational or environmental factors are reviewed. Although there is some evidence that cigarette smoking and lung cancer mortality are related to occupational factors for asbestos, uranium and nickel workers, small nonsmoking samples make these studies inconclusive. The author sees no clear evidence that air pollution, by itself or in combination with smoking, is a major factor in lung cancer development. (19 references)

- 5019 CARCINOMA RISK FACTORS IN THE DERMATOLOGY OF ACTINIC CARCINOGENESIS. (Ger.) Luger, A. (Dermatol. Div. Vienna City Hosp., Austria). *Oest Z Erforsch Bekamp Krebs* 26(6):404-417, 1971.

The effects of direct sunlight and other forms of UV light on the human skin and their relationship to cancer formation are reviewed. Animal experiments have demonstrated that skin carcinomas can develop by means of UV. In man, an acute overdose of UV evokes early symptoms of erythema in the exposed locations and these are followed by melanin synthesis. Later developments include atrophy and hyperkeratosis. UV also induces dimerization of thymidine in the chromosomes of the epithelial cells; further harm may be prevented (if the exposure was not excessive) by the "dark repair system". In the connective tissues, UV causes depolymerization of mucopolysaccharides, damaging fibroblasts and leading to an elastosis. Individual light-screening mechanisms can weaken the effects of sunlight on the skin. Some individuals are more sensitive to these effects than others, depending upon skin pigmentation. The irreparable phototraumatic microinjuries accumulate in the skin and eventually lead to clinically manifested changes. Such damage ensues when the product of concentration and time exceeds the individual tolerance threshold. This is also true for X-ray

exposure. Skin carcinoma is more apt to develop from a large number of small exposures than from one short exposure to intense irradiation. (43 references)

- 5020 APOPTOSIS: A BASIC BIOLOGICAL PHENOMENON WITH WIDE-RANGING IMPLICATIONS IN TISSUE KINETICS. (E.) Kerr, J. F. R. (Dept. Path., U. Aberdeen, Scotland), A. H. Wyllie and A. R. Currie. *Brit J Cancer* 26:239-257, 1972.

The process of apoptosis -- a general mechanism of cell deletion, complimenting mitosis -- is described and its role in normal and neoplastic tissues is discussed. Apoptosis affects scattered single cells; nuclei and cytoplasm of these cells condense, nuclei become fragmented, and cells break down into membrane-bounded, compact remnants. These remnants are taken up by other cells where they undergo changes similar to *in vitro* autolysis in phagosomes. Apoptosis has been found to occur in healthy tissues and in embryos. Focal apoptosis may play a vital role in embryonic processes. Apoptosis also occurs in teratogenesis and carcinogenesis. Apoptotic bodies (breakdown fragments of cells) have been found in human rectal adenocarcinomas and basal and squamous cell carcinomas. Apoptotic bodies have also been found in rat mammary tumors induced by 7,12-dimethylbenz(a)anthracene (DMBA). Apoptosis may also be important in therapeutically induced tumor regression. Agents that induce apoptosis include DMBA, steroid hormones, hepatotoxins and electromagnetic radiation. (51 references)

- 5021 CARCINOGENESIS IN THE CONTEXT OF OCCUPATIONAL HYGIENE. (E.) Roe, F. J. C. (Tobacco Res. Council, London, England). *Ann Occup Hyg* 15:1-7, 1972.

Factors complicating the extrapolation from animal experiments with carcinogens to human occupational hazards are discussed. Among these factors are environmental agents which may predispose men to cancer (e.g., by impairing immunological surveillance) without themselves being complete carcinogens for men or animals, and agents which modify carcinogen activity in one species but not in others (e.g., tumor promoters). In addition, agents which act as complete carcinogens in some circumstances may act as carcinogen-modifying agents in other circumstances. Furthermore, no laboratory animal can be assumed never to have been exposed to carcinogens. If cancer arises in an animal exposed to a given carcinogen, it is impossible to determine what role the carcinogen played in causing cancer; it may merely have increased the risk of cancer developing from an unknown cause. (3 references)

- 5022 MAMMARY GLAND CARCINOGENESIS IN WOMEN (EPI-DEMOLOGICAL AND CLINICAL DATA). (Rus.) Levshin, V. F. (I. M. Sechenov 1st Moscow Med. Inst., USSR). *Vopr Onkol* 18(7):97-108, 1972.

Epidemiological and clinical data on mammary gland carcinogenesis in humans are reviewed. The incidence is related to socioeconomic factors including number of children/woman, as well as to constitutional factors including hormonal excretion and menstrual function. As for the relationship between the incidence of mammary cancer and the number of births, there are two contradictory opinions. Some hold that women having few or no children are more likely to develop mammary gland cancer, while others believe that births are not a factor in mammary gland carcinogenesis. There are also contradictory data on the role of lactation in mammary gland carcinogenesis. Comparative studies of cancer patients and healthy persons do not confirm the roles of childbirth and lactation in carcinogenesis. The relationships between carcinogenesis and ovarian, steroid, and hypophyseal hormones have not been determined. A series of studies showed that there were functional nervous disorders in patients with mammary cancer. Changes in the nervous and endocrine systems may, therefore, have some effect on mammary carcinogenesis. Significant disorders in these systems can occur with minimal changes in the mammary gland. Also, mammary gland cancer can occur in the presence of insignificant steroid changes. (121 references)

- 5023 GENETIC FACTORS IN CARCINOGENESIS. (Ger.) Schroeder, T. M. (Inst. Anthropol. Human Genet., U. Heidelberg, West Germany). *Fortschr Med* 90(16):603-608, 1972.

Recent findings in four autosomal recessive diseases, Fanconi anemia, Bloom's syndrome, ataxia teleangiectasia and xeroderma pigmentosum, and their relevance to the etiology of neoplasias, are discussed. The association of chromosome changes in cancer cells and carcinogenesis may be due to chromosome mutations (Philadelphia chromosome) or constant deviations from the normal karyotype in meningiomas. Chromosome changes may not be primarily responsible for the origin of cancers, but may develop independently in the course of the disease. Another concept is that chromosome changes prepare the way for tumor development. Arguments for the mutation concept of carcinogenesis are presented in connection with the four diseases mentioned, based on DNA damage, spontaneous chromosome breakage and the subsequent rearrangement for the formation of clonal cell lines with abnormal chromosomes. In Japanese victims of the atom bomb radiation, chromosome aberrations and the high incidence of leukemia in children support this concept. It is not clear whether the primary cancer cells are developed from tumor-specific chromosome mutations, or whether these originate in a small clone before transference to the cancer cell. (19 references)

- 5024 THE MECHANISM OF CHEMICAL CARCINOGENESIS: ADVANCES AND PROBLEMS. (Ger.) Wunderlich, V. (Inst. Cancer Res., Berlin, West Germany). *Arch Geschwulstforsch* 38(3/4):310-326, 1971.

Recent research into the mechanisms of chemical carcinogenesis is reviewed. Of the chemical substances

implicated in carcinogenic activity the following groups are mentioned most frequently: polycyclic aromatic hydrocarbons; aromatic amides and amines; azo dyes; alkylating agents (including N-nitroso derivatives); and 4-nitroquinoline-N-oxide and derivatives. Reactive forms of chemical carcinogenesis are delineated, with particular mention of the recent theory that all chemical carcinogens are able to form electrophilic agents *in vivo*, which react with nucleophile groups in cellular macromolecules. Such interaction requires a receptor in the cell, which may be either nucleic acids or proteins. Special attention has been directed at changes in transfer RNA in carcinogenesis. Chemical carcinogens are known to effect molecular alterations in nucleic acids and in proteins; purine bases are especially altered in this connection. The direct chemical carcinogenic effects may be demonstrated by the induction of somatic mutations, in which DNA alterations occur. The individual phases of cancer development are detailed. Many former experiments, describing only a slight relationship between carcinogenesis and mutagenesis, are now considered to have employed an inadequate test organism. It has recently been shown that high genetic activity is compatible with the plasma mutation hypothesis of carcinogenesis. (26 references)

- 5025 IS BREAST CANCER IN MICE IDENTICAL WITH BREAST CANCER IN WOMEN? (Fr.) Hollmann, M. K. H. (Broussais Hosp., Paris, France). *Bord Med* 5(6):627-643, 1972.

The induction of mouse mammary tumors by a virus (MTV) transmitted in the mother's milk is recognized. The virus is an RNA oncornavirus present in all mouse mammary tumors. The particulate matter formed by the virus is called particle B. The manner of elaboration of B particles by cellular tumors appears to be associated with a swelling of surface membranes or with the formation of smaller particles called A particles. These particles are found in the cytoplasm, predominantly in the Golgi area. A tumor cell with intracytoplasmic A particles and B particles situated in the cytoplasmic vacuoles is illustrated. The chemical composition of the mammary tumors includes RNA, lipids, and possibly, polypeptides. Not all mice with this virus develop mammary tumors. Other factors in the development of carcinogenesis include the role of hormones (estrogens); genetic factors which influence hormonal responses and the susceptibility of the gland; and immunologic factors. The mouse tumor possesses an RNA-dependent DNA polymerase called reverse transcriptase. Arguments for a viral origin for human breast cancer are based on the presence of virus like particles in such cancers and in human milk; the presence of reverse transcriptase in some human milk; the presence of antibodies in human serum which neutralize the mouse tumor virus; the presence of 70S RNA in human milk; and the possibility of hybridization between the RNA from mouse tumors and the RNA extract of human mammary cancer. Therapeutic measures are delineated. (40 references)

- 5026 MUTANTS OF THE POLYOMA VIRUS. (Fr.)
Cuzin, F. (Inst. Pasteur, Paris, France).
Bull Cancer (Paris) 59(1):15-20, 1972.

Polyoma virus mutants are analyzed with respect to the molecular level of transformation. Two types of systems are distinguished: permissive and nonpermissive. In the permissive system, (mouse cells), the large majority of cells develop a lytic cycle and a small number survive the infection, some acquiring transformed characteristics. The successive events observed are penetration of the virus into the cell followed by decapsulation, synthesis of viral proteins, induction of the synthesis of cellular proteins (enzymes related to DNA), and viral DNA synthesis together with cellular DNA synthesis. The delayed events include protein synthesis of the viral capsule. In the nonpermissive (abortive) system (hamster cells), the initial events are similar, but it is not possible to detect viral DNA synthesis, and the delayed events are not observed. This infection does not produce viruses and the cells survive. Among these cells, some acquire a transformed phenotype. The various functions coded by the polyoma genome, particularly those responsible for the transformation of the cell, were investigated. Isolation of the thermosensitive mutants in a permissive system led to their classification into four complement groups: L1, L2, TSA and TS3. In the first two, the delayed function is blocked and during an infection at high temperature, there is no production of virus; but the initial events occur normally, particularly viral DNA synthesis. The viruses with these mutations transform the cells normally regardless of temperature. The TSA mutations inhibit viral DNA synthesis during lytic infection, but cellular DNA synthesis proceeds normally. Only a small number of the infected cells (abortive transformation) will produce stable clones which will maintain their transformed characters, and these will only last for two or three generations, after which they will return to a normal state. Two functions have been identified to date as necessary for transformation: one for the permanent hereditary fixation at the cellular clone level of the transformed state; and one which must be expressed continually so that the cell remains in this state. (No references)

- 5027 IS THERE A RISK OF CARCINOGENESIS BY BITUMENS? (Fr.) Siou, G. (No affiliation). *Rev Pathol Comp Med* 72(9):65-70, 73-75, 1972.

Bituminous products are reviewed in terms of physico-chemical, clinical and experimental findings relevant to their possible carcinogenic effects. These substances are mixtures of hydrocarbons which may be aliphatic, naphthenic or aromatic. In the bitumens, the saturated cyclic compounds predominate, in contrast to tars in which the carcinogenic cyclic aromatic compounds predominate. Although the bitumens are not carcinogenic, mixtures of bitumens and tar may still be carcinogens. In a 1968 survey, tumor development in 462 workers from seven different refineries was compared with that of 379 workers in

25 factories outside of the bitumen product industry. Although the refinery workers had been in contact with bituminous products for at least five years, their malignancy rate was not higher than in the other workers. Other evidence of this type is cited. While experiments with mice support the view that bitumens are carcinogenic, mice are not so susceptible to inhalation of bituminous fumes. The conditions for the animal experiments cannot be compared with the type of contact humans have with these products. Thus, there is no evidence at present of a risk of carcinogenesis in working with bitumens. (25 references)

- 5028 RNA ONCOGENIC VIRUSES AND MALIGNANT TRANSFORMATION. (Fr.) Du Pasquier, P. (Hosp. Pellegrin, Bordeaux, France), P. Grimont and J. C. Auriol. *Bord Med* 7:753-762, 1972.

A virus coming in contact with a cell will cause infection if the cell contains specific receptors permitting the fixation and penetration of the virus into the cytoplasm. The virus is then denuded of its protein capsule and of the viral nucleic acid. The relationships between the cell and the virus may develop in various fashions: by the lytic or infectious cycle (permissive cells); a chronic infection of the cellular culture; the abortive cycle (with nonpermissive cells); the abortive cycle with a defective virus; or by a malignant transformation. Oncogenic viruses with RNA are essentially responsible for animal leukemias (possibly also in humans). They form a homogeneous virologic group: nucleic capsules with helicoid symmetry, genetic information carried by RNA, and an envelope which is produced from the cytoplasmic membrane. The four modes of replication of these viruses are described. Cells transformed by the oncogenic viruses acquire new properties: a loss of the contact inhibition; morphologic alterations; an increase in growth rate; the possibility of subcultures *in vitro*; metabolic alterations; chromosomal anomalies; a reduced capacity of supporting the multiplication of certain infectious viruses; resistance to a reinfection by the transforming virus; the appearance of new cellular antigens; and the capacity to form cancers in hosts by transplantation or injection. (4 references)

- 5029 TUMOR IMMUNOLOGY: A PROBLEM OF MEMBRANE RESEARCH? (Ger.) Uhlenbruck, G. (Med. Univ. Clin., Cologne, West Germany) and U. Reifenberg. *Med Klin* 66(43):1435-1441, 1971.

An overview of tumor immunology includes: types of defense reactions, such as a normal immune activity, the formation of humoral antibodies, or an immune reaction similar to that against a transplant; measures by which immunity can be transferred to individuals with immunity defects, such as transfusion of humoral antibodies or immunologic-competent lymphocytes; and the role of the tumor cell membrane in this context. Some of the work carried out on membrane changes includes experiments with tumor cell charge,

methods of strengthening the antigen profile, and the treatment of tumor cells with enzymes. This treatment is described under the headings of glycosidases (particularly neuraminidase) and the proteolytic enzymes. A-like antigens, heterophilic antigens occurring in erythrocytes of the Cad blood group, consist of an end-N-acetyl-D-galactosamine linked by means of an α -glycosidic bond to an unknown carrier. The A-like antigens are reviewed, and the relationship between blood group antigens, tumor cell characteristic antigens and alterations in the cell membranes of tumor cells is shown in a diagram. The growth of malignant cells and the effect of agglutinin is illustrated in another diagram, involving the role of the tumor membrane. Therapeutic consequences of the most recent concepts are discussed. (29 references).

5030 CELL TRANSFORMATION THROUGH ONCOGENIC DNA VIRUSES. (Ger.) Westphal, H. (Cold Spring Harbor Lab., New York). *Zbl Bakt (Orig)* 220:27-38, 1972. (64 references)

5031 MALIGNANT TUMORS AND MICROORGANISMS. (Sp.) Gericke, D. (Hoechst Dye Ind. Frankfurt/Main, Germany). *Rev Inst Nac Cancer (Mex)* (23):719-722, 1972. (No references)

5032 ON THE CARCINOGENICITY OF CYTOSTATIC DRUGS. (It.) Hartwich, G. (Med. Clin., U. Erlangen-Nürnberg, Germany) and W. Butzler. *Min Med* 63(31):1786-1788, 1972. (34 references)

5033 GERMINAL TUMORS OF THE TESTIS. (Sp.) Gonzalez Gonzalez, D. (No affiliation). *An Med* 57(4):302-320, 1971. (43 references)

5034 HORMONE DEPENDANCE OF BREAST CANCER. (Fr.) Mauvais-Jarvis, P. (Salpetriere Hosp., Paris, France) and B. de Lignerres. *Nouv Presse Med* 1(29):1945-1948, 1972. (48 references)

5035 CHICKEN ONCORTINA VIRUSES: A MODEL FOR VIRUS-INDUCED CARCINOGENESIS. (Ger.) Bauer, H. (Max Planck Inst. Vir. Res. Tübingen, Germany), D. P. Bolognesi, H. Gelderblom, Th. Graf, R. Kurth and K. Mölling. *Zbl Bakt (Orig)* 220:66-78, 1972. (33 references)

5036 SLIDE SEMINAR ON TUMOURS OF THE UTERUS AND OVARY. (Ger.) Stegner, H.-E. (Women's Clin., U. Hamburg-Eppendorf, Germany). *Beitr Path* 146(2):192-217, 1972. (50 references)

5037 NEOPLASIA VIEWED AS A CYTOECOLOGICAL PROBLEM AND THE OPPORTUNITY OF REVISING THE CONCEPT OF CUTANEOUS TUMOR IRREVERSIBILITY. (It.) Bosco, I. (Dermatol. Clin. U. Palermo, Italy).

Ann Ital Dermatol Clin Sper 25(2):135-144, 1971. (No references)

5038 EPIDEMIOLOGY OF BREAST CARCINOMA. (Ger.) Maass, H. (Women's Clin. U. Hamburg-Eppendorf, Germany) and H. Sachs. *Internist* 13(8):326-331, 1972. (37 references)

5039 STILBESTROL AND CANCER OF THE VAGINA. (Nor.) Bergsjø, P. (Haukeland Hosp. U. Bergen, Norway) and J.-G. Forsberg. *T Norsk Lægeforen* 92(6):437-441, 1972 (32 references).

5040 IS THE FEMALE BREAST CARCINOMA VIRUS-INDUCED? (Ger.) Hollmann, K.-H. (Broussais Hosp. Paris, France). *Deutsch Med Wochr* 97(15):620-626, 1972. (40 references)

5041 THE RELATION OF THE EPSTEIN-BARR VIRUS TO BURKITT'S LYMPHOMA. (E.) Henle, W. (Children's Hosp., Philadelphia, Pa.) and G. Henle. *Zentralbl Bakteriöl Hyg* 220:40-46, 1972. (28 references)

5042 ANOMALIES OF THE CHROMOSOMAL SYSTEM AND THEIR POSSIBLE RELATIONSHIP WITH THE VIRAL ETIOLOGY OF MALIGNANT TUMORS IN HUMANS. (It.) Montaldo, G. (Inst. Anat. Path. Histol., U. Cagliari, Italy) and G. Zucca. *Arch De Vecchi Anat. Pat* 56(3):411-428, 1970. (21 references)

5043 OSSIFICATION IN OSTEOGENIC SARCOMA: ITS THEORETICAL AND PRACTICAL IMPORTANCE. (Por.) Carvalho, A. R. L. de (Cancer Hosp. Pernambuco, Brazil), H. de Almeida Soares and J. da Silva Rodrigues. *Rev Brasil Cir* 61(9/10):136-140, 1971. (12 references)

5044 THE PROCESS OF BLASTIC TRANSFORMATION OF LYMPHOCYTES IN THE IMMUNOLOGY OF NEOPLASTIC DISEASES. (Rus.) Zhukhina, G. Ye. (N. N. Petrov Sci. Res. Inst. Oncol. USSR). *Vop Onkol* 18(6):91-96, 1972. (66 references)

5045 ON THE POSSIBILITY OF THE DETERMINATION OF CARCINOGENIC COMPOUND DOSE LIMITS. (Rus.) Neyman, I. N. (Inst. Nutr., USSR Acad. Med. Sci., Moscow). *Gig Sanit* (5):90-93, 1972. (32 references)

5046 THE SIGNIFICANCE OF TUMOR VIRUSES FOR HUMANS AND ANIMALS. (Ger.) Bauer, H. (Robert Koch Inst. Berlin, Germany). *Z Allg Med/Landarzt* 48(8):373, 1972. (No references)

5047 CONSIDERATIONS ON THE METABOLISM OF THE NEOPLASTIC CELL. (It.) Floridi, A.

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Queen Helen Tumor Res. Inst. Rome, Italy). *Recent Progr Med (Roma)* 52(2):117-135, 1972. (59 references)

0048 GROWTH AND CELLULAR CYCLE OF HUMAN TUMORS. (It.) Pileri, A. (Med. Clin. U. Torino, Italy) and G. L. Pagliardi. *Recent Progr Med (Roma)* 52(2):136-151, 1972. (64 references)

0049 EVIDENCE FOR IMMUNE REACTIVITY AGAINST NEOPLASMS. (E.) McKhann, C. F. (Dept. Surg., Microbiol., U. Minnesota, Minneapolis) and S. M. Jagarlamoodu. *Transplant Rev* 7:55-77, 1971. (55 references)

0050 CANCER MORTALITY IN THE 1960's. (E.) Anonymous. *Stat Bull Metropol Life Ins Co* 53:2-5, 1972. (No references)

0051 THE ROLE OF TUMOR VIRUSES IN BASIC RESEARCH AND MEDICINE. (E.) Weil, R. (Dept. Molecular Biol., U. Geneva, Switzerland). *Triangle* 10(1):1-10, 1971. (55 references)

0052 VIRUSES AND NEOPLASIA. (E.) Rapp, F. (Pennsylvania State U. Coll. Med., Hershey, Pa.). *Hosp Pract* 6(5):49-58, 1971. (No references)

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0059 TOXICITY AND CARCINOGENICITY OF AFLATOXIN.

(Rus.) Beloshapko, A. A. (Inst. Nutr., USSR Acad. Med. Sci., Moscow). *Pat Fiziol Eksp Ter* 16(2):83-88, 1972. (88 references)

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5061 PRECANCEROUS LESIONS OF THE LARYNX. THE IMPORTANCE OF CYTOLOGY. (Sp.) Infante Sanchez, J. C. (Fac. Med., Valladolid, Spain) and J. H. Oteruelo. *Acta Otorinolaring Iber Amer* 22(6):736-758, 1971. (16 references)

5062 SUB-ACUTE MYELO-MONOCYTIC LEUKEMIA. A STUDY OF 27 CASES AND REVIEW OF THE LITERATURE. (Fr.) Zittoun, R. (Hotel-Dieu Hemat. Serv. Paris, France), A. Bernadou, G. Bilski-Pasquier and J. Bousser. *Sem Hop Paris* 48(27):1943-1956, 1972. (107 references)

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5064 HORMONE-INDUCED STIMULANT EFFECTS. DOSE AND ADMINISTRATION OF CARCINOGENS IN EXPERIMENTAL MAMMARY GLAND TUMORS. (Por.) Anonymous. *Bol Inst Port Oncol Francisco Gentil* 38(11):1-3, 1971. (No references)

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5067 PRECANCEROSES. EARLY DETECTION OF BREAST CARCINOMA. (Ger.) Eckmann, L. (Tiefenau Hosp. U. Bern, Switzerland). *Praxis* 61(32):1012-1013, 1972. (No references)

5068 TUMORIGENESIS VIEWED AS AN IMMUNOLOGICAL PROBLEM. (Ger.) Rapp, W. (Med. Clin. U. Heidelberg, Germany). *Med Welt* 23(21):788-792, 1972. (28 references)

5069 FETOPROTEINS IN HUMAN TUMOR CELLS. (Sw.) Wahren, B. (Natl. Bacteriol. Lab.,

Stockholm, Sweden), A. Fagraeus and J. Stjernswärd.
Läkartidningen 69(27):3236-3240, 1972. (28 references)

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 AND ALCOHOL. (Ger.) Schneiderbaur, A.
(City Hosp. Vienna-Lainz, Austria). *Med Welt*
23(20):751-754, 1972. (No references)

5071 VIRUS AND CANCER. (Por.) Anonymous.
 Bol Inst Port Oncol Francisco Gentil
39(1):1-3, 1972. (No references)

- 072 TUMOR INHIBITION, PERSISTENCE, AND BINDING OF ACTINOMYCIN D IN MOUSE SKIN. (E.)
 Regal, A. (New York U. Sch. Med., N.Y.), T. Honohan, I. Schroeder, C. Katz and B. L. Van Duuren. *Cancer Res* 32(7):1384-1390, 1972.

Female ICR/Ha Swiss mice were given 2 µg actinomycin D (AMD) by topical application to dorsal skin 31 days after treatment with 7,12-dimethylbenz(a)anthracene (DMBA) and 90 days before treatment with phorbol myristate acetate (PMA), a DMBA carcinogenesis promoter. Papilloma development was reduced by 63% in mice given AMD. Inhibition was 61% when AMD was given 90 days after DMBA and 14 days before PMA. AMD could be isolated from mouse skin until six days after application (3% of the AMD dose was recovered at this time). When AMD-methyl-¹⁴C (AMD-¹⁴C) was applied to mouse skin, 0.042% of the dose applied could be recovered in skin 28 days after application. Skins treated with AMD-¹⁴C were extracted with ethyl acetate, methanol or water; the results suggested that AMD bound to mouse skin in several different ways. Radioactivity was demonstrated in extracted skin; this radioactivity appeared to be unchanged AMD-¹⁴C. Eighty-eight percent of residual reactivity could be extracted with 4 M CsCl in 0.01 M Tris HCl at pH 8, while AMD-¹⁴C bound to mouse liver DNA could not be extracted. This suggested that AMD-¹⁴C was not bound to DNA. Autoradiography of AMD-¹⁴C-treated skins revealed that AMD persisted around hair follicles. No radioactivity was seen localized over cells (cytoplasm or nuclei).

- 5073 GROWTH KINETICS OF DIETHYLNITROSAMINE-INDUCED, ENZYME-DEFICIENT "PRENEOPLASTIC" LIVER CELL POPULATIONS *IN VIVO* AND *IN VITRO*. (E.)
 Rabes, H. M. (Inst. Path., U. Munich, West Germany), P. Scholze and B. Jantsch. *Cancer Res* 32(11):2577-2586, 1972.

Rats fed 5 mg diethylnitrosamine/kg/day died from hepatocellular carcinoma after 138.0 ± 10.7 days ($n=258$). Thirty days after start of feeding, circumscribed areas of deficiencies of glucose 6-phosphatase and adenosine triphosphatase appeared in the enzyme histochemical preparation of the liver. The number of enzyme-deficient areas increased approximately exponentially until the 70th day, after which it remained stationary. The enzyme-deficient areas of the liver sections were grouped into 54 classes according to size as measured by planimetry (increment/class, 0.9584 sq mm) as a function of time. The results showed that only areas of Class 1 to 8 (0.0584 to 0.467 sq mm) were present until the 80th day. Thereafter the number of larger areas up to Class 54 (3.154 sq mm) increased discontinuously. In autoradiograms prepared after seven injections of thymidine-³H at 6-hr intervals, at early stages the labeling index of hepatocytes of enzyme-deficient areas was not significantly different from the surrounding parenchyma. From the 90th day onward, however, it greatly increased in individual enzyme-deficient areas, while others maintained a low labeling index. Hepatocytes from nodular enzyme-deficient portions of liver tissue of diethylnitrosamine-

fed rats proliferated *in vitro*, in contrast to those of normal adult liver of control rats. The thymidine-³H labeling index of these cultured hepatocytes 30 min after addition of thymidine-³H differed by a factor of about 25 between individual liver explants of diethylnitrosamine-fed rats under standardized culture conditions. Foci of enhanced proliferation were seen within slowly proliferating hepatocytes. The varying behavior of the enzyme-deficient cell populations, as demonstrated *in vivo* and *in vitro*, indicates that they are not a homogeneous preneoplastic population but rather potentially preneoplastic cells in various stages of development. Rapidly proliferating subpopulations of the enzyme-deficient cell groups might be foci of origin of hepatocellular carcinomas.

- 5074 NEWER CONCEPTS OF CANCER OF THE COLON AND RECTUM: SIMILARITIES BETWEEN HUMAN AND EXPERIMENTALLY INDUCED TUMORS OF THE LARGE INTESTINE. (E.) Spjut, H. J. (Baylor Coll. Med., Houston, Tex.). *Dis Colon Rectum* 15(2):94-99, 1972.

The induction of intestinal neoplasms by 3-2'-dimethyl-4-aminobiphenyl (DMAB) was studied in male and female white Wistar rats which received the compound (2 mg/100 g body wt) according to a variety of experimental procedures. The types of experimentally induced neoplasms and their patterns of induction and growth were compared with those of previously observed human colonic tumors. The DMAB-induced rat intestinal neoplasms were grossly similar to human tumors in that the majority of both the benign and malignant lesions were polypoid. As with human tumors, the larger rat intestinal tumors tended to be malignant. In experimentally induced colonic neoplasms and those that occur in the human, the incidences of the neoplasms in males and females were fairly similar. The distributions of DMAB-induced rat intestinal neoplasms and those seen in the human large intestine were similar. Like humans, animals bearing colonic neoplasms were prone to develop other tumors in other parts of the body. No ultrastructural differences were observed between the benign and malignant intestinal neoplasms of the rat and human. Unlike human colonic tumors, however, the DMAB-induced rat intestinal neoplasms did not metastasize.

- 5075 LYSOSOMAL ENZYME ACTIVITY AS AFFECTED BY AFLATOXIN AND MITOMYCIN C. (Rus.)
 Pokrovskiy, A. A. (N. I. Pirogov 2nd Med. Inst. Moscow, USSR), L. V. Kravchenko and V. A. Tutel'yan. *Biokhimiya* 36(4):690-696, 1971.

Lysosomal enzymes as affected by aflatoxin and mitomycin C were studied. Aflatoxin (15 mg/kg) was administered through a gastric catheter to one group of Wistar rats. Mitomycin C (2.5 mg/kg) was administered i.p. in another group of rats. The animals were killed 1-96 hr after the introduction of antibiotics to obtain liver homogenates and lysosomal fractions. The following six lysosomal enzymes were studied spectrophotometrically: DNase, arylsulfatases A and B, β -glucuronidase, β -acetylglucosaminidase,

β -galactosidase, and β -glucosidase. The activity of the liver lysosomal enzymes increased after aflatoxin introduction. In three hr, DNase activity reached 168% of the control level; Arylsulfatases A and B and β -glucuronidase increased to 141.5 and 121%, resp. These enzymes reached maximum levels in approximately 49 hr. An electron microscopic study showed a significant increase in the number of lysosomes in the liver cells during these periods. Mitomycin C led to decreases in most enzymes studied: β -glucosidase decreased two times; β -glucuronidase and β -acetylglucosaminidase were 86 and 88% of the control volumes in three hr, remaining more or less at the same levels for 6-96 hr.

- 5076 URINARY 7-METHYL GUANINE EXCRETION OF THE RAT AFTER A SINGLE APPLICATION OF DIFFERENT CARCINOGENS. (Ger.) Weyland, P. (Max-Planck Inst. Biochem., Munich, West Germany), H. J. Gross and H. Dannenberg. *Z Krebsforsch* 77:141-149, 1972.

Urinary 7-methyl guanine excretion of Sprague-Dawley rats was followed up to 21 days after a single high dose of the carcinogens: dimethyl nitrosamine, diethyl nitrosamine, N-nitroso morpholine, trans-dimethylamino stilbene, and 9,10-dimethyl-benzanthracene. The carcinogens were administered orally or by i.p. injection. The normal amount of 7-methyl guanine excreted by rats was 210-255 γ /day. A perceptible increase in 7-methyl guanine excretion occurred only in the case of dimethylnitrosamine, in four animals who died on the third day after i.p. administration of 30 mg/kg of the compound. In the surviving animals, after an increase on the first day, there was a transitory drop with a minimum at 3 days. The other carcinogens all caused an immediate decrease in urinary 7-methyl guanine excretion which lasted six-nine days. Increased excretion of 7-methyl guanine may be due to the methylation of guanine in nucleic acids by dimethylnitrosamine along with normal degradation, with a further increase caused by depurination of the methylated nucleic acid. Decreased excretion may be due to damage to the kidneys, or a slow degradation of nucleic acids by the inhibition of nuclease, a decrease in methylation or an increase in degradation of 7-methyl guanidine.

- 5077 ONCOGENICITY OF 1-(4-CHLOROPHENYL)-1-PHENYL-2-PROPYL CARBAMATE FOR RATS. (E.) Harris, P. N. (Eli Lilly Co., Greenfield, Ind.), W. R. Gibson and R. D. Dillard. *Toxicol Appl Pharmacol* 21(3):414-418, 1972.

Male and female rats, aged four to six wk, were fed 1-(4-chlorophenyl)-1-phenyl-2-propyl carbamate as 0.025, 0.05 or 0.1% of their diet. All but four of 60 rats given the compound developed tumors; 36 rats had multiple tumors of the same type and 26 had more than one type of tumor. Tumors developed earlier in females than in males, and in females the commonest type of tumor was mammary adenocarcinoma. The most common tumor types in males were duodenal and upper jejunal tumors. Other tumors which developed were intracranial tumors, oral carcinomas, Wilms' tumor and glioma.

- 5078 THE CYTOTOXIC EFFECT OF ETHYLNITROSOUREA AND METHYLNITROSOUREA ON THE NERVOUS SYSTEM OF THE RAT AT DIFFERENT STAGES OF DEVELOPMENT. (E.) Bosch, D. A. (Dept. Path., U. Groningen, Netherlands), P. O. Gerrits and E. J. Ebels. *Z Krebsforsch* 77(4):308-318, 1972.

Rats one to 30 days old were injected with ethylnitrosourea (ENU) or methylnitrosourea (MNU) in amounts ranging from 20-240 mg/kg. Six hr after ENU or MNU administration, the rats were sacrificed and degree of cell damage was observed in the central nervous system; the peripheral nervous system, including trigeminal nerves and Gasserian ganglia; intestines and kidneys. In rats given 240 mg/kg ENU, a distinct cytotoxic effect was seen only in areas of active cell proliferation; degenerative cells in the central nervous system were confined to matrices and cell streams originating from them. Cells concerned with myelination were most involved in trigeminal nerves, while capsule cells were most involved in Gasserian ganglia. Cytotoxic changes were also seen in intestinal crypts and in kidney cells. Nondividing cells were resistant to the cytotoxicity of the agents. The cytotoxicity of ENU and MNU appeared to depend on the amount of alkylating groups administered in a dose. Equimolar doses of ENU and MNU produced equal proportions of lethally damaged cells and equal degrees of mitotic inhibition. Above 120 mg/kg of ENU or MNU, mitotic inhibition was complete.

- 5079 EFFECT OF DIETHYLNITROSAMINE (DENA) AND INFLUENZA VIRUSES ON THE INDUCTION OF LUNG CARCINOMAS IN MICE. (Ger.) Schmidt-Ruppin, K. H. (Pharmaceutic Res. Lab. J. R. Geigy AG, Basel, Switzerland), G. Papadopolu. *Z Krebsforsch* 77:150-154, 1972.

Groups of NMRI mice (20-25 g) were injected (nasal route) every four wk for six months with 0.05 ml ml Hanks solution containing sublethal doses (LD 10) of the influenza viruses A₂/Bethesda 10/63 (group A) and PR8/EIK (group B), or Hanks solution alone (group C). Surviving mice (39 out of 50 group A, 31 out of 60 group B and 25 out of 50 group C) were then fed diethylnitrosamine (DENA) in daily drinking water (5 ml containing 0.04 mg/ml DENA) for an additional six months (total: 36 mg/animal or 1080 mg/kg). A statistically significant increase in primary lung carcinoma was observed in surviving animals of groups A (78.2%) and B (58.3%) as compared with those of group C (10.5%), suggesting a strong cocarcinogenic activity of influenza virus and DENA.

- 5080 TUMORIGENICITY OF FIVE CYCLIC NITROSAMINES IN MRC RATS. (E.) Garcia, H. (Eppley Inst., Res. Cancer Omaha, Nebr.) and W. Lijinsky. *Z Krebsforsch* 77(4):257-261, 1972.

Thirty MCA rats were given 2 mg of one of the following nitrosamines in their drinking water, five days/wk for 50 wk: nitrosopiperidine, nitroso-morpholine, dinitrosopiperazine, nitrosoheptamethyleneimine, and N-nitroso-3-pyrroline. Nitrosoheptamethyleneimine caused a total of 26 squamous

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tumors in trachea, lung, esophagus and nasal cavities. Nitrosopiperazine caused a total of 14 tumors in liver and nasal cavities. Nitrosomorpholine caused a total of 19 tumors in liver, esophagus and nasal cavities. Nitrosopiperidine caused a total of 30 tumors in trachea, pharynx, larynx, liver, esophagus and nasal cavities. N-nitroso-3-pyrroline was the weakest carcinogen of the five; it caused a total of four tumors in liver and nasal cavities. Reasons for the pronounced organ specificities of the five nitrosamines are discussed.

5081 QUANTITATION OF ARYL HYDROCARBON HYDROXYLASE ACTIVITY IN INDIVIDUAL FETAL HAMSTER CELLS *IN VITRO*. (E.) Kouri, R. E. (Inst. Radiat. Biol., U. Tennessee, Knoxville), R. A. Lubet and D. Q. Brown. *J Nat Cancer Inst* 49(4):993-1005, 1972.

Aryl hydrocarbon hydroxylase (AHH) activity in individual fetal hamster cells was quantified by using a new microfluorometric technique. Treatment of fetal hamster cells with benzo(a)pyrene (BP) was followed by increased fluorescence at 520 nm. Several experiments indicated that the increased green fluorescence presented hydroxylated BP metabolites and was related to AHH activity. This fluorescence had the same spectrum as 3-hydroxybenzo(a)pyrene (3-OH BP), and the increase in fluorescence was related to the age of the hamster fetuses and the concentration of BP. Cells lacking AHH showed no increase in fluorescence, and chemicals known to inhibit or induce AHH activity altered the fluorescence accordingly. Amounts of extracellular 3-OH BP extracted from the culture medium paralleled intracellular concentrations, and ratios of extracellular to intracellular 3-OH BP allowed for an estimated average turnover time of 15 minutes for this metabolite. The rapid turnover rate suggested that amounts of intracellular 3-OH BP measured at a given time was an index of the number of active enzyme sites or the relative activity of these sites. Thus this microfluorometric technique can be used to describe the cytologic distribution of BP and its major metabolites, and to quantitate the amount of AHH metabolism proceeding at a given time.

5082 A STUDY OF H-PROTEINS IN THE LIVER OF ANIMALS WITH VARIED SENSITIVITY TO CARCINOGENIC SUBSTANCES. (Rus.) Kaledin, V. I. (Inst. Cytol. Genet., Siberian Branch, Acad. Sci. USSR, Novosibirsk). *Vopr Onkol* 18(6):57-60, 1972.

Extracts of the livers of Wistar rats, CC57Br and C3H mice, hamsters, guinea pigs, and rabbits were obtained by centrifuging standard homogenates of the liver of individual animals. The animals received azo dyes through the esophagus; the rats received 10 mg 4-dimethylaminoazobenzene (DAB); the mice received 5 mg aminoazotoluene or s.c. injections of 2.5% solution of DAB and azobenzene (15 mg/100 g). H-protein preparations were obtained from liver extracts by a chromatographic method. The h-protein level was studied by a radial agar immunodiffusion method. A total of five protein preparations containing DAB was obtained. An immunological

analysis of these preparations showed two fractions--h-A and h-B. With the aid of antisera obtained against the isolated protein, it was determined that both fractions from the liver of animals sensitive to carcinogenic aminoazo dyes were not specific (to these animals). But h-protein fractions not combining with carcinogens were not identical with h-proteins of the rat liver in terms of antigenic specificity and electric charge. Thus, differences in the sensitivity to carcinogens are related to the variable level of h-protein fractions in the organs. There was a correlation between the content of h-protein in the liver of adult white rats and mice and their sensitivity to the carcinogens. Thus, combination with h-protein fractions is a condition of the carcinogenic effect of azo dyes and aromatic amines.

5083 STUDIES OF MAMMARY CARCINOMA INDUCED BY 7,12-DIMETHYLBENZ(a)ANTHRACENE ADMINISTRATION. (E.) Murad, T. M. (Div. Clin. Cytol., Ohio State U., Columbus) and E. von Haam. *Cancer Res* 32(7):1404-1415, 1972.

Seventy-two female rats were injected i.v. with 2 mg of 7,12-dimethylbenz(a)anthracene (DMBA); 173 mammary carcinomas developed. These were observed during their development by light and electron microscopy. Multiple tumors and tumors with different histological patterns often appeared on the same rat. Surgical removal of the first primary tumor did not prevent further tumor development; however, no metastases were seen in any DMBA-treated rat. The earliest change in breast tissue was focal hyperplasia of the lining cells of the secretory units. Both epithelial and myoepithelial cells participated in the early stages of tumorigenesis; stromal tissue also showed early proliferation. The enzyme alkaline phosphatase continued to be reactive on the plasma membranes of proliferating myoepithelial cells. Tumors were removed from five to ten wk after DMBA. Seven tumor types were seen: adenoid cystic carcinoma, adenocarcinoma, solid medullary carcinoma, papillary carcinoma, follicular and pseudofollicular carcinoma, myxoid carcinoma and *in situ* ductular (lobular) carcinoma. Proliferation of epithelial and myoepithelial cells, when present in relatively equal proportions, may be the cause for the absence of metastases.

5084 ENHANCEMENT BY PHENOBARBITAL OF 2-ACETYLAMINOFLUORENE-INDUCED HEPATIC TUMORS IN THE RAT: CONSEQUENCES OF VARIOUS TEMPORAL COMBINATIONS OF 2-ACETYLAMINOFLUORENE AND PHENOBARBITAL TREATMENTS. (E.) Peraino, C. (Argonne Natl. Lab., Ill.), R. J. M. Fry and E. Staffeldt. *Argonne Nat Lab Ann Report* 7770:44-45, 1971.

Rats were fed 2-acetylaminofluorene (AAF) as 0.02 or 0.05% of diet; after AAF feeding, some rats were given phenobarbital in various regimens. Liver tumor incidence was increased by phenobarbital; rats given AAF only had a 4.2% tumor incidence by 164 days after the start of the experiment, while rats given phenobarbital and AAF had a 42.9% tumor incidence.

Shortening exposure to phenobarbital reduced but did not abolish enhancement of AAF tumorigenesis. Delaying administration of phenobarbital for ten days after AAF increased tumor incidence over that seen when phenobarbital was given immediately after AAF.

- 5085 THE ROLE OF THE KIDNEYS IN DISORDERS OF PORPHYRIN METABOLISM DURING CARCINOGENESIS INDUCED WITH LEAD ACETATE. (E.) Zawirska, B. (Med. Sch., Wrocław, Poland) and K. Medras. *Arch Immunol Therap Exp (Warsz)* 20:257-272, 1972.

Rats aged 215 days were fed lead acetate (3 mg/rat/day) for 60-504 days and porphyrin contents of kidneys, liver, bone marrow and 24-hr stools and urine were observed. Rats fed lead acetate developed hyperplasia in different organs and showed increased porphyrin contents compared with rats not fed lead acetate. The increase in porphyrin contents was especially conspicuous in rats fed lead acetate for 307 days or longer. Increases in porphyrin levels were more pronounced in male than in female rats. Porphyrin levels, and especially uroporphyrin levels, were especially high in kidneys of treated rats; in some cases, the amount of uroporphyrin in kidneys exceeded that in other organs by as much as 3-5-fold. Differences in porphyrin contents in urine and stools between lead acetate-fed rats and control rats were not statistically significant.

- 5086 *IN VIVO* AND *IN VITRO* STUDIES ON UTERINE ADENOCARCINOMA OF THE RAT INDUCED BY 7,12-DIMETHYLBENZ(A)ANTHRACENE. (E.) Sekiya, S. (Sch. Med., Chiba U., Japan), H. Takamizawa, F. Wang, T. Takane and T. Kuwata. *Am J Obstet Gynecol* 113(5):691-695, 1972.

Pellets of 7,12-dimethylbenz(a)anthracene (DMBA) were placed in the gestation sacs of rats pregnant for 10-12 days. Histologically different tumor types were induced, but adenocarcinoma was the most common. Uterine adenocarcinomas 219 and 314 days after DMBA treatment were established in culture. Outgrowth of epithelial cells was seen by two months after establishment of cultures, and epithelial cell cultures showed active proliferation. When the cultured epithelial cells were implanted s.c. into isologous rats, tumors developed which metastasized to viscera; the metastases had the histology of adenocarcinomas. Two distinct types of clonal lines were established from adenocarcinoma cells in culture: a highly tumorigenic clone (HTP) and a weakly tumorigenic clone (LTP). HTP was isolated from adenocarcinoma cells cultured in semisolid agar medium, LTP from tumor cells cultured in liquid medium. HTP and LTP cloned cells differed in colony-forming ability in semisolid agar and in tumorigenicity in isologous hosts.

- 5087 AUTORADIOGRAPHIC CHARACTERISTIC OF EXPERIMENTAL THYROID TUMORS IN RAT. (E.) Christov, K. (Cancer Res. Inst., Sofia, Bulgaria). *Endokrinologie* 59(3):382-390, 1972.

Male and female rats were treated with i.p. or oral doses of 30 μ Ci 131 I given alone or together with methylthiouracil (MTU). Thyroids of untreated and 131 I- and/or MTU-treated rats were removed between 365-600 days and subjected to autoradiography to detect organically bound 131 I (control rats, not otherwise treated, were nevertheless given 131 I in one dose for autoradiography). Thyroid follicles of control rats accumulated considerable 131 I. Most of the 107 epithelial tumors seen in the 80 thyroids examined developed in rats given 131 I and MTU; few tumors accumulated 131 I. Those tumors which did take up 131 I were usually of the follicular type. Most papilliferous tumors did not take up 131 I. Carcinomas were found only in rats given 131 I and MTU; most carcinomas lacked 131 I uptake.

- 5088 EXPERIMENTALLY INDUCED TUMORS OF THE PERIPHERAL NERVOUS SYSTEM IN THE DOG. (Ger.) Stavrou, D. (Vet. Med. School, U. Munich, West Germany) and K. G. Haglid. *Naturwissenschaften* 59(7):317-318, 1972.

The neuro-oncogenic effect of N-methyl-nitrosourea was tested in dogs who were injected with a single dose of 20 mg/kg at 30-day intervals up to the time of death. Three of the six animals died during the seventh or eighth month and the other three were found to have tumors in the 21st, 23rd and 25th month, resp. Tumor sites were in the heart, the duodenum and the cauda equina, resp. The dog with the peripheral nervous system (PNS) duodenal tumor also exhibited multiple hemangioendotheliomas in various organs (brain, spinal column, lungs, spleen). The other two dogs with neurinomas suffered a diffuse hemorrhagic diathesis terminally. The histological examination revealed well-differentiated PNS tumors with typical schwannoma structures. The results demonstrate that PNS tumors may be induced in dogs, as well as in rodents, with N-methyl-nitrosourea.

- 5089 HISTOLOGICAL AND AUTORADIOGRAPHICAL STUDIES ON INTESTINAL TUMORS OF RAT INDUCED BY ORAL ADMINISTRATION OF N,N'-2,7-FLUORENYLENEBISACETAMIDE. (E.) Yamada, S. (Aichi Cancer Ctr. Res. Inst., Nagoya, Japan), M. Ito and T. Nagayo. *Gann* 62(6):471-478, 1971.

Buffalo rats were fed a diet containing 0.025% N,N'-2,7-fluorenylenebisacetamide (2,7-FAA) beginning at age one to three months. Intestinal tumors occurred in 51.1% of 188 rats which survived 100 days of 2,7-FAA feeding. Tumor incidence in male rats was 56.5%, in females, 49.9%. Half of all intestinal tumors arose in the terminal ileum or ascending colon. The average number of tumors/rat was 3.8; more females than males had only one tumor/rat. Most tumors were 1 cm or less in diameter and most were adenomas. Tumors were classified as hemispheric, plateau, polypoid, polyp and umbilicated. Histological atypism was most common in umbilicated tumors; lymph node metastases were associated with 12.5% of these tumors. Some rats fed 2,7-FAA were injected with 3 H-thymidine for autoradiographic study. One hr postinjection,

³H-thymidine was seen only in proliferating cells of the intestinal mucosal glandular epithelium in rats not fed 2,7-FAA. In tumor-bearing rats fed 2,7-FAA, label was distributed diffusely in neoplastic tissue.

- 5090 THE STUDY OF C-CELLS OF THE THYROID IN RATS IN TUMOR INDUCTION. (Rus.) Kashulina, A. P. (P. A. Gertsen Res. Inst. Oncol., Moscow, USSR) and L. I. Rybakova. *Vopr Onkol* 18(8):62-64, 1972.

The state of thyroid gland C-cells in various stages of experimental blastomogenesis was studied in rats. Methylcholanthrene dissolved in peach oil (2 mg/100 g body wt) was administered s.c. to Wistar rats. Thyroid glands were studied 1-7 months after 20-methylcholanthrene introduction by Gomori's method, using paraldehyde-fuchsin coloring. C-cells were orientated toward the blood vessels and localized in interfollicular spaces of the peripheral sections of the gland. In rats receiving 20-methylcholanthrene, Gomori positive granules increased together with degenerating and pycnotic cells. Thus, changes indicating a weakening of the functional activity of C-cells were observed in early stages (1-3 months) of chemical carcinogenesis. These changes intensified with tumor progression.

- 5091 CARCINOGENICITY AND NEUROTOXICITY OF CYCASIN WITH SPECIAL REFERENCE TO SPECIES DIFFERENCES. (E.) Hirono, I. (Gifu U. Sch. Med., Japan). *Fed Proc* 31(5):1943-1947, 1972.

Tumor development in mice (dd strain), rats, hamsters, rabbits and guinea pigs given single s.c. or intragastric doses of cycasin was compared. Rabbits and guinea pigs failed to develop tumors after cycasin administration. In rats, kidneys and intestines were the main target organs, while the liver was the main target in mice and hamsters. Hepatocellular carcinomas were seen most often in mice, while intrahepatic bile duct alterations were the main lesions in hamster livers. Hepatocellular carcinomas, common in newborn hamsters, were not seen in adults. Cycasin was found to produce neurologic disorders, associated with necrosis of the external granular-layer of the cerebellum, in mice and hamsters.

- 5092 THE METABOLISM AND CARCINOGENICITY OF 2-ACETAMIDONAPHTHALENE. (E.) Conzelman, G. M., Jr. (Christ Hosp. Inst. Med. Res., Cincinnati, O.) and L. E. Flanders, III. *Proc West Pharmacol Soc* 15:96-99, 1972.

The metabolism of 2-acetamidonaphthalene was studied in urine of beagle dogs given a single 25 mg/kg oral dose of the compound or 65 mg/kg doses daily, six days/wk, for 21-24 months. Twenty-four hr urine specimens from dogs given 25 mg/kg 2-acetamidonaphthalene contained <3% of the dose as ortho-hydroxy amines and <2.5% as free diazotizable aromatic amines. Ninety percent of the 2-acetamidonaphthalene dose was ex-

creted. Urine specimens from dogs given the 65 mg/kg dose contained at least four metabolites which were diazotizable after acid hydrolysis. One of these metabolites was 2-acetamido-6-naphthyl glucuronide. No urinary bladder tumors were seen in any animal given the chronic dosage of 2-acetamidonaphthalene.

- 5093 SPECIFICITY OF TRANSFER RIBONUCLEIC ACID METHYLASES FROM NORMAL MOUSE COLON AND 1,2-DIMETHYLHYDRAZINE-INDUCED COLON TUMORS. (E.) Pegg, A. E. (Middlesex Hosp. Med. Sch., London, England). *Biochem J* 129(3):40, 1972.

The methylation of several tRNA species from *E. coli* and purified yeast by extracts of normal mouse colon and of 1,2-dimethylhydrazine-induced colonic tumors was studied. The following tRNA preparations from *E. coli* were found to be substrates for the formation of the methylated bases indicated (in parentheses): glutamic acid tRNA (5-methylcytosine and 1-methyladenine); serine tRNA₃ (5-methylcytosine, 1-methyladenine, *N*²-methylguanine and *N*²*N*²-dimethylguanine); formylmethionine tRNA (1-methyladenine, *N*²-methylguanine, 1-methylguanine and 5-methylcytosine). Phenylalanine and arginine tRNA from yeast were not methylated, but other tRNA preparations were. Enzymes from tumor tissue produced products with each of the substrates, similar to those found with tRNA's from normal colon. However, the rate and extent of methylation were greater with the tumor tRNA extracts than with normal extracts.

- 5094 ELECTRON SPIN RESONANCE STUDY ON THE FREE RADICAL PRODUCTION FROM N-METHYL-N'-NITRO-N-NITROSOGUANIDINE. (E.) Nagata, C. (Nat'l. Cancer Res. Inst., Tokyo, Japan), M. Nakadate, Y. Ioki and A. Imamura. *Cann* 63(4):471-481, 1972.

N-methyl-N'-nitro-N-nitrosoguanidine (MNNG) was stirred with a magnetic stirrer or exposed to photoirradiation from a mercury lamp (wavelengths below 340 nm shielded); the electron spin resonance (ESR) spectra of stirred and irradiated samples were measured to study the production of free radicals by stirred and irradiated MNNG. A free radical with a characteristic ESR signal was produced from MNNG after only one hr of stirring. The free radical was stable; only a small decrease in ESR signal was seen after 170 days from stirring. The amount of free radical produced by stirring depended on pH; the optimum pH was 3-6, N-Ethyl-, N-propyl-, and N-butyl-N'-nitro-N-nitrosoguanidine were not converted to free radicals with clear ESR signals by magnetic stirring. Photoirradiation of MNNG for five minutes produced a free radical with an ESR similar to that of the radical produced by stirring. Wavelengths longer than 340 nm were effective in producing radicals, indicating that the genesis of the free radical was correlated with n- π^* transition at 400 nm. Photoirradiation also converted N-ethyl-, N-propyl-, and N-butyl-N'-nitro-N-nitrosoguanidine to free radicals with characteristic MNNG signals. Photoirradiated dimethylnitrosamine, gave no ESR signal (i.e., was not converted to a free radical). A carcinogenic

role is postulated for the free radical produced by MNNG.

- 5095 ON PENETRATION OF 3,4-BENZOPYRENE IN THE ORGANISM. (Rus.) Dorogokuplya, A. G. (Inst. Exp. Clin. Surg., Alma-Ata, USSR), A. I. Myasnikov, N. E. Zhirnova and A. N. Ninichenko. *Vopr Onkol* 18(8):70-72, 1972.

Benzo(a)pyrene is contained in smoked food products such as smoked sausage. The possibility of benzo(a)pyrene penetrating the body through such food products was studied. Four dogs received 1.0 kg smoked sausage and 1 liter sour cream. Three hr later blood and thoracic lymph samples were analyzed. In all animals, benzo(a)pyrene levels were higher in the lymph (0.01-0.014 γ /ml) than in the blood (0.0001-0.0003 γ /ml). This shows that benzo(a)pyrene penetrates the body through intestinal lymphatic ducts, the blood, and then organs. Invasion of the body by the carcinogen in the air was studied in 25 white rats exposed to air containing 8-36 mg/m³ benzo(a)pyrene. All 25 rats showed the carcinogen in various organs. Most rats showed benzo(a)pyrene in the lungs, trachea, and bronchi. In nine rats, the benzo(a)pyrene level in the gastric juice was 0.002-0.004 γ /g. Thus the carcinogen invaded the body via the respiratory tract (lung, trachea, and bronchi) and penetrated to the digestive organs (stomach). Twelve blood donors were on a diet containing 0.4 kg smoked sausage and 0.25 kg sour cream. Benzo(a)pyrene was detected in the blood of these donors three hr after eating. Benzo(a)pyrene level in the blood of 10 diesel automobile operators was 0.000003-0.0001 γ /ml.

- 5096 AN EXPERIMENTAL STUDY OF THE CARCINOGENIC EFFECT OF TUBAZID (ISONIAZID) AND PHTHIVAZID. (Rus.) Pershin, G. N. (S. Ordzhonikidze All-Union Pharm. Chem. Res. Inst., Moscow, USSR), O. O. Makeeva, A. A. Grushina and V. A. Chernov. *Vopr Onkol* 18(6):50-53, 1972.

The carcinogenic effects of Tubazid and Phthivazid in aqueous solution were studied in healthy white mice. One group of mice (100) received 1 mg Tubazid; a second group (100) received 2 mg phthivazid; and a third group (100) did not receive any drugs. Sixteen animals in the first group, 19 in the second group, 11 in the third group died within eight months. The animals were killed to study their internal organs. Tumors were detected in 7.4% of the control group, 35.7% of the Tubazid group, and 23.3% of the Phthivazid group. In the first group, adenomas of the lungs were seen in 27.6% and mammary gland tumors in 8.2%. Similarly, adenomas of the lungs were seen in 15.6% and mammary gland tumors in 7.8% in the second group.

- 5097 MACROPHAGES AND MULTINUCLEATE GIANT CELLS IN NITROSOQUINOLINE-INDUCED GRANULOMATA IN RATS: AN AUTORADIOGRAPHIC STUDY. (E.) Carter, R. L. (Royal Cancer Hosp., London, England) and J. D. B. Roberts. *J Pathol* 105(4):285-288, 1971.

Male Wistar rats were injected s.c. with 25 mg N-nitroso-2,2,4 trimethyl-1,2-dihydroquinoline (NTDQ); after NTDQ, the rats were injected with ³H-thymidine. Seven to 63 days after NTDQ, injection-site granulomas were removed and examined autoradiographically. By seven days, many macrophages were seen in granulomas. Multinucleate giant cells had replaced macrophages as the most prominent cells in the granulomas by 14-20 days. The turnover of macrophages was not uniform; short-lived and longer-lived macrophage populations were in evidence. Short-lived as well as long-lived macrophages took up NTDQ; macrophages which took up large amounts of NTDQ showed no nuclear labeling with ³H-thymidine. ³H-thymidine was also absent in giant cell nuclei. This indicated that giant cells were formed by fusion of macrophages which did not synthesize DNA.

- 5098 α -FETOPROTEIN AND HEPATOCARCINOGENESIS IN RATS FED 3'-METHYL-4-(DIMETHYLAMINO)-AZOBENZENE OR N-2-FLUORENYLACETAMIDE. (E.) Kitagawa, T. (Cancer Inst., Tokyo, Japan), T. Yokochi and H. Sugano. *Int J Cancer* 10(2):368-381, 1972.

The appearance of serum α -fetoprotein and its relation to hepatocarcinogenesis were studied in four different strains of rats fed a diet containing 3-methyl-4-(dimethylamino)azobenzene (MDAB) or N-2-fluorenylacetamide (FAA). The appearance of α -fetoprotein, as determined by immunoelectrophoretic methods, was biphasic showing an early (third to fifth wk) and a late appearance (15th to 24th wk, during the development of large carcinomas). The frequency of early appearance depended on the age, sex, and strain, being highest in younger male animals of the Donyu strain. The lowest frequency of early α -fetoprotein occurrence was found in Sprague-Dawley and ACI rats. These early changes were paralleled histologically by the appearance of proliferative oval cells and small hepatocytes. There was a good correlation between serum α -fetoprotein levels and the intensity of oval cell proliferation. In general, MDAB was a much stronger carcinogen than FAA in producing early serum α -fetoprotein. With the appearance of hyperplastic nodules beginning in the sixth wk, serum α -fetoprotein fell to very low levels or disappeared. With the development of hepatic carcinomas, which were usually multiple, serum α -fetoprotein levels again increased. Most MDAB-induced tumors were of the mixed type and required a minimal diameter of 10 mm before serum α -fetoprotein could be detected. The FAA-induced tumors, which were primarily trabecular, were relatively weak α -fetoprotein producers and required a diameter of over 20 mm for fetoprotein synthesis. The degree of early α -fetoprotein production correlated with the frequency of development of carcinomas which produced high α -fetoprotein levels. However, the early appearance of serum α -fetoprotein was not necessary for the subsequent development of liver carcinomas.

- 5099 ELECTRONIC STRUCTURE AND CARCINOGENIC ACTIVITY OF 3,4-BENZOPYRENE AND 1,2-BENZOPYRENE. (Ger.) Popp, F. A. (Radiation Clin. U. Marburg, West Germany). *Z Naturforsch [B]* 27(7):850-863, 1972.

Differences in the properties of electronic structures between 3,4-benzpyrene (BP), and 1,2-benzpyrene were used to construct a possible model of the mechanism of chemical carcinogenesis. From a resonance analysis, the following statements emerged: The first stage of chemical carcinogenesis consists of resonance coupling of the carcinogen sender with the bioreceptor imprisoner, in which electric dipole oscillations are caught and imprisoned, thus apparently damaging the structure of the receptor. The carcinogen disturbs the structure of the bioreceptor by excitons of a higher energy. The receptors are the DNA and RNA bases in which the hydrogen bridges are disrupted. This mechanism affects the 3,4-BP release but not the 1,2-BP. The 3,4-BP has better acceptor as well as donor abilities than the 1,2-BP; the overlapping and free valence of atom 17 of 3,4-BP is more conducive to coupling with the receptor than the 1,2-BP in every possible relative position. The excitons can be led in every direction within the 3,4-BP molecule, but can only move in one direction in the 1,2-BP.

5100 ALTERATION IN THE DISTRIBUTION OF BASIC SOLUBLE RAT LIVER PROTEINS DURING AZO DYE CARCINOGENESIS. (E.) Louis, C. J. (Dept. Path., U. Melbourne, Australia) and J. M. Blunck. *Cancer Res* 31(12):2110-2115, 1972.

Antigens of *h* protein and azoproteins were prepared from cell sap of livers of normal rats and rats fed or injected with 3'-methyl-4-dimethylaminoazobenzene (3'-MeDAB). Antibodies to these antigens were induced in mice by injecting them with cell sap antigens i.p. Ascites from injected rats were tapped and γ -globulin fractions were isolated and labeled with fluorescein isothiocyanate (FITC); FITC-labeled anti-*h* and antiazoprotein antisera were used as histoserological stains for sections of livers of normal rats and rats fed or injected with 3'-MeDAB. Anti-*h* protein serum stained cytoplasm of normal liver cells; fluorescence staining was uniformly distributed throughout cytoplasm. Similar cytoplasmic staining with anti-*h* protein was seen in 3'-MeDAB-treated liver sections. Pretreatment of normal liver sections with unlabeled anti-*h* protein followed by FITC-labeled antiazoprotein inhibited cytoplasmic fluorescence. Normal rat livers were stained by antiazoprotein serum; staining was concentrated in nuclear and plasma membranes, and to a lesser degree in cytoplasm. FITC-labeled antiazoprotein stained only cytoplasm in 3'-MeDAB-treated cells. This cytoplasm staining was inhibited by pretreating liver sections with unlabeled antiazoprotein serum but not by pretreatment with anti-*h* protein. Neither serum stained 3'-MeDAB-induced hepatoma cells.

5101 ULTRASTRUCTURAL ASPECT OF LESIONS INDUCED IN MOUSE LUNG BY N-NITROSO-N-METHYLURETHANE: WITH AN ATTEMPT AT INTERPRETATION OF CRYSTALLINE CELLULAR INCLUSIONS. (Fr.) Pluot, M. (Fac. Med. Reims, France), C. Hopfner, J. J. Adnet and T. Caulet. *Z Krebsforsch* 77(4):279-291, 1972.

A morphological study of pulmonary tumors induced in

mice by N-nitroso-N-methylurethane (NMUR) is described. Nuclei in the area of the tumor, are described with reference to their shape, volume, chromatin, interchromatin granules, nucleoli and nuclear membrane. The mitochondria in the cytoplasm and microbodies in contact with them are also detailed, as well as the Golgi apparatus. In a large number of tumor cells there appear crystalline spindle-shaped formations which cling together longitudinally, and are thought to be lipoproteins. In the peritumoral areas, a dense collagenic substance is described, as well as crystalline formations. The presence of some peritumoral capillaries of a fenestrated type may indicate a bronchial origin. Almost all tumoral cells include numerous microvilli, and lamellar intramitochondrial bodies are described. The constitution of the crystalline inclusions is discussed together with their induction by chemicals. It is suggested that they are formed in the endoplasmic reticulum; they occur either free in the intercellular space or may be phagocytosed by the macrophages of the peritumoral areas. Macrophage-like cells phagocytosing these crystals are found within the body of the tumor; most of these cells were proven to be real macrophages and some were found to be atypical tumor cells.

5102 PURIFICATION AND PROPERTIES OF THE PRINCIPAL LIVER PROTEIN CONJUGATE OF A HEPATIC CARCINOGEN. (E.) Sorof, S. (Inst. Cancer Res., Philadelphia, Pa.), V. M. Kish and B. Sani. *Biochem Biophys Res Commun* 48(4):860-865, 1972.

Adult rats were fed diets containing 0.058% 3'-methyl-4-dimethylaminoazobenzene (3'-Me-DAB) for 15-18 days. After 3'-Me-DAB feeding, the rats were killed and their livers perfused and homogenized to yield clear cytosol fractions. The main carcinogen-protein conjugate of rat liver cytosol was purified and characterized. This principal azocarcinogen-protein conjugate (h_2 -5S) was purified 204- to 286-fold compared to its concentration in whole liver. The isolated azoprotein was 88-91% pure according to gel electrophoresis. The subunit molecular wt of the azoprotein was 43,000 (minor component 28,000, trace component 38,000), indicating that the molecule (molecular wt 60,000-80,000) exists as a dimer. The subunits were apparently not disulfide-linked, since omission of β -mercaptoethanol before gel electrophoresis yielded protein of the same subunit size. The average subunit of the h_2 -5S azoprotein contained 0.7 mole of azo dye, equal to 1.4 moles dye/mole average protein (two subunits). The azoprotein was apparently not derived from liver arginase, and it differed from the previously isolated minor conjugate derived from liver protein.

5103 CARCINOGENICITY OF AZOXYMETHANE DEPENDENT ON AGE IN BD RATS. (E.) Druckrey, H. (Max Planck Inst. Immunobiol., Freiburg, West Germany) and A. Lange. *Fed Proc* 31(5):1482-1484, 1972.

Rats aged 1, 3, 10, 30 or 60 days were given single s.c. injections of 4, 6, 12, 20 or 40 mg/kg azoxyme-

thane; adult rats were given repeated weekly injections. All doses of azoxymethane were carcinogenic. Fourteen of 58 rats given azoxymethane at one day of age developed fatal malignant brain and nervous system tumors, mostly neurinomas of the trigeminal nerve. With increasing age at treatment, the yield of neurogenic malignant tumors decreased markedly. The yield of nephroblastomas was not dependent on the age of treated animals. Colonic and rectal adenocarcinomas were induced by a single dose of azoxymethane on the first day of life. Preliminary results suggest that with increasing age at treatment, the relative yield of intestinal tumors increases.

- 5104 CARCINOGENESIS IN TISSUE CULTURE. XVI. MALIGNANT TRANSFORMATION OF RAT CELLS BY N-METHYL-N'-NITRO-N-NITROSOGUANIDINE. (E.) Takii, M. (Fac. Med., Kyushu U., Fukuoka, Japan), R. Takaki and N. Okada. *Jap J Exp Med* 41(6):563-579, 1971.

Malignant transformation of thymus and lung cells from young rats was achieved in 15- and 25-day-old cultures given a single 2-hr exposure to 10 $\mu\text{g/ml}$ N-methyl-N'-nitro-N-nitrosoguanidine (NG) or seven 2-hr exposures to 1 $\mu\text{g/ml}$ NG. Loss of contact inhibition and a criss-cross arrangement of cells were observed two months after one exposure to 10 $\mu\text{g/ml}$ NG and 2 wk after the final exposure to 1 $\mu\text{g/ml}$ NG. In single-treated cells, morphological alterations and pleomorphism were seen by five months. Cultures receiving multiple treatments showed a considerable number of giant cells 2 wk after the last treatment. Cell proliferation rate in these cells increased but remained lower than that in untreated control cells. Rat thymus cells in 169-day-old cultures also underwent malignant transformation following seven exposures to 10 $\mu\text{g/ml}$ NG; however, no obvious changes occurred in the morphology of these cells. When NG-treated cells were inoculated s.c. into three syngeneic newborn rats, tumors developed in every case. Untreated cells produced no tumors. Cells transformed by a single NG treatment contained 68-83 chromosomes after 365 days of culture compared with 37-46 chromosomes in untreated cells. NG-transformed cells and control cells did not differ significantly in their resistance to the cytotoxic effect of NG. A higher colony-forming efficiency (CFE) was seen in soft agar for NG-transformed cells than for untreated cells, but the CFE of the transformed cells did not appear to correlate with tumorigenicity on implantation.

- 5105 MODIFICATION OF THE FLOW DICHROISM SPECTRUM OF RAT LIVER NUCLEAR DNA BY *IN VIVO* ALKYLATION WITH HEPATOCARCINOGENIC DIALKYLNITROSAMINES. (E.) Arcos, J. C. (U.S. Public Hlth. Service Hosp., New Orleans, La.), N. Venkatesan and M. F. Argus. *Gann* 62(6):523-533, 1971.

The differential flow dichroism (expressed as $\Delta\epsilon/M$) and the reduced dichroism ($\Delta\epsilon/\epsilon$) of DNA isolated from the livers of intact rats as well as of rats injected i.p. with dimethylnitrosamine (DMN) and diethylnitrosamine (DEN) were studied in 0.001, 0.01, and 0.1M NaCl (pH 7). The $\Delta\epsilon/M$ spectra of normal

liver DNA approximate is typical absorption spectrum and the increase of ionic strength has a strong hypochromic effect. Increase of ionic strength has, however, considerably less hypochromic effect of the $\Delta\epsilon/M$ of DMN-alkylated DNA and no effect on DEN-alkylated DNA. The $\Delta\epsilon/\epsilon$ of normal rat liver DNA increases about five-fold between 220 and 290 nm. The upward trend of the $\Delta\epsilon/\epsilon$ spectrum is interrupted by a peak at 250 nm (approximating the deoxyguanilic acid max. at pH 7) and a shoulder at 270-280 nm (approximating the highest absorption range of deoxycytidylic acid at pH 7). Increase of ionic strength brings about progressive lowering of the whole $\Delta\epsilon/\epsilon$ spectrum of normal DNA, but has little or no effect on the 250-nm peak and 270-280 nm shoulder. The $\Delta\epsilon/\epsilon$ spectra of the alkylated DNA's is appreciably lower in 0.001M NaCl than the $\Delta\epsilon/\epsilon$ of normal DNA, but the spectra change little with increase of the ionic strength. In contrast, unlike in normal DNA, the 250-nm peak of the alkylated DNA's progressively flattens by decreasing the ionic strength. The data suggest that at the alkylated G+C-rich segments the helix opens and "puffs" appear because of loss of hydrogen bonding. The "puffs", large at low ionic strength, are minimized by hydrophobic compression at high ionic strength.

- 5106 A STUDY ON POSSIBLE BLASTOMOGENIC EFFECT OF LUBRICATING OILS. (Rus.) Vasil'eva, N. N. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow), A. B. Linnik and A. K. Sgibnev. *Gig Tr Prof Zapol* 10:50-51, 1971.

The carcinogenicity of pentaerythrite ester oil (oil No. 1), diethylene glycol oil (oil No. 2), and a mixture of these two oils (No. 3) was studied using 218 hybrid mice (F_1 C57xCBA). Two drips of oil were applied on the previously depilated interscapular skin three times a week for one yr. The animals were studied for two yr. After two yr all surviving animals were sacrificed for study of the skin and the internal organs, which were paraffin-treated, formaldehyde-fixed and hematoxylin-eosin-stained. Application of the oil to the skin caused papilloma of the skin in only one case (oil No. 2). Lymphoreticulosarcoma was observed in six of 74 mice treated with oil No. 1 and in four of 70 treated with oil No. 3, while 315 control mice did not show any incidence of lymphoreticulosarcoma. However, the number of animals with tumors in all series of experiments did not exceed the number of control animals with tumors. Oil No. 2 (diethylene glycol) can be safely used as lubricating oil, while oil No. 1 (pentaerythrite ester oil) should be studied further in relation to its possible leukemia-inducing effect.

- 5107 MORPHOLOGY OF TUMORS OF THE NERVOUS SYSTEM PRODUCED BY ALKYLATION. (Ger.) Zülch, K. J. (Max-Planck Inst. Brain Res., Cologne, West Germany) and H. D. Mennel. *Zentralbl Neurochir* 32(5/6): 225-243, 1971.

A report is given on the morphology and localization of 1731 experimentally induced tumors of the brain, spinal cord, and peripheral nervous system. The tumors developed in rats, rabbits, or hamsters given chemical substances for which alkylation is assumed to be the common mode of action. Test results are classified according to substance applied and type of application, tumor type and incidence, number of test animals, number of tumors produced and their location. Iso- and polymorphous forms of tumors are distinguished according to a four degree scale: benign, semibenign, semimalignant, and malignant. Individual descriptions are given of glioma, ependymoma, neurinoma, sarcoma, hypophyseal adenoma, medulloepithelioma, esthesio-neuroepithelioma, and some rare tumors. The white matter was affected in 50% of the experimentally induced brain tumors, one-fifth of which were limited to the subependymal area. These were mainly small isomorphous gliomas. Twenty percent of all brain tumors occurred in the ventricular system. In the spinal cord, the preferred sites were the central canal or the area of the septum dorsale. Most tumors of the peripheral nervous system occurred in the trigeminal nerve. The implication of test results for the pathogenesis of tumors in man is discussed.

R. (Path. Inst. Med. Acad. Erfurt, East Germany). *Exp Pathol (Jena)* 6(3/4):158-166, 1972.

Tumor clones from dogs and rats in which central nervous system tumors were induced by methyl nitroso urea (MNU) were studied morphologically and cytogenetically in repeated cloning for purposes of characterization. The clones originated in the following primary tumors: clones PIE 9-1 and 9-2, a multiform glioblastoma induced in a dog by 20 mg/kg, (i.v.) at 4-week intervals, with a latency period of 426 days; and clone PIE 31-2, a gliosarcoma of the cerebrum, induced in a rat with a similar dose i.p. In the course of cloning, the individual clones developed from 20-40 cells/colony to a marked polymorphy. Giant cells with giant nuclei, or with smaller nuclei, were present with irregular numbers of nucleoli. There was a variable number of cell processes, which were more marked in clone PIE 31-2. Mitoses were confined mostly to mononuclear cells, generally unequal and often multipolar. Even long-term cultures did not reveal definite cell types. It is thus concluded that polymorphism occurs through cell fusions and multipolar mitoses. Analogous changes occurred during repeated *in vivo* transplantations.

5108 INDUCTION OF HEART TUMORS IN BD-RATS BY CONTINUOUS ORAL ADMINISTRATION OF THE CARCINOGEN 1-PYRIDYL-3,3-DIETHYL-TRIAZENE (PDET). (Ger.) Ivankovic, S. (Inst. Exp. Toxicol. Chemother. German Cancer Res. Ctr., Heidelberg, West Germany), H. Wohlenberg, H. D. Mennel and R. Preussmann. *Z Krebsforsch* 77(3):217-225, 1972.

5110 MORPHOLOGY OF TRANSPLACENTALLY INDUCED NEUROGENIC TUMORS IN SYRIAN HAMSTERS. (Ger.) Mennel, H. D. (Max Planck Inst. Brain Res., Cologne, West Germany) and K. J. Zülch. *Acta Neuropathol (Berl)* 21(3):194-203, 1972.

Fine tissue analysis of tumors induced by ethylnitrosourea (ENU) transplacentally in Syrian hamsters is presented. The ENU was injected i.v. on the 15th day of pregnancy in a dose of 30 mg/kg. The neonates were observed for neurological symptoms or indications of malnourishment when they were sacrificed and examined. Of 22 animals, 14 died with malignant tumors of the trigeminal, the peripheral subcutaneous or kidney types. In the 14 animals with tumors, there was a total of 16 tumors, five of which affected the trigeminal nerve or the Gasserian ganglion. These tumors appeared early and exhibited features typical of malignant neurinomas. Trigeminal tumors with marked regressive changes were also observed; such regressive changes are generally associated with peripheral tumors. With the onset of tumor growth, especially in the trigeminal and Gasserian ganglion, there was a direct increase of Schwann's cells between the boundaries of this nerve. The marked regressive changes appear to be a specific feature of the Syrian hamster species.

5111 POST- AND PRENATAL NERVOUS SYSTEM TUMOR INDUCTION WITH PHENYL-DIMETHYL-TRIAZENE IN THE RAT. (Ger.) Schneider, J. (Med. Acad. Erfurt, East Germany), R. Warzok and D. Schreiber. *Zentralbl Allg Pathol* 115:8-12, 1972.

Nervous system tumor induction by 1-phenyl-3,3-dimethyl-triazene (PDMT) was observed in two groups of Hauben rats: 44 young male and female rats

5109 *IN VITRO* BEHAVIOR OF CLONES OF GIANT CELL TUMORS EXPERIMENTALLY INDUCED IN THE CENTRAL NERVOUS SYSTEM OF DOG AND RAT. (Ger.) Thust,

given 10 mg/kg PDMT i.v., at biweekly intervals, as an oil emulsion in 10% ethanol (Group I); and 59 offspring from nine litters whose mothers had received 10 mg/kg PDMT on days 14, 16, 17, 22 or last day (23) of pregnancy (Group II). The last animal in Group I died after 755 days, and the sacrifice of Group II survivors was carried out after 980 days. Four out of the Group I animals developed cerebral tumors and five developed malignant extraneural tumors. A single i.v. injection of 10 mg/kg PDMT during the second half of pregnancy induced tumors of the central nervous system in eight of 59 offspring, and malignant tumors with predominantly newly differentiated lympho- and reticulosarcomas in 12 other offspring. The microcephalia observed in 20% of the offspring demonstrates that PDMT also exerts a teratogenic effect in the nervous system of rats. The results are compared with reports in the literature.

5112 KARYOLOGY OF 3-METHYLCHOLANTHRENE-INDUCED RHABDOMYOSARCOMAS. (It.) Basso, M. (Inst. Animal Biol. U. Padua, Italy). *Tumori* 58:107-120, 1972.

Three primary rhabdomyosarcomas, induced in adult female rats with a single dose of 3-methylcholanthrene (50 mg), were subjected to karyologic studies in an attempt to establish the effect of the neoplastic condition on the chromosomal setup of the rat. Monocellular tissue suspensions of the three tumors, referred to as S1, S2, and S3, were prepared by digestion with trypsin and seeded into an Eagle's medium containing 20% of horse serum. Metaphase block was achieved with colchicine 48-72 hr after culture initiation. The three sarcomas presented different numerical distributions of chromosomes: most of the S1 metaphases (65%) were subtetraploid with 67-70 chromosomes; the majority of the S2 metaphases were diploid with 39-47 chromosomes and only 25% were subtetraploid with 76-83 chromosomes; S3 presented hypertetraploid or even suboctoploid metaphases with 57-165 chromosomes. An increasing number of chromatid breaks and translocations leading to the formation of additional chromosomes, not occurring in the normal rat karyogram, as observed along with the increase in the number of chromosomes. The karyologic setup of the tumors corresponded to their histologic features, in that the polyploid S1 and S3 rhabdomyosarcomas were highly dedifferentiated, while the almost diploid S2 presented a well-distinguished muscular component. The occurrence of new chromosomes might, possibly, be associated with the initiation of the neoplastic process.

5113 INDUCTION OF LUNG CANCER IN GERM-FREE, SPECIFIC-PATHOGEN-FREE, AND INFECTED RATS BY N-NITROSEPTAMETHYLENEIMINE: ENHANCEMENT BY RESPIRATORY INFECTION. (E.) Schreiber, H. (Oak Ridge Natl. Lab., Tenn.), P. Nettesheim, W. Lijinsky, C. B. Richter and H. E. Walburg, Jr. *J Nat Cancer Inst* 49(4):1107-1114, 1972.

The effect of chronic respiratory infection on the development of lung cancer induced by N-nitrosoheptamethyleneimine was tested in rats. The nitrosamine was administered in drinking water for 22 wk to germ-free and specific-pathogen-free (SPF) rats and to rats with chronic murine pneumonia. All animals were killed two wk after the last treatment. The incidence of lung neoplasms was 17% in germfree males, 37% in SPF males, and 83% in infected males. An incidence of 90-100% was found among females in all 3 experimental groups. The results in males demonstrate that chronic respiratory infection can enhance the neoplastic response of the lungs to a systemic carcinogen. Possibly infection accelerates the growth of transformed cells by inducing vigorous repair processes. Alternatively, infection may increase the size of the susceptible cell population, alter the metabolism of the carcinogen, or suppress immunologic surveillance. The normal microbial flora did not appear implicated in the nitrosamine carcinogenesis. There was no significant difference in incidence of esophageal tumors among the three groups.

5114 INTERACTION OF URETHAN WITH MACROMOLECULES IN MALE AND FEMALE NEWBORN, ADULT, AND TUMOR-BEARING MICE. (E.) Chavan, B. G. (Cancer Res. Inst., Bombay, India) and S. V. Bhide. *J Nat Cancer Inst* 49(4):1019-1025, 1972.

Interactions of urethan with different macromolecules, such as DNA, RNA, and protein, from lung and liver tissues of adult, newborn, and tumor-bearing Swiss mice were studied. After tritiated urethan injection, more specific radioactivity was observed in lung DNA than in liver DNA of adult mice at 12 hr. Specific radioactivity in RNA and protein fractions from lung and liver tissues was similar. Study of mice treated with ^{14}C -urethan and sodium carbonate showed that radioactivity at 4 hr was due to binding, whereas at 12 hr the radioactivity was only partly due to binding. The time curve of radioactivity in DNA and RNA fractions of newborn mice treated with ^3H -urethan indicated that radioactivity was still present until 2 wk after urethan administration. Only the urethan-DNA interaction showed differential behavior in the tissues of tumor-bearing mice.

5115 A COMPARATIVE STUDY OF THE TUMORIGENIC ACTION OF URETHAN IN C_3H MICE AND *PEROMYSCUS LEUCOPUS*. (E.) Kisielski, W. E. (Argonne Natl. Lab., Ill.), E. Staffeldt and R. J. M. Fry. *Argonne Nat Lab Ann Report* 7870:47-48, 1971.

C_3H mice, aged 85 or 282 days, and *Peromyscus leucopus*, aged 18-20 months, were injected i.p. with 1.0 mg/kg ^{14}C -labeled urethan. Animals were killed at 4, 6, 24 and 48 hr postinjection and blood, liver, lung and thymus were extracted for ^{14}C contents. ^{14}C -labeled urethan appeared in equal concentrations in liver, lung and thymus of mice. Less than 1-2% of label was retained by mice after 24-48 hr. Urethan was taken up and cleared at the same rate in *P. leucopus* as in mice. There was no apparent difference in the catabolism of urethan in the two species. Therefore, the reported

lack of tumor production in *P. leucopus* exposed to urethan as compared with increased tumor incidence in exposed mice does not reflect species differences in urethan uptake and catabolism.

- 5116 ULTRASTRUCTURAL CHANGES PRODUCED BY THE CARCINOGEN, AFLATOXIN B₁, IN DIFFERENT TISSUES. (E.) Bauer, L. (Path. Inst., U. Erlangen-Nuremberg, West Germany), A. H. Tulusan and E. Müller. *Virchows Arch Zellpathol* 10(4):275-285, 1972.

Fresh water fish (*Brachydanio rerio*) and snails (*Planorbis corneus*) were exposed to aflatoxin B₁ in their aquarium water (2 ppm dilution). Ultrastructural changes in liver cells of fish and in epithelial cells from snails' tentacles were inspected. In fish exposed to aflatoxin B₁ for 24 hr, liver cell nucleoli were diminished in size and showed a compact spheroidal shape. Two zones of different densities were seen in modified nucleoli: a fibrillar zone and a granular zone. These changes were more pronounced in hepatic cells from fish exposed to aflatoxin B₁ for 48-72 hr. Similar changes were seen in nucleoli from snail cells. No neoplasms were observed in fish or snails nine months after acute exposure to aflatoxin B₁.

- 5117 MORPHOLOGIC CHANGES IN RAT LUNGS INDUCED BY INTRATRACHEAL INTRODUCTION OF CHRYSOTILE ASBESTOS ALONE AND WITH BENZ(a)PYRENE. (Rus.) Pylev, L. N. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow). *Vopr Onkol* 18(6):40-45, 1972.

Possible carcinogenic properties of asbestos were studied using mice. Ground chrysotile (2 mg) in 0.2 ml physiological solution was administered intratracheally to 61 hybrid mice for one month. A mixture of 2 mg ground chrysotile and 5 mg benzo(a)pyrene in 0.2 ml physiological solution was administered once to 35 mice. Benzo(a)pyrene (5 mg) was administered once to 28 mice. All mice died within 29 months. Early mortality was high in the group receiving the mixture of chrysotile and benzo(a)pyrene: 24 mice died within 1.5 months. Paraffin sections were made of lungs, liver, kidneys, and spleen of dead animals for histological and polariscopic studies. Inflammatory changes were most pronounced in the second group during 1.5 months, accompanied by interstitial pneumonia with sclerotic patches. Such changes were less evident in the third group, which received only benzo(a)pyrene. This group did not show sclerotic patches. The second group showed chronic productive interstitial pneumonia with parenchymal sclerosis. The asbestos grains were visible in polarized light in the lungs in both the first and second groups. Precancerous changes were most pronounced in animals of the second group, who showed hyperplasia and proliferation of the bronchial epithelium with dense cell metaplasia. Tumors of the lungs and pleura were found in 6/11 (54.5%) animals of the second group. Two of these mice had pleural mesotheliomas. Although there were precancerous changes in some animals, tumors were not seen in animals of the remaining two groups.

- 5118 THE RANGE OF EXTRANEURAL TUMORS, DEVELOPED IN RATS AFTER ADMINISTRATION OF N-METHYL-N-NITROSOUREA. (Ger.) Schreiber, D. (Med. Acad., Erfurt, East Germany), R. Warzok, P. Scholtze, J. Schneider, A. Lageman and H. Batka. *Zentralbl Allg Pathol* 115:48-61, 1972.

The distribution of extraneural tumors in 808 rats following administration of methyl nitrosourea is described. Intragastric, i.p. and i.v. routes were used as well as various dose levels: 10 and 25 mg/kg at two and four wk intervals, resp., for i.v. injection; and 10 and 20 mg/kg at two and four wk intervals, resp., for i.p. and intragastric administration. In some of the 12 experimental groups, the effects of hypoxia and hormonal disturbances were tested. The results showed 251 rats with simultaneous malignant extraneural and neural tumors, and 143 with malignant tumors only outside the nervous system. The highest induction of extraneural tumors was effected by the intragastric route of administration. Repeated i.v. injections of 25 mg/kg of the carcinogen produced a significantly higher incidence of extraneural tumors than the similarly administered 10 mg/kg dose. A significantly higher incidence of tumors was also seen in animals ovariectomized before the start of the experiments. The following locations of extraneural tumors are listed in order of preference: stomach, tongue, intestine, mesentery, pelvic organs and abdominal wall, cardiac muscle, hearing area, mediastinum, throat region, and kidneys. In the gastric tumors there was a predominance of cornified squamous epithelial carcinomas of the omasum. Species-dependent differences between rats and rabbits are indicated.

- 5119 HIGH YIELD OF HEPATIC TUMORS IN RATS BY CYCASIN. (E.) Fukunishi, R. (Kagoshima U. Sch. Med., Japan), S. Terashi, K. Watanabe and K. Kawaji. *Gann* 63:575-578, 1972.

Sprague-Dawley rats, aged 21 and 50 days, were given 10 mg/kg cycasin in drinking water daily for ten days. Hepatic tumors were induced in 80-90% of rats. Latent periods for tumor induction were 167-480 days for 21-day-old rats and 251-556 days for 50-day-old rats. Two kinds of liver tumor were seen: hepatoma and hepatic sarcoma. Hepatomas were slightly more common than hepatic sarcomas. In two animals, both tumor types occurred. A few kidney tumors were also induced in cycasin-fed rats.

- 5120 CYTOPHOTOMETRIC MEASUREMENTS OF DNA AND HISTONE PROTEIN CONTENT IN EXPERIMENTALLY INDUCED SKIN TUMORS OF THE RAT AND HAIRLESS MOUSE. PART II. (Ger.) Rohrbach, R. (Path. Inst., U. Freiburg i. Br., West Germany), M. Lau, C. Thomas and W. Sandritter. *Beitr Pathol* 146(2):111-121, 1972.

Skin tumors induced in rats and hairless mice by repeated i.v. and i.p. injections, resp., of diazoacetic-ester were examined cytophotometrically for DNA and histone protein content. Increases in both substances were closely correlated in all tumor cell populations. The Feulgen fast green quotient varied slightly between 0.95-1.31. Basal cell carcinomas fell into two groups histologically and cytophotometrically. Those consisting mainly of solid masses showed an euploid DNA distribution and only a 6.8-22.9% increase in DNA and histone protein, while a larger group of basal cell carcinomas with horny cysts, sebaceous gland cells, and spinal cells exhibited aneuploid stem lines and a 35-114% increase in DNA and histone protein. The biological behavior of the experimentally produced tumors is discussed in relation to human basal cell carcinomas.

5121 ARYL HYDROCARBON HYDROXYLASE INDUCTION IN HUMAN LEUKOCYTES. (E.) Busbee, D. L.

(U. Texas M. D. Anderson Hosp., Houston), C. R. Shaw and E. T. Cantrell. *Science* 178(4058):315-316, 1972.

A method for measuring aryl hydrocarbon hydroxylase (AHH) induction in normal human leukocytes is described. Leukocytes from healthy volunteers were incubated in the presence of phytohemagglutinin (PHA) for 72 hr. Addition of 3-methylcholanthrene (3MC, 0.75 mM) to the 72-hr cultures caused a fourfold increase in AHH activity. In the absence of PHA, 3MC stimulation of AHH activity did not occur.

5122 DIFFERENCES IN THE PATTERNS OF METHYLATION IN RAT LIVER RIBOSOMAL RIBONUCLEIC ACID AFTER REACTION *IN VIVO* WITH METHYL METHANESULPHONATE AND *NN*-DIMETHYLNITROSAMINE. (E.) O'Connor, P. J. (Paterson Labs., Manchester, England), M. J. Capps, A. W. Craig, P. D. Lawley and S. A. Shah. *Biochem J* 129(3):519-528, 1972.

Rats were given i.p. injections of ^{14}C -methyl methanesulphonate (50 mg/kg) or *NN*-dimethylnitrosamine (2 mg/kg). Three or five hr later, rats were killed, livers were removed, and rRNA was extracted from liver homogenates. This ^{14}C -methylated rRNA was subjected to enzymic digestion to nucleosides at pH 8, alkaline hydrolysis and conversion into nucleosides, or acid hydrolysis to bases. Methylation products of rRNA hydrolysates were analyzed by column chromatography on Dowex-50 (H^+ form) and Dowex-50 (NH_4^+ form). With both methylating agents the principal product of methylation was 7-methylguanine. Column chromatography of acid hydrolysates revealed differences in the methylation of other minor bases. Methyl methanesulphonate treatment produced more 1-methyl-adenine and 1-methylcytosine than treatment with *NN*-dimethylnitrosamine. In addition, methylation at the 0-6 position of guanine was not detected after methanesulphonate treatment, while 3-4% of the total methylation products were present as 0⁶-methylguanine after the reaction with *NN*-dimethylnitrosamine.

5123 CHANGES IN tRNA METHYLASE ACTIVITY OF RAT KIDNEY FOLLOWING ADMINISTRATION OF THE CARCINOGEN, DIMETHYLNITROSAMINE. (E.) Stewart, B. W. (Middlesex Hosp. Med. Sch., London, England) and A. E. Pegg. *Biochim Biophys Acta* 281(3):416-424, 1972.

Female rats which had been fed a protein-deficient diet for one wk were injected i.p. with 40 mg/kg dimethylnitrosamine. After another wk on the protein-deficient diet, rats were killed, kidneys were removed, and tRNA methylase activity was assayed in kidney extracts. Dimethylnitrosamine increased tRNA methylase in kidneys of rats fed a protein-deficient diet. At two days after dimethylnitrosamine, the rate of tRNA methylase in kidneys was about 85 pmoles methyl incorporated/mg protein/15 min, while the rate for control rats not given dimethylnitrosamine was about 40 pmoles methyl. At four days after carcinogen, tRNA methylase activity was 50% greater than in controls; by seven days, tRNA methylase was normal in dimethylnitrosamine-treated rats. However, increased tRNA methylase was also found in preparations from kidneys of rats treated with methylnitrosamine six months previously, two of which had overt kidney tumors.

5124 TRYPTOPHAN METABOLISM IN PATIENTS WITH BLADDER CANCER OF OCCUPATIONAL ETIOLOGY. (E.) Brown, R. R. (U. Wisconsin Med. Sch., Madison), G. H. Friedell and J. E. Leklem. *Am Ind Hyg Assoc J* 33(4):217-222, 1972.

Four groups of male subjects were given 2 g L-tryptophan and their excretion of urinary tryptophan metabolites was measured. The subjects included nine chemical workers with known exposure to bladder carcinogens (aromatic amines) and active bladder tumors (group I); ten men with similar exposures and with diagnosed bladder cancer, but who were tumor-free at the time of the study (group II); ten men exposed to carcinogens but with no sign of bladder tumors (group III); and ten unexposed healthy men (group IV). There were no statistically significant differences between the four groups in average basal, post-tryptophan or yield levels of any of the metabolites measured (kynurenine, acetylkynurenine, hydroxykynurenine, kynurenic acid, xanthurenic acid, indican, anthranilic acid glucuronide, o-aminohippuric acid) or creatinine. Kynurenine and hydroxykynurenine were slightly elevated in groups I and II relative to other groups. Two of eight subjects in group I and two of ten in group II showed two or more tryptophan metabolites in amounts greater than two standard deviations above normal. These subjects were regarded as having abnormal tryptophan metabolism.

5125 HEPATIC ADENYL CYCLASE: ALTERATIONS IN HORMONE RESPONSE DURING TREATMENT WITH A CHEMICAL CARCINOGEN. (E.) Christoffersen, T. (Inst. Pharmacol., U. Oslo, Norway), J. Morland, J.-B. Osnes and K. Elgjo. *Biochim Biophys Acta* 279(2):363-366, 1972

adenyl cyclase activity was assayed in liver particles from adult rats fed a diet containing 0.05% or 0.03% 2-acetylaminofluorene for four and ten wk, resp., and in particles from untreated rats. Adenyl cyclase response to adrenalin was of special interest. Adrenalin had only a slight effect on adenyl cyclase in liver particles from untreated rats. In livers of rats which had been given 2-acetylaminofluorene but which did not develop hepatocarcinomas, adenyl cyclase was markedly stimulated. The degree of adenyl cyclase stimulation by adrenalin over basal enzyme levels in liver particles from rats fed 2-acetylaminofluorene was similar to that in newborn rats. Adenyl cyclase from 2-acetylaminofluorene-fed rats which did develop tumors showed only a slight increase in response to adrenalin; however, basal adenyl cyclase levels in hepatocarcinoma-bearing, carcinogen-fed rats were increased.

26 CARCINOGEN-INDUCED tRNA METHYLASE ACTIVITY IN YEAST CELLS. (E.) Hancock, R. L. Div. Med. Biochem., U. Calgary, Alberta, Canada. *Archiv Biochem Biophys* 281(3):472-475, 1972.

Yeast cell extracts were cultivated with or without 100 µg of DL-ethionine, a hepatocarcinogen for mice. The tRNA methylase activity of yeast extracts as affected by ethionine was measured. Ethionine increased tRNA methylase in yeast cell extracts, while noncarcinogenic DL-methionine did not. Di-2-ethylaminoazobenzene also increased tRNA in yeast cell extracts, while noncarcinogenic aminoazobenzene did not.

27 INTRACELLULAR BINDING OF PHENOBARBITAL IN RAT LIVER. (E.) Peraino, C. (Argonne Natl. Lab., Ill.) and W. E. Kisielski. *Argonne Natl. Lab. Ann Report* 7870:45, 1971.

Rats were injected i.p. with 100 µCi ¹⁴C-phenobarbital. Twenty-four hr later, livers were removed and fractionated into nuclei, mitochondria, microsomes and supernatant. Labeled phenobarbital was found in nuclear, mitochondrial or microsomal fractions. Labeled phenobarbital was, however, found in cell sap, indicating that it bound strongly to soluble macromolecules, probably proteins.

28 METHYLAZOXYMETHANOL ACETATE: INDUCTION OF TUMORS AND EARLY EFFECTS ON RNA SYNTHESIS. (E.) Zedeck, M. S. (Sloan-Kettering Inst. Cancer Res., New York, N.Y.), S. S. Sternberg, J. McGowan and R. W. Poynter. *Fed Proc* 31(5):1485-1492, 1972.

A single i.v. injection of 35 mg/kg methylazoxymethanol acetate (MAM acetate) induced 22 cancers in 26 treated rats within 5-12 months. The cancers developed in the large and small intestines, liver and kidney. Fifteen rats had benign tumors, 7 of which were hyperplastic nodules of the liver. Hepatic structural alterations were seen as early

as 15 min after MAM acetate injection. DNA, RNA and protein synthesis were inhibited in liver one to three hr after treatment. Pathological effects of MAM acetate, including decreased cytoplasmic basophilia in hepatocytes, were noted as early as six hr after injection. Inhibition of RNA synthesis in isolated liver cell nuclei of rats given MAM acetate was confirmed in studies of UTP-5-³H uptake by these cells. Inhibition of UTP-5-³H uptake was dependent on the dose of MAM acetate and increased with time after MAM acetate. MAM acetate did not affect either RNA synthesis in kidney cell nuclei or orotic acid uptake into nucleolar RNA.

5129 PROLACTIN DEPENDENCE IN HUMAN BREAST CANCERS. (E.) Salih, H. (Westminster Hosp., London, England), H. Flax, W. Brander and J. R. Hobbs. *Lancet* 2(7787):1103-1105, 1972.

Biopsy tissues from 50 breast cancer patients were cultured with sheep prolactin, 17 β-estradiol and testosterone and the prolactin-dependence of the dehydrogenase activity of the pentose shunt was observed. Comparison biopsy tissues from the breast cancers were not cultured with added hormones. Cancer tissues from 16 patients showed higher dehydrogenase levels with prolactin added at 220 mU/ml. Four cancer specimens even showed increased dehydrogenase when prolactin was added at 22 mU/ml. Of the remaining 34 breast cancer specimens, 12% showed only estrogen dependence and 2% only androgen dependence. Fifty-four percent of the specimens were apparently not hormone-dependent at all.

5130 THE EFFECT OF CIGARETTE-SMOKE CONDENSATE ON THE *IN VITRO* FIXATION OF BENZO(a)PYRENE ON DNA. (E.) Alexandrov, K. (Inst. Sci. Res. Cancer, Villejuif, France) and C. Frayssinet. *Experientia* 28(8):932-933, 1972.

Male rats were injected i.p. with 3-methylcholanthrene (MC, 20 mg/kg/rat/day for two days) or cigarette smoke condensate (20 mg/kg). Liver microsomes were isolated and the bonding of benzo(a)pyrene (B(a)P) and/or its metabolites to microsomal DNA was observed. Both MC and cigarette smoke condensate facilitated bonding of B(a)P-³H and DNA. In microsomes from rats given neither MC nor smoke condensate, bonding of B(a)P-³H to DNA proceeded at a rate of 3.2 µM B(a)P-³H/µmoles P-DNA, while rates for rats given MC and smoke condensate were 23.0 and 22.0 µM B(a)P-³H/µmoles P-DNA, resp. Smoke condensates added to B(a)P-³H-DNA incubation mixtures *in vitro* inhibited fixation of B(a)P-³H to DNA. Metabolites of B(a)P-³H were fixed to complexes between DNA and smoke condensate metabolites less readily than to DNA itself.

5131 CYTOSKELETON ALTERATIONS IN CELLS OF RAT HEPATOMAS INDUCED BY 4-DIMETHYLAMINO-

AZO BENZENE. (E.) Briere, N. (U. Hosp. Ctr., Sherbrooke, Quebec, Canada). *J Nat Cancer Inst* 48(2):441-449, 1972.

Male Wistar rats were fed a low-protein diet containing 0.06% 4-dimethylaminoazobenzene (DAB). Animals were sacrificed at 30-day intervals during a 210-day feeding period. Histologic sections of liver containing preneoplastic foci and hepatomas were studied. Cytoplasmic RNA in these cell populations stained intensely with toluidine blue, and this phenomenon was used to identify them. The staining technique [tannic acid-phosphomolybdc acid-amido black (TPA)] that permits observation with the light microscope of cell web (cytoplasmic tonofibrils), terminal bars, and desmosomes was used to determine whether the hyperbasophilic cells were characterized by any modifications in cell web elements and other TPA-positive components. In normal hepatocytes and those surrounding the hyperbasophilic areas, the cell web was complete, extending all around the cells, and desmosomes were always present near the bile canaliculi. In preneoplastic and tumor cells, cytoskeleton and desmosomes were much reduced, absent, or too scanty to be observed. Moreover, cytoplasmic background (probably proteins) in surrounding tissue stained intensely with TPA, whereas hyperbasophilic cells were negative or weakly positive. RNA extracted by RNase did not alter significantly protein stainability, suggesting that those proteins were not masked by the RNA responsible for hyperbasophilia, but were present in small concentrations or were absent from cancer cells. These results indicated that important alterations in TPA-positive materials, especially the cytoskeleton and cellular attachment sites, are associated with the phenomenon of hyperbasophilia and neoplastic transformation.

5132 INDUCTION OF INTERSTITIAL CELL TUMORS BY CADMIUM CHLORIDE IN ALBINO RATS. (Ger.) Knorre, D. (St. George District Hosp., Leipzig, East Germany). *Arch Geschwulstforsch* 38(3-4):257-263, 1971.

The development of interstitial cell tumors (ICTs) was studied in 104 mature male rats given a single s.c. injection of 0.003 mM cadmium chloride/100g body weight. Within 48 hr, total necrosis of the testes occurred. Among 43 rats observed for 157-698 days postinjection, 36 developed ICTs. The ICTs were uni- or bilateral, and were often hemorrhagic. In most cases, the ICTs were only discovered histologically as subcapsular tumors, and in the same area where regeneration of interstitial tissue was initiated. In the large ICTs, small and dark-celled areas which alternated with light cells of a hypernephroid type; in the small ICTs, the cells were more compact and smaller. Metastases occurred in only one case. The biological evaluation of ICTs is predominantly subject to the length of time required for their development; the first ICT was not discovered until 355 days postinjection, while development of the two largest tumors took 580 days.

5133 EFFECT OF ENZYME INDUCTION ON THE METABOLISM OF BENZO(a)PYRENE AND 3'-METHYL-4-MONOMETHYLAMINOAZOBENZENE IN THE PREGNANT AND FETAL RAT. (E.) Welch, R. M. (Burroughs Wellcome Co., Research Triangle Park, N.C.), B. Gommi, A. P. Alvares and A. H. Conney. *Cancer Res* 32(5):973-978, 1972.

The effect of polycyclic hydrocarbons on the metabolism of benzo(a)pyrene (BP) and 3'-methyl-4-monomethylaminoazobenzene (3-m-MAB) in maternal and fetal rat liver was studied. Sprague-Dawley rats, pregnant 14-19 days, were treated with a single p.o. dose of 3-methylcholanthrene (3-MC), 60mg/kg, and killed 24 hr later. Microsomal preparations prepared from homogenates of maternal liver, placentas and fetal livers were tested for BP hydroxylase and 3-m-MAB *N*-demethylase activities using BP and 3-m-MAB resp. as substrates. 3-MC stimulated both BP and 3-m-MAB *N*-demethylase activity in maternal liver (13- to 15-fold and two-fold, resp.) and fetal liver (30-fold and two- to three-fold, resp.). Control animals which had received a p.o. placebo and 16-day pregnant rats treated with phenobarbital (50 mg/kg/day p.o. for three days) showed no BP hydroxylase activity in fetal liver homogenate. The effect of 3-MC and phenobarbital on induction of mixed-function oxidases in liver microsomes of 16-day pregnant rats was analyzed by observing increases in microsomal hemoprotein concentration as measured by the change in absorbance at 450 or 455 nm, when carbon monoxide or ethyl isocyanide was added as ligand to reduced liver microsomes. 3-MC and phenobarbital increased the microsomal hemoprotein concentration in maternal liver. 3-MC also increased hemoprotein concentration in fetal liver microsomes. 3-MC increased the ratio of the peak at 455 nm to the peak at 430 nm and shifted by two nm the maximum absorption of the 450 nm peak to a shorter wavelength in both maternal and liver microsomes, thus indicating a qualitative alteration of the microsomal hemoproteins. Phenobarbital had no effect on hemoprotein concentration in fetal liver microsomes. Several polycyclic hydrocarbons found in the environment and in cigarette smoke increased metabolism of BP and 3-m-MAB by fetal rat liver. Dibenz(a,h)anthracene and BP were the most potent stimulators (70- and 100-fold, resp.), but benz(a)anthracene (60-fold) and chrysene (30-fold) also increased enzyme activity. Anthracene had little or no effect. Maternal liver and placenta BP hydroxylase activity were ten to 20 times more sensitive to induction by BP (0.5 to 1.0 mg/kg/day for three day) than was fetal liver enzyme. Pretreatment of 16-day pregnant rats with nonradioactive BP (20 mg p.o. for three day) followed 24 hr later by p.o. administration of BP-³H showed that enzyme induction increased the ratio of BP-³H metabolites to BP-³H by 84-, 19- and 185-fold in the fetus, placenta and maternal lung, resp.

5134 PHENACETIN ABUSE AND CARCINOMA OF THE PELVIS. (Ger.) Grob, H. U. (Distr. Hosp. St. Gallen, Switzerland). *Helv Chir Acta* 38(5/6):537-539, 1972.

The carcinogenic effect of phenacetin is described. In a study of 20 patients with pelvic tumors, five were found to have used phenacetin to excess, and

these patients were definitely younger than the others. Two cases of pelvic carcinoma are described, both of these patients having ingested two to three pills of phenacetin/day for more than 18 years. The survival chances of patients with renal damage due to phenacetin have improved with modern methods of nephrology, but the incidence of pelvic carcinoma has increased comparatively. Since a cure for pelvic carcinoma is unknown, prophylactic measures must be taken in dealing with exogenous carcinogens.

5135 TUMORS, DEVELOPED AFTER I.P. INJECTION OF FIBER-LIKE DUSTS, IN THE RAT. (Ger.)

Pott, E. (Air Hyg. Silicosis Res. Med. Inst., U. Düsseldorf, West Germany) and K. H. Friedrichs. *Naturwissenschaften* 59(7):318, 1972.

To determine whether the tumor-inducing effects of asbestos are due to its physicochemical properties or to its fibrous consistency, a study was conducted in rats using various dust particles of a fibrous consistency or of some other form. The results of i.p. injections of 25 mg of each substance up to four times in one week showed that tumors were induced in animals receiving chrysotile, nemalite and glass fiber. These chemicals resemble each other in form but not chemically. Other substances, resembling chrysotile chemically but which are granular or foliar in form, did not lead to tumor formation within 530 days. Even nemalite, the chemical suspected of carcinogenic effects, did not induce tumors. It is thus possible that the inhalation of other fibrous dusts, particularly those of glass, leads to tumor formation.

5136 LEUKEMIA AND MAMMARY TUMOR IN RATS ADMINISTERED N-NITROSOBUTYLUREA. (E.) Hosokawa, M.

(Hokkaido U. Sch. Med., Japan), E. Gotohda and H. Kobayashi. *Gann* 62(6):557-559, 1971.

Rats were divided into four groups for administration of N-nitrosobutylurea in drinking water, as follows: female rats aged 1.5 months given 480 mg N-nitrosobutylurea for 120 days (A); females aged two months given 600 mg for 140 days (B); females aged three months given 720 mg for 180 days (C); and males treated as in (C), (D). Leukemia developed in 15% of rats in group A, in 53.6% of rats in group B, in 64.3% of rats in group C and 88.8% of rats in group D. Mammary tumors were observed in all group A rats, in 75% of group B rats, in ten of 14 group C rats and in no group D rats. The mean latent period for leukemia in all groups was 33 wk, while that for mammary tumor was 25 wk. Both leukemia and mammary tumors were found in individuals in groups A, B and C.

5137 THE KINETICS OF DECOMPOSITION OF N-ALKYL DERIVATIVES OF NITROSOGUANIDINE. (E.)

Haga, J. J. (Chem. Dept., North Texas State U., Denton), B. R. Russell and J. F. Chapel. *Cancer Res* 32:2085, 1972.

The kinetics of formation of the active alkylating species of N-methyl-, N-propyl-, N-ethyl- and N-butyl-N'-nitrosoguanidine were studied by scanning the spectra of the compounds in Tris and sodium phosphate buffers. The rate of decomposition of the N-methyl-, N-ethyl and N-propyl derivatives was found to be first order and to vary as a function of the increasing carbon number in the alkyl portion of the molecule. In addition, the decomposition rate was pH-dependent for all compounds except N-ethyl-N'-nitrosoguanidine. Because of its insolubility, no kinetic data were obtained for the N-butyl derivative.

5138 REACTION OF NITROSOUREAS WITH POLYCYTIDYLATE TEMPLATES FOR RIBONUCLEIC ACID

POLYMERASE. (E.) Ludlum, D. B. (U. Maryland Sch. Med., Baltimore) and P. N. Magee. *Biochem J* 128(3):729-731, 1972.

Samples of the polycytidylate template (poly(C)) were treated with N-methyl- or N-ethyl-N-nitrosourea and reacted with RNA polymerase. In the presence of methyl-nitrosourea-treated poly(C), GMP incorporation in the RNA polymerase reaction was reduced to 10% of its level in reactions with untreated poly(C). A significant misincorporation of UMP in the reaction was also seen with nitrosourea-treated poly(C). The substitution of cytosine by reaction with the carcinogens may have caused a misreading of the template by RNA polymerase.

5139 INHIBITION OF DNA REPAIR BY COCARCINOGENS.

(E.) Gaudin, D. (U. Alabama Sch. Med., Birmingham), R. S. Gregg and K. L. Yielding. *Biochem Biophys Res Commun* 48(4):945-949, 1972.

³H-thymidine-labeled normal human lymphocytes were exposed to UV radiation and mixed with hydroxyurea. DNA repair synthesis in this system was observed as uptake of ³H-thymidine by lymphocytes in the presence of three cocarcinogens: anthralin, 12-O-tetradecanoyl-phorbol-13-acetate and the neutral fraction from cigarette smoke condensate. All three agents were potent inhibitors of UV-stimulated DNA repair synthesis. At concentrations of 2.5×10^{-5} M, anthralin reduced DNA repair synthesis (measured as ³H-thymidine uptake) to <10% of that in lymphocytes not treated with cocarcinogens, while the phorbol ester reduced DNA repair synthesis to about 50% of normal at the same concentration. The neutral fraction of cigarette smoke, at a 0.01% dilution, reduced DNA repair synthesis to 50% of control.

5140 MOLECULAR ORBIT COMPUTATIONS ON 3,4-BENZPYRENE AND 1,2-BENZPYRENE PROVIDE A MODEL FOR THE

INTERPRETATION OF CHEMICAL CARCINOGENESIS. (Ger.) Popp, F. A. (Rad. Clin. U. Marburg/Lahn, West Germany). *Z Naturforsch [B]* 27(6):731, 1972.

A comparison of the differences in electronic structure between 3,4-benzpyrene (BP) and 1,2-benzpyrene by means of a semiempirical molecular orbit computation is presented. 3,4-BP manifests the first, energetically lowest pi-electron stimulus at 3.14 eV, and the second at 3.29 eV. With 1,2-BP, the stimulus energy is 3.54 eV for both the lowest and second-lowest stimuli. This is due to a superposition of the two configurations, whereas the higher stimulus of 3.74 eV represents a single configuration. The condition of the bipolar structures in a charge-transfer complex explains the different actions of the two substances. A disturbance in the H-bridge of 3,4-BP and the interaction with DNA or RNA bases are presumed to be the first steps in its carcinogenic effect.

- 5141 CARCINOGENIC ACTIVITY OF 5-HYDROXY-3,4-BENZOPYRENE. (E.) Nagata, C. (Nat'l. Cancer Ctr. Res. Inst., Tokyo, Japan), Y. Tagashira, M. Inomata and M. Kodama. *Gann* 62(5):419-421, 1971.

Male ddN mice were injected s.c. or intracutaneously with 0.3 mg or 0.06 mg 5-hydroxy-3,4-benzopyrene dissolved in benzene. One of 30 mice treated s.c. and one of 10 treated intracutaneously developed fibrosarcomas at the injection site. It had been shown previously that 7 mg 5-hydroxy-3,4-benzopyrene administered as crystals moistened with glycerol were not carcinogenic. The significance of solvents in hydrocarbon carcinogenesis is discussed.

- 5142 SKIN CARCINOGENESIS TESTS OF HYDROGENATED DERIVATIVES OF ANTHANTHRENE AND OTHER POLYNUCLEAR HYDROCARBONS. (E.) Lijinsky, W. (Eppley Inst., Omaha, Nebr.) and H. Garcia. *Z Krebsforsch* 77(3):226-230, 1972.

Anthanthrene, two of its derivatives and two derivatives of benz(a)anthracene were applied topically to Swiss mice for 50-75 wk. No tumors appeared in mice given anthanthrene, 4,5-dihydroanthanthrene or 1,2,3,7,8,9-hexahydroanthanthrene in amounts of 43, 39 and 36 µg, resp., twice a wk. However, 5,6-dihydro-7,12-dimethylbenz(a)anthracene (32 µg) caused squamous cell papillomas and squamous cell carcinomas in 50% of mice and 6,7,8,9,10,12b-hexahydro-3-methylcholanthrene (35 µg) caused squamous tumors in 67% of mice.

- 5143 SENSITIVITY OF REPAIR-DEFICIENT MUTANTS AND SIMILAR MUTANTS TO 4-NITROQUINOLINE 1-OXIDE, 4-NITROPYRIDINE 1-OXIDE, AND THEIR DERIVATIVES. (E.) Nagao, M. (Nat'l. Cancer Res. Inst., Tokyo, Japan) and T. Sugimura. *Cancer Res* 32(11):2369-2374, 1972.

The chemical carcinogens 4-nitroquinoline 1-oxide (4NQO) and 4-nitropyridine 1-oxide (4NPO), and their carcinogenic or noncarcinogenic derivatives, were tested by a slight modification of the rapid screening method for mutagens and carcinogens

described by Slater, Anderson, and Rosenkranz. *N*-Methyl-*N'*-nitro-*N*-nitrosoguanidine and methylmethanesulfonate were also tested. 4NQO, 4-hydroxyaminoquinoline 1-oxide, 3-methyl-4-nitropyridine 1-oxide, and 2,3-dimethyl-4-nitropyridine 1-oxide caused wider growth-inhibiting zones with mutants of *Escherichia coli*, such as the DNA polymerase I-deficient mutant, *polA1*, and the recombination-deficient mutants, *recA13* and *recB21*, than with the wild strain. These compounds also caused wider growth-inhibiting zones with ultraviolet-sensitive mutants of *Saccharomyces cerevisiae* and *Bacillus subtilis* than with the corresponding wild types. 4NPO, *N*-methyl-*N'*-nitro-*N*-nitrosoguanidine (MNNG) and methylmethanesulfonate (MMS) caused wider growth inhibition zones with the *polA1*, *recA13*, and *recB21* mutants of *E. coli* than with the wild strain but similar zones with UV-sensitive mutants of *S. cerevisiae* and *B. subtilis* and the wild strains. The results indicate that different mechanisms are involved in repair of DNA damaged by ultraviolet irradiation or 4NQO and its derivatives on the one hand and by 4NPO, MNNG, or MMS on the other.

- 5144 CARCINOGENIC ACTION OF A SINGLE SUBCUTANEOUS ADMINISTRATION OF *n*-BUTYL-NITROSOUREA TO NEWBORN RATS: A SIMPLE MODEL FOR NEURO-ONCOLOGICAL STUDIES. (Ger.) Zeller, W. J. (Inst. Exp. Toxicol. Chemother., Heidelberg, West Germany) and S. Ivankovic. *Z Neurol* 202:121-127, 1972.

The production of malignant neurogenic tumors in the central and in the peripheral nervous systems by a single s.c. injection of 120 mg/kg of *n*-butyl-nitrosourea (BNU) in newborn rats is reported. Out of a total of 25 rats, 17 developed a total of 29 tumors, located in the cerebellum, cerebrum, trigeminal, cauda equina, spinal column, and various adjacent areas. The mean induction time was about 290 days. It is submitted that the organotropic action of a carcinogen is not only dependent on the chemical structure, but also on type of administration, dosage, and conditions of development of the biological receptors. The method is recommended for the study of neurogenic tumors.

- 5145 INHIBITION OF CARCINOGENIC AND TOXIC EFFECT OF DIETHYLNITROSAMINE ON RAT LIVER. (Ger.) Weissberg, M. (Inst. Cancer Res. U. Vienna, Austria). *Experientia* 28(6):682-683, 1972.

Experimental evidence is presented that i.p. injections of homologous thymus tissue in rats will protect the animals against toxic and carcinogenic effects of diethylnitrosamine (DNA). The study was conducted in 33 male Sprague Wistar rats who were injected i.p. with whole thymus (in physiological saline) taken from animals of the same strain; three such injections were effected at the rate of one/wk. One wk after the last thymus injection, the experimental animals, as well as a group of untreated controls, were given 400 mg DNA/kg body wt, in their drinking water. The experimental period ended when each rat (weight 150 g) had consumed 60 mg DNA. One month after the end

of the experimental period (and at various intervals following that), the rats were sacrificed and the liver was examined. The untreated controls revealed the presence of 14 carcinomas (out of 30 animals), whereas no carcinomas were found in the experimental animals. The extent of degeneration was marked in the controls and very slight in the treated animals. The study also demonstrated that toxic liver degeneration results from DENA (without protection by thymus) many months after the carcinogen was administered and is independent of time and dosage.

- 5146 CANCER INDUCING EFFECT OF N-NITROSOMETHYLUREA AFTER ADMINISTRATION OF HORMONAL CONTRACEPTIVES. (Ger.) Thomas, C. (Path. Inst. Ludwig Aschoff House, Freiburg i. Br., Germany), H. Rogg and J. Bucheler. *Beitr Pathol* 146(4):332-338, 1972.

The organotropic effect of N-nitrosomethylurea (NMU) was investigated with respect to changes by hormone contraceptives. Experiments were conducted in female Wistar rats who were divided into three groups of 40 rats each; all groups were given 40 mg NMU/kg. The control group was given NMU for three consecutive days; the experimental groups, in addition to the NMU, received an aqueous suspension of 0.0075 mg mestranol and 0.25 mg lynestrenol per day for 30 days, prior to or after NMU administration. Numerous tumors developed in control animals and animals given the hormone contraceptives after NMU treatment. Tumor production was significantly decreased in the group receiving the hormone contraceptives before NMU; a decrease in nephroblastomas was particularly evident. It was concluded that hormonal contraceptives do not directly induce cancer. No particular organotropic effect was manifested, particularly with respect to mammary or uterine tumors.

- 5147 A RESTATEMENT OF THE THEORY OF REGIONS K AND L IN RELATION TO THE MOLECULAR MECHANISMS OF ACTION OF CHEMICAL CARCINOGENESIS. (Fr.) Shou-Sin Sung, M. (CNRS, Essonne, France). *C R Acad Sci [D] (Paris)* 275(12):1307-1310, 1972.

An attempt to combine 11 aromatic nonalternating polycyclic hydrocarbons with 62 previously analyzed alternating homologs, is presented. The 11 hydrocarbons are shown in a table wherein the simple and complex indices of the K and L positions are calculated and the carcinogenic activity estimated. In a histogram of the distribution of energies of ortho-localization associated with 73 aromatic hydrocarbons (both alternating and nonalternating), the 11 hydrocarbons of this study are included. By this means the addition of nonalternating hydrocarbons is seen to differ from the alternating ones in the histogram. Experimental proof of the fixation of the carcinogenic hydrocarbons to biomacromolecules in the K region of the molecule was recently obtained in connection with fluorescent spectra of a mouse skin extract to which benzo(a)pyrene was applied. It is concluded that the experimental facts to date are too

few, and at times too contradictory, to attempt a statistical analysis dealing with a total of 62 molecules.

- 5148 THE CONTAMINATION OF FOOD WITH CARCINOGENIC HYDROCARBONS THROUGH TECHNOLOGICAL AND PREPARATIVE PROCESSES. (Ger.) Fritz, W. (Central Inst. Nutr., Berlin, West Germany). *Arch Geschwulstforsch* 40(1):81-90, 1972.

In consideration of the unexplained etiology of gastric cancer, the formation of carcinogenic hydrocarbons in cooking of food was investigated. In the roasting procedure of coffee beans, there are as a rule slight amounts of benzo(a)pyrene, also found in burnt bread crust and burnt biscuits. Under proper conditions of heating, such carcinogenic substances are negligible. Malt coffee roasted in contact with flue gas contained significant quantities of carcinogenic hydrocarbons, including benzo(a)pyrene, benzofluoranthene, indenopyrene and other polyaromatic substances. Similar contamination of smoked (or grilled) meats or fish is possible, depending on the processing. Contamination of cereals is effected by smoke-drying; systematic studies revealed that smoke-drying with technical fuel gas, such as city gas, was not associated with food contamination, whereas smoke-drying with gases emanating from diesel oil or heating oil, caused an increase in polyaromatic content. Ways to avoid contamination of foods with carcinogenic hydrocarbons during processing and cooking are discussed.

- 5149 EFFECT OF AGE AT TREATMENT AND DOSE OF 3-METHYLCHOLANTHRENE ON DEVELOPMENT OF LEUKEMIA AND SARCOMA IN AKR MICE. (E.) Whitmire, C. E. (Microbiol. Assoc., Inc., Bethesda, Md.), R. A. Salerno, V. A. Merold and L. S. Rabstein. *J Nat Cancer Inst* 49(5):1411-1415, 1972.

Several previous studies suggested a mutual exclusion between spontaneous leukemia and sarcoma induced in AKR mice by 3-methylcholanthrene (MCA). The results presented here indicate that this apparent exclusion was a function of the latency periods for spontaneous leukemia and MCA-induced sarcoma development. Leukemia occurred at about 32 wk of age and the latency period was unaffected by MCA treatment except in newborn animals. Sarcoma (independent of age of mice at MCA treatment) developed about 24 wk after treatment with 150 µg MCA, about 19 wk after 300 µg MCA, and about 17 wk after 450-500 µg MCA. When MCA was given at an age so that the latency period for sarcoma induction coincided with the chronologic age for leukemia development, leukemia and induced sarcoma were often found in the same animal.

- 5150 SELECTIVE INHIBITION OF NUCLEOPLASMIC RAT LIVER DNA-DEPENDENT RNA POLYMERASE BY AFLATOXIN B₁. (E.) Saunders, F. C. (Dept. Med., U. Washington, Seattle), E. A. Barker and E. A. Smuckler. *Cancer Res* 32(11):2487-2494, 1972.

Aflatoxin B₁, a potent hepatocarcinogen, causes rapid but reversible *in vivo* inhibition of DNA-dependent RNA polymerase in isolated nuclei. This study was designed to determine whether the consequent decrease of RNA formation occurs as a result of direct alteration of RNA polymerase. Aflatoxin B₁, 1 mg/kg body wt, was administered i.p. to male rats; nuclei were isolated from liver homogenates at various times up to 24 hr thereafter. RNA polymerase was solubilized by sonic disruption, concentrated, and dialyzed. Some preparations were further purified by fractionation with diethylaminoethyl Sephadex chromatography. Methods were selected to measure nucleoplasmic or nucleolar RNA polymerase in intact nuclei and in crude solubilized or fractionated preparations with exogenous template (denatured calf thymus DNA). Nucleoplasmic enzyme activity of all three preparations was inhibited to 40% of control values at two through nine hr after aflatoxin administration, but it returned to control values at 24 hr. Fractionated nucleolar polymerase activity two and 24 hr after toxin administration was not significantly different from control values. Addition of aflatoxin B₁ *in vitro* to nuclei and crude solubilized polymerase did not produce altered nucleotide incorporation. Aflatoxin B₁ *in vivo* appears directly to alter nucleoplasmic rat liver DNA-dependent RNA polymerase function. In the dose selected for this study, aflatoxin impairs nucleolar RNA polymerase much less, if at all. The failure of direct addition of aflatoxin B₁ to alter ³H-labeled uridine 5'-triphosphate incorporation *in vitro* provides further support to the theory that it is altered metabolically to a toxic form.

- 5151 PARTICIPATION OF SOLUBLE INORGANIC PYROPHOSPHATASE IN CANCERATION (RAT LIVER FOLLOWING DIETHYLNITROSAMINE AND CCl₄). (Ger.) Kittlick, P.-D. (Path. Inst. Friedrich-Schiller U., Jena, East Germany), H. Büttner and W. Klemm. *Exp Pathol (Jena)* 6(5/6):248-256, 1972.

The effect of changes in Mg⁺⁺ concentration on the activity of soluble inorganic pyrophosphatase (PPase), as well as changes in PPase, was investigated in rat liver in the presence of a constant physiological Mg⁺⁺ concentration during DENA (diethylnitrosamine)-induced carcinogenesis. The results were compared to liver regeneration following CCl₄ intoxication. DENA was administered over a 25 wk period; CCl₄ was given i.p. in a single dose of 0.3 ml/100 g body wt. The results in rat liver homogenates indicated that the soluble inorganic pyrophosphatase in proliferating tissues exerts a regulatory effect; enzyme activity can be influenced by Mg concentration. Enzyme alteration may be due to a dissociation of the enzyme into subunits or to a desensitization of the allosteric site in the direction of degeneration. The intracellular inorganic pyrophosphate (PP) concentration is determined by the enzyme activity and the substrate affinity. With constant Mg⁺⁺ concentration following DENA, the V_{max} of liver activity and the substrate affinity changed equally after the second week of

administration. During regeneration after CCl₄, low substrate affinity appeared to be compensated by increased total activity. Due to the allosteric properties of PPase, the Mg activation is lost when total liver activity drops after DENA or CCl₄ and, simultaneously, the mitotic activity in the tissues reaches a maximum. A difference in regeneration mechanisms between CCl₄ and DENA effects is suggested.

- 5152 AFLATOXIN B₁, A HEPATOCARCINOGEN IN THE INFANT MOUSE. (E.) Vesselinovitch, S. D. (Pritzker Sch. Med., U. Chicago, Ill.), N. Mihailovich, G. N. Wogan, L. S. Lombard and K. V. N. Rao. *Cancer Res* 32(11):2289-2291, 1972.

Aflatoxin B₁ was administered to newborn and infant C57BL X C3H F₁ mice for a further evaluation of its hepatocarcinogenicity in this species. To date, adult animals have been shown to be relatively refractory. One-, 4-, or 7-day-old groups of animals were exposed to either single or limited numbers of i.p. injections of aflatoxin B₁. Animals selected at random were sacrificed at 52 and 82 weeks of age. Newborn animals were more prone to the lethal effect of aflatoxin B₁ than the 4- or 7-day-old infants. Male infants developed hepatomas by 52 weeks of age. At 82 wk, both tumor incidence and tumor mass increased in all male groups. Seven-day-old treated females developed hepatomas, although at a low incidence rate. Thus, it was demonstrated that aflatoxin B₁ is a potent hepatocarcinogen under the experimental conditions. It was concluded that the infant age and the male hormonal environment were factors favorable for the inception and expression of liver neoplasia in mice.

- 5153 METABOLISM OF AFLATOXIN B₁ IN RHESUS MONKEYS. (E.) Dalezios, J. I. (Dept. Nutrition Food Sci., Massachusetts Inst. Technol., Cambridge) and G. N. Wogan. *Cancer Res* 32(11):2297-2303, 1972.

The metabolism of aflatoxin B₁ was investigated in male rhesus monkeys given i.p. injections of a mixture of ring-labeled aflatoxin B₁-¹⁴C and nonradioactive toxin, at a total dose of 0.4 mg/kg. Thirty-five percent of the administered radioactivity was excreted in urine within 96 hr. The excretion rate reached a maximum one hr after dosing and then fell rapidly, but urine excreted after 96 hr still contained detectable radioactivity. A new method for isolation and identification of urinary aflatoxin metabolites was devised. Of the total urinary metabolites, only 12 to 15% were chloroform extractable, including at least three fluorescent metabolites of unknown structure in addition to aflatoxins B₁ and M₁. Chloroform-insoluble metabolites were isolated on an Amberlite XAD-2 column and separated by a DEAE-Sephadex A-25 column into six subfractions. The major subfraction (60%) was hydrolyzed almost quantitatively by β -glucuronidase and the liberated metabolite was identified as aflatoxin P₁, the O-demethylation product of aflatoxin B₁. Aflatoxin P₁ in urine represented approximately 20% of the

(5154-5157)

administered dose, 17% as glucuronide, 3% as sulfate, and 1% as unconjugated phenol. Aflatoxins M_1 and B_1 in urine accounted for 2.3 and 0.01 to 0.1% of the dose, resp. Four days after injection, 5.6% of the aflatoxin dose was still retained by liver and was mainly bound to liver proteins. Radioactivity in blood attained a peak at one hr after injection, and at 96 hr it decreased to 40% of its maximum value. Gel electrophoresis of serum followed by autoradiography indicated association of the radioactivity with the albumin fraction.

skin carcinomas. The animals receiving the synthetic tar exhibited a longer survival period, the longest being 2 years, and no signs of skin carcinoma. The results confirm the possibility of using a tar which does not cause skin cancer. The fact that some inflammatory or hyperplastic skin changes were found in animals receiving the synthetic tar is explained by the continuous s.c. injections in a particular skin area. Other manifestations of skin edema or leukemias are considered to have been spontaneously evoked and not due to the tar administration, since animals receiving the solvent alone showed similar reactions. The application of this tar in certain skin diseases is proposed.

- 5154 THE EFFECT OF FRESH CIGARETTE SMOKE ON LUNG TISSUE CULTURES AND ON THE DEVELOPMENT OF LUNG TUMORS IN THE SNELL MOUSE. (Ger.) Leuchtenberger, C. (Swiss Inst. Exp. Cancer Res., Lausanne) and R. Leuchtenberger. *Schweiz Med Wochenschr* 101(38):1374-1381, 1971.

- 5156 NITROSATION OF TERTIARY AMINES AND SOME BIOLOGIC IMPLICATIONS. (E.) Iijinsky, W. (Eppley Inst. Cancer Res., Omaha, Neb.), L. Keefer, E. Conrad and R. Van de Bogart. *J Nat Cancer Inst* 49(5):1239-1249, 1972.

The relationship of cigarette smoke to carcinogenesis was studied according to two model systems: inhalation studies in animals with fresh cigarette smoke; and studies of the effects of such smoke on cell, tissue, and organ cultures. The bronchogenic carcinoma, which often occurs in human cigarette smokers, was not found in the Snell mice exposed to fresh smoke. Two other types of lung tumors were found in the animals: a benign adenoma and a malignant adenocarcinoma. Male control animals developed spontaneous tumors twice as often as did females. Following inhalation of the gas phase of cigarette smoke, the frequency of tumors increased significantly in experimental animals. This frequency increase applied to a fivefold increase of adenocarcinoma in the males and a threefold increase in the females compared with their controls. The fact that the gas phase is an important factor in carcinogenesis contradicts the notion that lung cancer develops from the particulate matter. Results of the culture experiments revealed that the alveolar macrophages in lung cultures of Snell mice have a higher degree of sensitivity toward charcoal-filtered cigarette smoke than the epithelioid cells. Exposure of lung explant cultures to the gas phase of such smoke results in a stimulation of DNA synthesis by the macrophages. The presence of macrophages appears to have a growth-regulating effect on the epithelioid cells in the lung cultures.

The reactions of a variety of trisubstituted amino compounds with nitrite were studied in mildly acid conditions (pH 3-6.5). Nitrosamines were detected in every reaction, in variable yields of up to 100%; most of these were known carcinogens. Oxidative dealkylation of trialkylamines, followed by nitrosation, occurred in near neutral buffer solution and in mildly acidic medium. Steric effects in the intermediate *N*-nitrosotrialkylammonium ion appeared to be the primary determinants of reaction course, electronic effects apparently having little influence on the results. Nucleophilic anions, such as chloride, markedly increased the yield of nitrosamine in many cases. The predictive value of the mechanistic conclusions of this work was tested and verified in studies of the nitrosation of some tertiary amines of environmental interest, including nitrilotriacetic acid, triethanolamine, and *N,N*-dimethyldodecylamine.

- 5155 COMPARATIVE STUDIES OF CARCINOGENIC ACTION OF COAL-TAR AND A NEW SYNTHETIC TAR. (Ger.) Hilfrich, J. (Med. U., Hannover, West Germany) and U. Mohr. *Arch Dermatol Forsch* 242:176-178, 1972.

- 5157 MAMMARY TUMOR REGRESSION. I. PHYSIO-PATHOLOGIC CHARACTERISTICS OF HORMONE-DEPENDENT TISSUE. (E.) Gullino, P. M. (Natl. Cancer Inst., Bethesda, Md.), F. H. Grantham, I. Losonczy and B. Berghoffer. *J Nat Cancer Inst* 49(5):1333-1348, 1972.

The carcinogenic activity of coal tar and synthetic tar was compared by injecting one group (100) of 10-week-old female MNRI mice s.c., three times weekly, with a 5% solution of Pix lithanthracis (coal tar) and a second group (100) with a 5% solution of a synthetic tar in dimethylsulfoxide. Control groups received only the solvent. None of the animals treated with coal tar survived longer than 16 months, and those who survived beyond 12 months developed

Primary 7,12-dimethylbenz[a]anthracene-induced and transplantable MTW9 mammary carcinomas of the rat were used to study the regression process of hormone-dependent tumors. Both tumors were half their initial size within a few days after the host was deprived of hormone. Chemical composition, nuclear/cytoplasmic ratios of DNA, RNA, and protein, and average DNA content/nucleus were similar in regressing and growing tumors. Vascular space, blood flow, and regulation of blood supply were similar in regressing and growing tumors. Regression could not be identified by histologic analysis until it was far advanced and tumor size was significantly reduced. Extensive invasion by immunologic-type cells was not seen in regressing tumors, except for isolated foci of macrophages

and lymphocytes, observed mostly around necrotic areas. In a group of "spontaneous" mammary tumors, no relation was found between tumor regression and functional differentiation of neoplastic cells, as measured by lactose, phosphoprotein, and triglyceride production. Transplantation of regressing MTW9 fragments into hosts with the appropriate hormonal milieu was as successful as transplantation of fragments from growing tumors. The tumor models indicated that regression consisted of a coordinated sequence of events, which occurred in the whole tumor and involved rapid destruction of single cells, but did not change significantly the relative size of the vascular, interstitial, and cellular compartments or the efficiency of the vascular system of the tumor.

- 5158 MAMMARY TUMOR REGRESSION. II. AUTOPHAGY OF NEOPLASTIC CELLS. (E.) Gullino, P. M. (Natl. Cancer Inst., Bethesda, Md.) and R. H. Lanzerotti. *J Nat Cancer Inst* 49(5):1349-1356, 1972.

MTW9-transplanted and primary, 7,12-dimethylbenz[a]-anthracene-induced mammary tumors of the rat were used to study the behavior of the pericellular environment during hormone-dependent tumor regression. Three observations are reported: 1) The sodium space/unit tumor weight did not change substantially during regression. 2) The protein and phosphorous content of the pericellular fluid remained equal in growing and regressing tumors, but the level of amino acid in efferent blood of regressing tumors was higher than that in afferent blood. This difference was not found in growing tumors. 3) The activity of six lysosomal hydrolases significantly increased in the total homogenate of regressing tumors but not in the pericellular fluid. There was no indication that the pericellular fluid of solid tumors, either growing or regressing, contained an appreciable amount of lysosomal enzymes *in vivo*. These data are interpreted to show that cell lysis, occurring during tumor regression, results from an autophagic process, i.e., an endocellular event, that is unable to alter the *in vivo* pericellular environment and does not endanger the survival of neighboring cells.

- 5159 A STUDY OF POSSIBLE CARCINOGENIC AND COCARCINOGENIC PROPERTIES OF OVERHEATED OILS. (Rus.) Dzagnidze, L. I. (Inst. Oncol. GSSR Min. Pub. Hlth, Tiflis, USSR) and P. N. Krasniyanskaya. *Soobshch Akad Nauk GSSR* 67(1):229-231, 1972.

Possible carcinogenic effects of cooking oils (butter oil and sunflower oil) heated at 160-180 C for 30-40 min were studied. A group of white mongrel rats (390) three- to five- months old, received six i.m. injections of natural or overboiled oils in a dose of 2 ml at ten-day intervals, alone or in conjunction with a single injection of 1 mg benzo(a)pyrene. Another group of animals received 1 ml of the oils eight times at ten-day intervals, alone or in conjunction with a single injection of 0.5 mg benzo(a)pyrene. Of 116 surviving rats of the first group, 19 showed

tumor development. Of 177 surviving rats of the second group, 51 had tumors. The highest tumor incidence was seen in animals which had received overheated butter oil with the single administration of the carcinogen. The control animals, which had received natural oils, did not show tumors. The latent period of tumor formation was three to four months for both groups. The tumors were rhabdomyoblastomas, polymorphous-cellular and spindle-cell sarcomas irrespective of the carcinogenic agents. Overheated oils were concluded to possess carcinogenic and cocarcinogenic properties.

- 5160 NITROSAMINE METABOLISM *IN VIVO*. I. β -OXIDATION OF ALIPHATIC DI-N-ALKYLNITROSAMINES: FORMATION OF 7-METHYLGUANINE ALONG WITH 7-PROPYL AND 7-BUTYLGUANINE RESP., FOLLOWING APPLICATION OF DI-N-PROPYL OR DI-N-BUTYLNITROSAMINE. (Ger.) Krueger, F. W. (German Center Cancer Res., Heidelberg, West Germany). *Z Krebsforsch* 76(2):145-154, 1971.

Because of the association of carcinogenesis with the alkylation of N-nitroso compounds, *in vivo* investigations of the alkylizing properties of 1- and 2-[14 C]-di-n-propylnitrosamine and of 1-[14 C]-di-n-butylnitrosamine were conducted in the ribonucleic acids of rat liver. Following doses of 388 mg/2000 microCi/kg of the first, 400 mg/2060 microCi of the second, and 371 mg/3125 microCi/kg of the third compound, the specific RNA activity was determined. The main participation of this activity is found by a labeling of pyrimidine nucleotide. The results revealed that the higher dialkylnitrosamines are metabolized to methylated compounds *in vivo*. It was demonstrated that in the 1- and 2-[14 C]-di-n-propylnitrosamines, the alkyl chain between the α - and β -C-atom must be split. The formation of 7-[14 C]-n-propyl- and 7-[14 C]-n-butyldiguanine shows, however, that besides the metabolism to methylated compounds, there is also a transference of intact alkyl groups to the genetic material.

- 5161 CERTAIN ASPECTS OF CARBOHYDRATE METABOLISM IN RAT TISSUES DURING DIMETHYLAMINOAZOBENZENE-INDUCED CARCINOGENESIS. (Rus.) Arzamastsev, V. P. (Orenburg Med. Inst., USSR). *Patol Fiziol Eksp Ter* 15(4):25-28, 1971.

Changes in glycolysis, especially in hexokinase activity, and oxygen requirement of the liver in the process of carcinogenesis were studied with 60 hybrid rats weighing 120-150 g. Dimethylaminoazobenzene (12 mg in 1 ml sunflower oil) was administered to 40 rats through a catheter in the esophagus six times a week for six months. Experimental and control animals were fed a diet low in riboflavin and protein. Biochemical and histological studies were done for two months following the end of carcinogen administration. Oxygen consumption, anaerobic and aerobic glycolysis by tissue sections of liver, kidneys, and spleen were determined, using a Warburg apparatus,

glucose as substrate and sodium pyruvate in the medium. Hexokinase activity was determined manometrically. At autopsy, dystrophic and cirrhotic changes were seen in the liver of experimental animals, indicating precancerous changes. Biochemical studies showed intensification of anaerobic and aerobic glycolysis due to the high concentration of oxidized nicotinamide-adenine-dinucleotide in experimental livers. There was an increase in hexokinase activity in the liver homogenates of experimental animals (160%). Hexokinase activity was also increased in the kidneys and spleen of experimental animals (142% in the kidneys and 137% in the spleen). Intensification of glycolysis in these organs could not be determined. Oxygen consumption by the control and experimental liver tissues was the same (2.3 mm³/hr). Oxygen consumption was the same in experimental and control kidneys (9 mm³/hr). Oxygen consumption in the control spleen was higher (4.8 mm³/hr) than in the experimental spleen (3.9 mm³/hr).

5162 INDUCTION OF CARDIAC TUMORS IN BD RATS BY CONTINUOUS ORAL ADMINISTRATION OF THE CARCINOGEN 1-PYRIDYL-3,3-DIETHYL-TRIAZENE (PDAT). (Ger.) Ivankovic, S. (German Cancer Res. Ctr., Heidelberg, West Germany), H. Wohlenberg, H. D. Mennel and R. Preussmann. *Z Krebsforsch* 77(3):217-225, 1972.

BD rats, aged 3 months, received 2 or 4 mg/kg of the carcinogen 1-pyridyl-3,3-diethyl-triazene (PDAT) in their drinking water (five days per week). The development of cardiac tumors was confirmed clinically by the manifestation of dyspnea and subacute edema. The first malignant tumors were observed one yr after the beginning of the administration of the carcinogen. Of 25 rats given 2 mg/kg doses, ten animals died within 414-712 days. These had malignant cardiac tumors. Of 19 animals given 4 mg/kg, five times weekly, six animals died without developing tumors, and six others showed the beginnings of cardiac tumors at autopsy. These tumors were only discovered upon dissection of the heart. The mean induction time was 500 days. It appears that cardiac tumors occurred more frequently in the animals receiving the lower doses of carcinogen, although tumors in other organs were found less frequently in this group than in the group receiving double the dose. It thus follows that the heart is more sensitive to PDAT than are other organs.

5163 ULTRASTRUCTURAL CHANGES IN RAT LIVERS INDUCED BY REPEATED INJECTIONS OF TRYPAN BLUE. (E.) Gillman, T. (Inst. Animal Path., Cambridge, England) and R. C. Hallows. *Cancer Res* 32(11):2393-2399, 1972.

Repeated injections of trypan blue into the s.c. tissue of inbred Wistar rats induced tumors in the liver. The morphological changes that occurred during induction of the tumors were studied ultrastructurally. The earliest recognized change was the appearance in the portal tracts of focal collections

of monocytic cells that resembled Kupffer cells. They appeared either to collect in the periportal connective tissue or to migrate through the endothelial wall and collect within the portal venules or lymphatics. This caused periportal cyst formation and pressure atrophy of the surrounding hepatocytes. No mitotic activity was seen in the monocytic cells, but their numbers increased and occluded lymph flow. The more numerous these cells became, the less they resembled Kupffer cells and the more they came to resemble cells of the established tumors. Collagen fibrils and bundles as well as fibrin appeared among the cells. Subsequently, nonperiodic fibrillar material was also seen around the cells. The cellular areas were then indistinguishable from established primary tumors. The morphological changes seen in the liver resemble those reported in histopathological descriptions of Kupffer cell sarcoma in humans.

5164 GENETIC PROPERTIES OF SUBSTITUTED DERIVATIVES OF *N*-METHYL-4-AMINOAZOBENZENE IN RELATION TO AZO-DYE CARCINOGENESIS. (E.) Fahmy, O. G. (Inst. Cancer Res., London, England) and M. J. Fahmy. *Int J Cancer* 10:194-206, 1972.

N,N-dimethyl-4-aminoazobenzene (DAB) and several of its analogous substituted derivatives were injected into the hemocoel of *Drosophila melanogaster*; mutagenicity of the compounds for the heterochromatic *bobbed* (*bb*) and *Minute* (*M*) loci relative to general mutability as indicated by the overall response of the X-chromosome (recessive lethals and visibles), was observed. DAB and its 3'-Me and 3'-ClMe derivatives did not raise X-mutation frequencies above control levels, nor did these compounds increase mutation frequencies at selected euchromatic loci investigated with the *bb* loci. The *N*-benzoyloxy derivative of DAB (*N*-BzO-MAB) raised X-chromosome mutation frequencies, as did chloroethylamines (*N*-ClEt-MAB). DAB and its 3'-Me analog, and *N*-substituted reactive DAB derivatives were all mutagenic for the heterochromatic *nucleolar organizer* region of the X-chromosome, a major r-RNA-forming segment. *N*-BzO-MAB was a more active mutagen than DAB for these regions. DAB increased maximal X-mutation frequencies in spermatogonia, as did its 3'-Me derivative. Mutagenicity of both DAB and of *N*-BzO-MAB were maximal in spermatogonia. The mutagenicity and/or gene selectivity on the *bb* loci activity of tested azo dyes was correlated with the carcinogenicity of the tested agents, the most selective and mutagenic dyes (DAB, its 3'-Me derivative and *N*-BzO-MAB) being strong hepatocarcinogens.

5165 STUDIES ON CARCINOGENIC TRYPTOPHAN METABOLITES. II. ENZYMATIC FORMATION AND HYDROLYSIS OF SULFURIC ESTER OF 3-HYDROXYANTHRANILIC ACID. (E.) Watanabe, M. (Natl. Inst. Hyg. Sci., Tokyo, Japan) and K. Minegishi. *Biochem Pharmacol* 21(9):1347-1356, 1972.

The enzyme that forms the sulfuric ester of 3-hydroxyanthranilic acid (3-OHAA) was precipitated from livers of guinea pigs, rats and DDN mice by

(NH₄)₂SO₄. Enzymes were preincubated with ATP and SO₄²⁻, then incubated with 3-OHAA for 60 min. The rate of formation of the sulfuric ester of 3-OHAA (3-OSAA) was determined fluorometrically; at the same time, the formation of p-nitrophenylsulfate (NPS) was estimated. 3-OSAA was formed by enzymes from all three species. The ratio of formation of 3-OSAA and (NPS) per mg protein was 0.23:1, 0.45:1 and 0.39:1 in guinea pigs, mice and rats, resp. The rate of hydrolysis of 3-OSAA by the enzyme from human urine was 0.065 times the rate of hydrolysis of 2-hydroxy-5-nitrophenylsulfate. These results suggest that formation of 3-OSAA is possible in the animal body that hydrolysis of 3-OSAA may be negligible in urine.

- 5166 DIFFERENCES IN (Mg²⁺) AND (Ca²⁺) DEPENDENCE OF AMINO ACID INCORPORATION BY FREE AND MEMBRANE-BOUND POLYRIBOSOMES ISOLATED FROM LIVER AND AN EFFECT OF THE HEPATOCARCINOGEN DIMETHYLNITROSAMINE. (E.) Vernie, L. N. (Netherlands Cancer Inst., Amsterdam), W. S. Bont and P. Emmelot. *Biochim Biophys Acta* 281(2):253-262, 1972.

Free and membrane-bound polyribosomes were isolated from livers of normal rats and rats given a single i.v. injection of 50 mg dimethylnitrosamine (DMNA) per kg five hr previously. Amino acid incorporation by polyribosomes was studied in the presence of 2-8 mM Mg²⁺ and 0-5 mM Ca²⁺. Ca²⁺ in combination with Mg²⁺ was more effective than Mg²⁺ alone in sustaining amino acid incorporation by free polyribosomes. Optimal incorporation occurred at 6 mM Mg²⁺ and 2-3 mM Ca²⁺. The breakdown of free polyribosomes during amino acid incorporation at Mg²⁺ levels below 7 mM was counteracted by Ca²⁺. Amino acid incorporation depended on the relative concentrations of the two ions rather than on their sum concentration. Ionic conditions for incorporation were not changed by DMNA action. The Mg²⁺ dependence of amino acid incorporation by membrane-bound polyribosomes differed from that of free ribosomes, optimal incorporation occurring at 4 mM Mg²⁺ and 2 mM Ca²⁺. Also, various Ca²⁺ concentrations stimulatory or not active for amino acid incorporation by free polyribosomes were inhibitory in the case of the membrane-bound ribosomes. The relative effects of various Ca²⁺ concentrations on DMNA preparations at 6 and 4 mM mg²⁺ were similar to those on normal preparations at, resp., 8 and 6 mM Mg²⁺. Thus, DMNA affected the ionic conditions for amino acid incorporation by membrane-bound polyribosomes by causing a shift to a lower requirement for added ions.

- 5167 BIOCHEMICALLY DIFFERENTIATED NEOPLASTIC CLONE OF SCHWANN CELLS. (E.) Pfeiffer, S. E. (Dept. Microbiol., U. Connecticut, Storrs) and W. Wechsler. *Proc Nat Acad Sci USA* 69(10):2885-2889, 1972.

Malignant neurinomas were induced in rats by a single i.v. injection of 80 mg ethylnitrosourea. Four clones were established from one of these

tumors, a transplantable tumor of the cervical spinal-nerve root. One clone (RN-2) possessed some properties of Schwann cells. It contained the nervous system specific protein S-100 as 0.1% of total soluble protein; showed high levels of 2',3'-cyclic nucleotide-3'-phosphohydrolase, an enzyme found in large amounts only in glial cells; and produced a basic protein related by immunological cross-reaction, molecular size, and amino-acid composition to the encephalitogenic protein from beef brain myelin. RN-2 grew in monolayers with a doubling time of 20 hr and a plating efficiency of 50%. Its cells had a mode of 43 normal chromosomes. Inoculated s.c. in rats, cells of this clone grew as tumors.

- 5168 DETERMINING ROLE OF AGE AND THYMUS IN PATHOLOGY OF 7,12-DIMETHYLBENZ(A)ANTHRACENE-INDUCED LEUKEMIA IN MICE. (E.) Shisa, H. (Aichi Cancer Ctr. Res. Inst., Nagoya, Japan) and Y. Nishizuka. *Gann* 62(5):407-412, 1971.

Leukemia incidence was investigated in five groups of Swiss/Ms mice injected in the intrascapular s.c. area with a lipid emulsion of 7,12-dimethylbenz(a)-anthracene (DMBA). Group 1 consisted of three-day old mice; group 2 of 35-day old mice; group 3 of 35-day-old mice pretreated with cortisone; group 4 of 70-day-old mice; and group 5 of female mice injected three days after parturition (average age, 71 days). Group 1 received 100 µg DMBA and the other groups 1 mg. Leukemias developed in all groups. Thymic lymphocytic or lymphoblastic leukemias developed in 96.5, 50.0 and 26.1% of animals in groups 1, 2 and 4, resp. In groups 3 and 5, the percentages of thymic leukemias were 91.3 and 71.4%, resp. Non-thymic leukemias were classed as undifferentiated cell leukemias. These were more common in adult mice. Thymuses in cortisone-treated mice and in postpartum mice showed prompt weight decreases followed by increases as lymphocytes diminished, then proliferated.

- 5169 FINE STRUCTURAL CHANGES IN RAT PANCREATIC CELLS DURING PROLONGED TREATMENT WITH 4-ACETYLAMINOFLUORENE. (E.) Flaks, B. (U. Bristol Med. Sch., England) and J. Lucas. *Chem-Biol Interact* 5(4):217-225, 1972.

Male rats were fed the noncarcinogen 4-acetylaminofluorene (4-AAF) as 0.05% of diet. The rats were killed after 7-10 days, 3-4 wk, 8-12 wk, or 8-10 months on the diet and pancreatic acinar cells were prepared for electron microscopic examination. After 7-10 days on 4-AAF, some acinar cells showed lesions of the granular endoplasmic reticulum. The cisternae of granular endoplasmic reticulum were much dilated, as was the perinuclear envelope. By 8-12 wk, most acinar cells exhibited changed granular endoplasmic reticulum, and large autophagic vacuoles had begun to appear in many acinar cells. Some mitochondrial damage and focal cytoplasmic degradation was also seen in acinar cells. By 8-10 months, mitochondrial damage was still evident, but dilation of the granular endoplasmic reti-

culum was less severe. The changes produced in pancreatic acinar cells by 4-AAF were similar to changes produced by the carcinogenic 2-AAF. However, 4-AAF did not appear to inhibit secretory enzyme protein transport; this inhibition was one of the effects of 2-AAF on pancreatic acinar cells.

- 5170 THYROID CARCINOGENESIS IN HAMSTERS AFTER TREATMENT WITH ^{131}I -IODINE AND METHYLTHIOURACIL. (E.) Christov, K. (Cancer Res. Inst., Sofia, Bulgaria) and R. Raichev. *Z Krebsforsch* 77(3):171-179, 1972.

Female hamsters were given methylthiouracil (MTU) as 0.2% of drinking water and/or ^{131}I (i.p. injections of 10 μCi). The hamsters were killed at various intervals and their thyroids were examined. Thyroid adenomas were first found in MTU-treated animals five months after the start of MTU-feeding; by the end of a yr, 58% of MTU-treated hamsters had thyroid adenomas of a papilliferous type. Small papilliferous adenomas were also seen in hamsters given ^{131}I , beginning eight to 12 months after the start of treatment. Thyroid adenomas appeared as early as the fourth month in hamsters given MTU and ^{131}I . In the combined-treatment group, the thyroid adenomas were more numerous and larger than in hamsters given MTU or ^{131}I only. In the fifth month thyroid carcinomas were seen in this group.

- 5171 EARLY CHANGES IN RAT ADRENAL PROTEIN SYNTHESIS AFTER DIMETHYLNITROSAMINE ADMINISTRATION. (E.) Bauer, G. E. (Dept. Anat., U. Minnesota, Minneapolis), E. A. Smuckler and T. Hultin. *Proc Soc Exp Biol Med* 140(4):1402-1404, 1972.

Male rats were given dimethylnitrosamine (DMNA) by gastric intubation (20 mg/kg) or by i.p. injection (20 mg/kg). Some rats given DMNA i.p. were also given Celite (acid-washed diatomaceous earth) (225 mg/kg) in i.p. injections. The incorporation of ^{14}C -leucine into protein in adrenals of rats given DMNA was observed as an index of adrenal protein synthesis. Intragastric DMNA caused a prompt increase of more than 50% in ^{14}C -leucine uptake, with a return to control levels by eight hr. Treatment of adrenal slices *in vitro* with DMNA produced a 16% decrease in amino acid uptake; liver slices treated with DMNA *in vitro* showed a marked inhibition of ^{14}C -leucine uptake. Intraperitoneal injection of DMNA caused a prompt increase in ^{14}C -leucine uptake by adrenals. Amino acid uptake reached its maximum by two hr, fell to near control levels by four hr, and rose again at 12 hr, finally to return to normal by 24 hr. In rats given Celite along with i.p. DMNA, ^{14}C -leucine uptake showed a more prolonged and sustained stimulation.

- 5172 ETHYLATION OF NUCLEIC ACIDS BY ETHYLNITROSOUREA- ^{14}C IN THE FETAL AND ADULT RAT. (E.) Goth, R. (Max-Planck Inst., Tübingen, West Germany)

and M. F. Rajewsky. *Cancer Res* 32:1501-1505, 1972.

Pregnant female rats were injected i.v. with 75 $\mu\text{g/g}$ body wt *N*-ethyl-*N*-nitroso-urea- ^{14}C (ENU), an amount representing 30% of the 50% lethal dose for these rats. One hr later, fetuses, brains and livers were removed and the formation of the ENU alkylation product 7-ethylguanine (7-EG) in nucleic acids of fetal and adult brain and liver was examined by ion-exchange radiochromatography. The degree of ethylation of ENU (expressed as the fractions of guanine residues ethylated (7-EG:guanine)) in whole fetus nucleic acids was 1.7×10^{-5} for DNA and 0.6×10^{-5} for RNA. The 7-EG:guanine value for fetal brain DNA was 2.2×10^{-5} and the 7-EG:guanine value for fetal liver DNA was 4.4×10^{-5} . The corresponding values for adult brain and liver were 2.1×10^{-5} and 3.5×10^{-5} , resp. These findings indicate that the tumorigenic effect of an alkylating carcinogen is not a simple function of the degree of *N*-7-alkylation produced in the nucleic acids.

- 5173 INFLUENCE OF "FEEDER CELLS" AND INDUCERS AND INHIBITORS OF MICROSOMAL MIXED-FUNCTION OXIDASES ON HYDROCARBON-INDUCED MALIGNANT TRANSFORMATION OF CELLS DERIVED FROM C3H MOUSE PROSTATE. (E.) Marquardt, H. (McArdle Lab. Cancer Res., U. Wisconsin, Madison) and C. Heidelberger. *Cancer Res* 32(4):721-725, 1972.

Irradiated (5,000 R) rat or mouse embryo fibroblasts ("feeder cells") were added to G23 C3H mouse prostate fibroblasts; the feeder cells were known to metabolize polycyclic aromatic hydrocarbons, while G23 cells metabolized hydrocarbons poorly. Various carcinogens were added to the feeder cell-G23 mixtures and hydrocarbon-induced cytotoxicity, plating efficiency of cells and hydrocarbon-induced malignant transformation was observed. Feeder cells greatly increased hydrocarbon metabolism in G23 cells, and also increased plating efficiency of prostate cells and cytotoxicity of 3-methylcholanthrene (MCA) and 7,12-dimethylbenz(a)anthracene (DMBA). Feeder cells did not affect the cytotoxicity of the K-region epoxide of MCA. Malignant transformation of G23 cells by MCA was increased by feeder cells; but transformation by DMBA was not affected and transformation by MCA's K-region epoxide was reduced. Irradiated human skin cells used as feeders had no effect on plating efficiency, hydrocarbon-induced cytotoxicity, or hydrocarbon-induced transformation. Induction of microsomal mixed-function oxidases in G23 cells by benz(a)anthracene (BA) or 2,5-diphenyl-oxazole increased cytotoxicity of MCA, BA and DMBA but did not affect cytotoxicity of MCA's K-region epoxide. Malignant transformation in G23 cells by BA and MCA was increased by enzyme induction, but DMBA transformation was not affected. Transformation by MCA's K-region epoxide was reduced by enzyme induction in G23 cells. Inhibition of microsomal mixed-function oxidases by α -naphthoflavone decreased the cytotoxicity of MCA and increased that of its K-region epoxide. Enzyme inhibition prevented MCA transformation, but enhanced transformation by its K-region epoxide.

- 5174 STRUCTURE-ACTIVITY RELATIONSHIPS IN DNA BINDING AND NUCLEAR EFFECTS OF AFLATOXIN AND ANALOGS. (E.) Edwards, G. S. (Dept. Nutr. Food Sci., Massachusetts Inst. Technol., Cambridge), G. N. Wogan, M. B. Sporn and R. S. Pong. *Cancer Res* 31:1943-1950, 1971.

Aflatoxins B₁, B₂ and G₁ and three synthetic compounds were evaluated for their ability to inhibit RNA polymerase activity, decrease the nuclear content of RNA and cause nucleolar macrosegregation in rat hepatocyte nuclei. The ability of each of the compounds to bind to native calf thymus DNA was studied by equilibrium dialysis. 5,7-Dimethoxycyclopentenone [2,3-c]coumarin (compound 11) had the highest association constant followed, in decreasing order, by aflatoxins B₁, B₂ and tetrahydrodeoxyaflatoxin B₁. The DNA-binding capacity of these compounds did not reflect their toxic or carcinogenic activity. The ability of aflatoxins B₁, B₂ and G₁ to inhibit Mg⁺⁺- and Mn⁺⁺-stimulated RNA polymerase correlated with carcinogenic activity. Assay of liver homogenates from pretreated rats showed that aflatoxins B₁ and G₁ inhibited both polymerase activities by about 40% and 35%, resp., while aflatoxin B₂ had no effect. Aflatoxin B₁ was more active in causing RNA degradation (reduction in RNA:DNA ratio) in hepatoma nuclei isolated from treated rats than was aflatoxin G₁; aflatoxin B₂ showed no effect at a dose 100 times that of aflatoxin B₁. Aflatoxins B₁ and G₁ produced a rapid macrosegregation of the fibrillar and granular portions of the hepatocyte nucleolus. Aflatoxin B₂ induced only minimal segregation (microsegregation). Coumarin, tetrahydrodeoxyaflatoxin B₁, aflatoxin G₂ and three carcinogenically inactive aflatoxin analogs caused no observable ultrastructural changes. Rats were given i.p. injections of ring-labeled aflatoxins B₁-¹⁴C or B₂-¹⁴C, sacrificed after three hr and examined to determine the extent of metabolism of the two compounds. The noncarcinogenic aflatoxin B₂ was catabolized and excreted from the liver twice as fast as the carcinogenic aflatoxin B₁. However, this difference was not sufficient to account for the large differences in acute activities of these two compounds.

- 5175 *IN VITRO* INCREASE OF THE LIFE SPAN OF HAMSTER EMBRYO CELL CULTURES TREATED WITH CHEMICAL CARCINOGENS. (Rus.) Irlin, I. S. (N. F. Gamaleya Inst. Epidemiol. Microbiol., Acad. Med. Sci. USSR, Moscow) and I. I. Parkhomenko. *Vop Onkol* 17(11):62-68, 1971.

The effects of various chemical carcinogens on trypsinized cultures of late pregnancy hamster embryos were studied. The carcinogens used were 3,4-benzo(a)pyrene (BP), 7,12-dimethyl-1,2-benzanthracene (DMBA), 20-methylcholanthrene (MCA), pyrene (P), and anthracene (A). The nutritive medium contained 10% inactivated bovine serum medium. To study the sensitivity of the transformed cells to toxic effects of the carcinogens, the cells were inoculated into a Petri dish filled with a growth medium containing various doses of the above carcinogens. For the study of transplantability of the

cultures *in vivo*, various doses of cells in a growth medium were injected s.c. into hamsters. From 21 primary cultures grown in the presence of MCA in doses 2, 6, 10, and 20 µg/ml, 18 cell lines (86%) were obtained after 3-4 months. They survived 55-60 passages for 1.5 yr. All 26 control cultures of embryonic hamster tissue degenerated after 5-6 passages. Only one of eight cultures treated with DMBA (0.5-1 µg/ml) for 48 hr produced a new cell line. Two cell lines (from the culture treated with 5 µg/ml) were obtained from nine cultures treated with BP (1, 2, 5 and 10 µg/ml) for 3-6 days. Incubation with Tween 80 (400-450 µg/ml) for 28 hr to eight days before or after treatment with BP or MCA shortened the time for transformation of cultures into cell lines to 2-3 months. Inoculation of stable cultures (85-160 days of growth *in vitro*) treated with MCA into adult hamsters induced tumors (25/58 hamsters).

- 5176 RESPIRATORY TRACT CARCINOGENESIS INDUCED IN HAMSTERS BY DIFFERENT DOSE LEVELS OF BENZO[a]PYRENE AND FERRIC OXIDE. (E.) Saffiotti, U. (Nat. Cancer Inst., Bethesda, Md.), R. Montezano, A. R. Sellakumar and D. G. Kaufman. *J Nat Cancer Inst* 49(4):1199-1204, 1972.

Dose-response relationships in respiratory tract tumor induction were investigated in Syrian golden hamsters given 30 weekly intratracheal instillations of 0.25, 0.5, 1.0, or 2.0 mg benzo(a)pyrene mixed with equal amounts of Fe₂O₃. A positive correlation was demonstrated between the dose level of individual administrations and the yield of respiratory tumors. Both tumor latency and tumor multiplicity were related to the dose per administration and hence total dose. As previously noted in this animal model, squamous cell carcinomas were the predominant morphologic type, and the most frequently affected site was the bronchi, followed by the trachea.

- 5177 CONVERSION OF CARCINOGENIC HYDROCARBONS IN TUMOR CELL CULTURES. (Rus.) Bakulina, S. P. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow), C. A. Belitskii, I. M. Buzhurina and M. A. Panov. *Vopr Onkol* 18(7):65-68, 1972.

Formation of metabolites of benzpyrene and 7,12-dimethylbenzanthracene was studied spectrometrically in normal fibroblastoid hamster cells and in cell lines of fibroblasts transformed by polyoma and SV40 viruses--610, 70/0, and CA-1 (used in a previous work). H³-benzpyrene and acid-soluble metabolites did not accumulate in cultures of CA-1 line cells during 1-72 hr of incubation. H³-benzpyrene accumulated somewhat in firmly combined form in cultures of 70/0 and 610 line cells, but acid-soluble H³-benzpyrene metabolites did not accumulate in these cell cultures. Acid-soluble metabolites of H³-dimethylbenzanthracene did not accumulate in the normal fibroblastoid cells during 24-72 hr of incubation, while H³-dimethylbenzanthracene derivatives which combine with cells and pro-

tein increased somewhat in these cells. H^3 -dimethylbenzanthracene derivatives were not seen in the transformed cells (70/0, 610, and CA-1 cells). Benzpyrene metabolism was accompanied by an accumulation of the acid-soluble metabolites in normal cell cultures, but these metabolites were not seen in the transformed cell cultures. Dimethylbenzanthracene was metabolized significantly more slowly than benzpyrene in normal cell cultures.

5178 TUMORS OF THE NERVOUS SYSTEM FOLLOWING INTRAPERITONEAL INJECTION OF METHYLNITROSOUREA. (Ger.) Schreiber, D. (Med. Acad. Erfurt, East Germany), P. Scholtze, W. Jänisch and H. Batka. *Zentralbl Allg Pathol* 115(1/2):3-7, 1972.

Methylnitrosourea (MNU) was administered i.p. to rats for the induction of tumors of the nervous system, and the results compared with those obtained with i.v. injections in a previous study. The tests were conducted in newborn, young and adult Hauben rats (groups I-VI) and in adult Wistar rats (group VII). With the exception of groups V and VI, which were all males, the animals were of both sexes. Groups I, III, and VII received 10 mg/kg MNU in buffer solution at pH 4.2-4.4, biweekly, i.p. and the other four groups received twice this dose every four weeks. The rats in groups V and VI were castrated before the beginning of the experiments or given i.m. injections of testosterone, resp. Tumors of the nervous system were demonstrated in 40.7% of the Wistar rats and in 75.9% of the Hauben rats; this incidence was comparable to the results of i.v. administration of MNU. Multiple tumors were observed in 36.1% of the Hauben rats and in 3.7% of the Wistar rats. The induction time of tumors was much shorter in the younger animals, although frequency of tumors was not affected by age; no significant differences were found due to dose levels, castration or treatment with testosterone. The tumors included gliomas, sarcomas, gliosarcomas, neurinomas, neurosarcomas and one meningioma. The simpler i.p. technique was as effective as the i.v., for tumor induction in rats.

5179 CULTURE OF MAMMALIAN BUCCAL CELLS. II. A STUDY OF THE ACTION OF ATMOSPHERIC MICROCONSTITUENTS. (Fr.) Frappa, J. (Microbiol. Div., C.R.S.S.A., Lyon, France), P. Deschaux, C. Bottex and R. Fontanges. *C R Seances Soc Biol* 165(7/8):1633-1638, 1971.

Oxygen consumption and glucose incorporation were studied in embryonic calf buccal cell cultures and tissue explants inoculated with up to 1000 μ g atmospheric organominerals, up to 400 μ g natural carcinogenic hydrocarbons, and up to 100 μ g synthetic carcinogenic hydrocarbons. The cell cultures and tissue explants were examined 1 and 48 hr after contact with the pollutants. Oxygen consumption in cell cultures was depressed by organomineral complexes in the first hr but was increased after 48 hr. The increase

was proportional to the concentration of pollutants. Low concentrations of the organic fraction tended to decrease O_2 consumption, while higher concentrations increased it. In tissue explants, O_2 consumption was low with a mixture of microconstituents, markedly decreased by the organic fraction, and increased by the mineral fraction. The results were similar for glucose consumption. The particular effect of the organic fraction was confirmed by the study of the effects of benzo(a)pyrene, benzanthracene, benzperylene, and coronin. Their effect on cell cultures was comparable to that of the organic fraction.

5180 TEST OF ALCOHOLIC BEVERAGES AND ETHANOL SOLUTIONS FOR CARCINOGENICITY AND TUMOR-PROMOTING ACTIVITY. (E.) Kuratsune, M. (Fac. Med., Kyushu U., Japan), S. Kohchi, A. Horie and M. Nishizumi. *Gann* 62(5):395-405, 1971.

Wistar rats and CF_1 and ddN mice were subjected to chronic treatment with Japanese or Scotch whiskey, sherry, *Sake*, and an aqueous solution of ethanol. The agents were administered by forced drinking, skin painting or s.c. injection. No malignant tumors which could be ascribed to chronic treatments were seen. In tumor promotion experiments, topical applications of 7,12-dimethylbenz(a)anthracene were followed by topical applications of distillation residues of *Sake* and whiskey. *Sake* and whiskey distillates, used as tumor promoters, increased tumor development over that in animals given carcinogens with no promoter; however, the differences in tumor incidence were not statistically significant.

5181 THE ROLE OF DNA CROSS-LINKING IN THE INACTIVATION OF BACTERIOPHAGE T_7 BY CARCINOGENIC BROMOMETHYLBENZ(a)ANTHRACENES. (E.) Venitt, S. (Roy. Cancer Hosp., London, England) and K. V. Shooter. *Biochim Biophys Acta* 277(3):479-488, 1972.

T_7 bacteriophage DNA was exposed to the carcinogens 7-bromomethylbenz(a)anthracene or 7-bromomethyl-12-methylbenz(a)anthracene, then denatured to determine the extent of DNA cross-linking induced by the compounds. Both compounds induced heat-stable and alkali-stable interstrand cross-links in T_7 DNA. There was a dose-dependent increase of carcinogen binding to DNA and a concomitant increase in DNA cross-linking. It was calculated that 1700 7-bromomethyl-12-methylbenz(a)anthracene residues and 4890 7-bromomethylbenz(a)anthracene residues, resp., were needed to produce one cross-link in a T_7 DNA molecule of molecular wt 2.5×10^7 . The effects of the two carcinogens on the survival of T_7 plaque formation was investigated in related experiments. No significant inactivation of T_7 by 7-bromomethyl-12-methylbenz(a)anthracene was seen, though 7-bromomethylbenz(a)anthracene caused inactivation of T_7 plaque formation. This inactivation followed single-hit kinetics; the extents of reaction reducing T_7 survival of plaque formation

to 37% were 6.2 arylalkylations/T7 DNA molecule and 2.5 arylalkylations/total coat protein, resp.

- 5182 DEGRADATION OF STEROIDS BY INTESTINAL BACTERIA. IV. THE AROMATIZATION OF RING A. (E.) Goddard, P. (St. Mary's Hosp. Med. Sch., London, England) and M. J. Hill. *Biochim Biophys Acta* 280(2):336-342, 1972.

E. coli or *C. paraputrificum* were incubated anaerobically with the substrate 4-androsten-3,17-dione. After anaerobic growth for 72 hr some cultures were exposed to disruption by ultrasound (assay system 2), while others were simply exposed to aerobic conditions (assay system 1). Substrate and metabolite were examined by thin-layer chromatography. In assay 1, *E. coli* produced estradiol as a metabolite from 4-androsten-3,17-dione. *C. paraputrificum*, in the same assay system, produced two metabolites, one of which was relatively nonpolar compared to estradiol or estrone. This metabolite was identified as 17-methoxy-1,3,5(10)-estratriene-3-ol following analysis of its UV and fluorescence spectra, its mass spectrum and its trifluoroacetyl derivative. In assay system 2, no aromatization of substrate occurred unless bacteria had been grown in the presence of the substrate. This suggested that inducible enzymes were involved in the aromatization.

- 5183 HISTOPATHOLOGICAL ANALYSIS OF KIDNEY TUMORS IN RATS INDUCED BY CHEMICAL CARCINOGENS. (E.) Ito, N. (Nara Med. U., Japan), Y. Hiasa, Y. Kamamoto, S. Makiura, S. Sugihara, M. Marugami and E. Okajima. *Gann* 62(6):435-444, 1971.

Wistar, Sprague-Dawley and BDIX rats were treated with carcinogens as follows: basic lead acetate as 1.5% of diet; N-nitrosodimethylamine injected s.c. (0.1 mg/rat) or in diet (500 ppm); N-butyl-N-(4-hydroxybutyl)nitrosamine as 0.05% solution in drinking water; 3-methylcholanthrene (0.2 mg) by a cotton kidney implant impregnated with the agent; 4-nitroquinoline 1-oxide (0.4 mg) administered in the same manner as 3-methylcholanthrene. Kidney tumor incidence was observed. All rats given basic lead acetate developed renal cell tumors (adenomas, clear cell carcinomas and dark cell carcinomas); no other types of kidney tumors were induced by basic lead acetate. Of rats given N-nitrosodimethylamine, 14.4% had renal cell tumors, 83.2% had embryonal cell tumors and 2.4% had hemangioendotheliomas. Of rats given N-butyl-N-(4-hydroxybutyl)nitrosamine, 4.2% had embryonal cell tumors and 95.8% had transitional cell tumors. All rats given either 3-methylcholanthrene or 4-nitroquinoline 1-oxide had transitional cell tumors; none had tumors of the other three types.

- 5184 TRACE ELEMENTS IN SOIL AND PLANTS AND ANTRAL CANCER. (E.) Baumslag, N.

(U. Cincinnati Coll. Med., Ohio) and P. Keen. *Arch Environ Health* 25(1):23-25, 1972.

- 5185 THE EFFECT OF VITAMIN B12 ON THE FUNCTION OF THE ADRENAL CORTEX IN METHYLCHOLANTHRENE INDUCTION OF SARCOMA IN MICE. (Rus.) Ostryanina, A. D. (Inst. Nutr., USSR Acad. Med. Sci., Moscow). *Pat Fiziol Eksp Ter* 16(2):18-23, 1972.

- 5186 THE COMBINED EFFECT OF A SINGLE APPLICATION OF 7,12-DIMETHYLBENZ(A)ANTHRACENE AND REPEATED APPLICATIONS OF BENZO(A)PYRENE ON THE SKIN. (Rus.) Turusov, V. S. (Inst. Exp. Clin. Oncol., USSR Acad. Med. Sci., Moscow) and L. A. Andrianov. *Bull Eksp Biol Med* 73(3):80-83, 1972.

- 5187 GASTRIC CANCER INDUCTION IN RATS AS AFFECTED BY THYROID GLAND HORMONES. (Rus.) Beloshapko, A. A. (Inst. Nutr., USSR Acad. Med. Sci.) *Vop Onkol* 18(5):102-103, 1972.

- 5188 STUDIES ON THE FORMATION OF CARCINOGENIC NITROSO-COMPOUNDS IN THE STOMACH OF EXPERIMENTAL ANIMALS AND ITS SIGNIFICANCE FOR HUMANS. (Ger.) Sander, J. (Hyg. Inst. U. Tübingen, Germany). *Arzneimittelforschung* 21(10):1572-1580, 1971.

- 5189 INHIBITION OF DAB-INDUCED CARCINOGENESIS AND CIRRHOSIS OF THE LIVER IN THE RAT BY MEANS OF A LATHYROGENIC COMPOUND (AAN). (It.) Bartoloni St. Omer (Inst. Anat. Path. Histol., U. Florence, Italy), G. Mincione and L. Duchini. *Arch De Vecchi Anat Pat* 56(3):463-477, 1970.

- 5190 INFLUENCE OF 4-HYDROXYPENTENAL ON OXYGEN UPTAKE AND THE SH CONTENT OF THE NORMAL RAT LIVER AND THE HEPATOMA INDUCED BY DIETHYLNITROSAMINE. (Ger.) Schauenstein, E. (Inst. Biochem. U. Graz, Austria), R. Rindler, R. Schindler and M. Tauffer. *Z Naturforsch* 26b(8):788-791, 1971.

- 5191 CHANGES IN THE DUCTS OF THE GLANDS OF THE HARD PALATE IN REVERSE SMOKERS. (E.) Reddy, C. R. R. M. (Andhra Med. Coll, Visakhapatnam, India), M. V. S. Raju, C. Ramulu and P. G. Reddy. *Cancer* 30(1):231-238, 1972.

- 5192 A COMPARATIVE STUDY OF *IN VIVO* RNA AND PROTEIN SYNTHESIS IN RAT LIVER AND LUNG. (E.) Witschi, H. (Fac. Med., U. Montreal, Quebec, Canada). *Cancer Res* 32:1686-1694, 1972.

- 5193 RELATION OF REVERSE SMOKING TO CARCINOMA OF THE HARD PALATE. (E.) Reddy, C. R. R. M.

(Andhra Med. Coll., Visakhapatnam, India), C. Sekhar, M. V. S. Raju, S. S. Reddy and V. R. Kameswari. *Indian J Cancer* 8(4):263-268, 1971.

5194 DUODENAL ULCERS PRODUCED BY PROPIONITRIL IN RATS. (E.) Szabo, S. (Inst. Med., Exp. Surg., U. Montreal, Canada) and H. Selye. *Arch Pathol* 93(5):390-391, 1972.

5195 METHEMOGLOBIN - INDUCED BY CARCINOGENIC AMINOAZO DYES IN RATS. (E.) Lin, J.-K. (Coll. Med., Natl. Taiwan U., Taipei), S.-M. Hsu and Y.-H. Wu. *Biochem Pharmacol* 21(15):2147-2150, 1972.

5196 THE INFLUENCE OF URETHANE ON OVULATION IN THE RAT. (E.) Lincoln, D. W. (Med. Sch., Bristol, England) and W. A. Kelly. *Endocrinology* 90(6):1594-1599, 1972.

See also:

- * (Rev): 5005, 5006, 5007, 5009, 5011, 5012, 5014, 5024, 5027, 5032, 5034, 5039, 5045, 5056, 5059, 5064, 5070
- * (Phys): 5199
- * (Viral): 5240, 5252, 5271, 5272
- * (Immun): 5291, 5293, 5294, 5300, 5317, 5332, 5335, 5351, 5353, 5361, 5363
- * (Path): 5399, 5401, 5404
- * (Epid-Biom): 5414, 5417

- 5197 EXPERIMENTAL BRONCHOPULMONARY CANCER IN THE RAT BY INHALATION OF RADON. COMPARISON WITH MORPHOLOGICAL ASPECTS OF HUMAN CANCERS. (Fr.) Perraud, R. (Atom. Energy Commis., Paris, France), J. Chameaud, J. Lafuma, R. Masse and J. Chretien. *J Fr Med Chir Thorac* 26(1):25-41, 1972.

The effects of radon inhalation were studied in rats to test the hypothesis that such inhalation will not induce pulmonary tumors where no preexisting lesion is present. Two pieces of equipment were used: one for inhalation of radon and another for inhalation of ceric hydroxide, a substance known to cause tissue reactions. In one experiment, the animals were first exposed to ceric hydroxide, amounting to 0.5-1 mg in the lungs of each rat. These animals were then exposed to radon three days a week for five hr, for a period of 10 months. In a second experiment the rats were exposed to radon only, for five hr daily for a total exposure of 620 hr, the mean radon concentration being 7.5×10^{-7} curie/liter as in the first group. All animals who survived to the 11th month following the beginning of the experiment exhibited pulmonary cancers, regardless of preexisting lesions. These tumors were multiple and predominantly distal. From the morphological viewpoint, it appears that carcinogenesis may be induced in rats (which are resistant to spontaneous pulmonary malignant tumors) with all the features described in human bronchopulmonary carcinomas, except for anaplastic carcinomas with small cells. The apparatus is recommended for further studies in inhalation.

- 5198 DOSE TO OSTEOGENIC CELLS FROM PLUTONIUM-239 DEPOSITED IN RAT BONE. (E.) James, A. C. (Roy. Free Hosp. Sch. Med., London, England). *Radiat Res* 51(3):654-673, 1972.

Male Marshall-August rats, seven wk old, were injected i.v. with 4.5 μ Ci/kg body wt soluble $\text{Pu}(\text{NO}_3)_4$. Between one and 48 hr later, the rats were killed and their femora and vertebra examined for ^{239}Pu content. Soon after injection, average ^{239}Pu dose rates to bone tissue, at distances of 5, 12.5 and 20 μ m into the narrow space, ranged from 58, 38 and 26 rads/day to 22, 12 and 7 rads/day on different endosteal surfaces. These local dose rates changed with time by factors on the order of 2, in either direction. There were significant differences, between bones, in plutonium distribution and dose to osteogenic cells. Cumulative doses above 2000 rads delivered at 20 μ m from trabecular surfaces were associated with a 5-10% probability of producing an osteosarcoma.

- 5199 THE SEMINAL GLAND TUMORS INDUCED BY CELLOPHANE. (Rus.) Korobko, Yu. A. (A. N. Severtsov Inst. Animal Ecol. Morphol., Moscow, USSR). *Vopr Onkol* 18(8):65-69, 1972.

In 40 male white rats (85-110 g), the left testicle was wrapped with sterile cellophane film two or three times. This resulted in the formation of 19

tumors, the first of which appeared after 13 months. Altogether, 24 rats survived 13 months. Metastases in intestinal and spinal muscles were observed in four cases. The tumors obtained were hard to classify but were not teratomas. However, the tumors were spindle-shaped and polymorphous fibroblastoid cells. Two chondral tumors and two seminomas were also observed. All the tumors were considered to be induced by cellophane because of their localization in the testicle, the absence of cellophane inside the tumors and its presence in the periphery of the tumors.

- 5200 RADIATION-INDUCED HAIR-FOLLICLE DAMAGE AND TUMOR FORMATION IN MOUSE AND RAT SKIN. (E.) Albert, R. E. (New York U. Med., Ctr., N.Y.), F. J. Burns and P. Bennett. *J Nat Cancer Inst* 49(4):1131-1137, 1972.

The dorsal skin of 158 Swiss Millerton mice was irradiated with electrons in single exposures at six dose levels from 500-4000 rads. The mice were observed for skin-tumor formation every four wk for 88 wk. At death each tumor was examined histologically, and whole-skin mounts were used to determine the survival of intact hair follicles and the incidence of atrophic follicles. These data were compared with the dose-response characteristics for tumor induction and hair-follicle survival in the rat from previous experiments. The incidence of epithelial skin tumors was markedly lower in mice than in rats, the greatest number of epithelial tumors for any dose group was three in an average group of 21 mice compared with rat maximal response of 4.0 tumors/rat. This difference was due to the failure of mice to develop adnexal tumors, which are the predominant type of skin tumor in the rat. In the mouse the highest atrophic follicle incidence was only about 6%, when the total follicle survival was only about 15-20%. In the rat the highest atrophic follicle incidence was about 20%, when the total follicle survival time was about 50-60%. The relatively low level of atrophic follicle formation in the mouse skin as a consequence of radiation damage may be related to the failure to develop adnexal skin tumors.

- 5201 ANDROBLASTOMAS OF THE OVARIES INDUCED BY PENETRATING RADIATION. (Rus.) Gubareva, A. V. (Cent. Res. Inst. Roentgenol. Radiol., Leningrad, USSR). *Arkh Patol* 34(5):17-21, 1972.

Virgin hybrid mice (1663) received gamma rays in doses of 200, 600, and 900 rad at the age of 12 wk. Some of the animals were killed less than one yr after irradiation in order to study the changes in their sterilized ovaries. Most of the animals were observed until they died naturally. There were only eight androblastomas (0.3 x 0.3-1.0 x 1.0 cm) among the more than 1000 ovarian tumors induced by the penetrating radiation. The androblastomas were classified by Meyer's system as sertoliomas of the testicular tubular adenoma type (two cases) and intermediate-type androblastomas (six cases). The survival time of mice with blastomas exceeded 1 1/2 yr

postirradiation in all cases. The tumors occurred over a period of 1-1 1/2 yr. The microscopic picture of the androblastomas was not essentially different from that of human ovarian tumors. The sertoliomas were made up of numerous canals. The intermediate-type androblastomas were combinations of sarcoma-like structures and epithelioid and epithelial structures. The development of the ovarian androblastomas in mice involved the tegumental epithelium and the reticular tissue. The possibility of occurrence of androblastomas from medullary ligaments is not excluded.

5202 RADIATION LEUKEMIA IN GUINEA PIGS. (E.)

Van Pelt, A. (Biol. Div., Oak Ridge

Natl. Lab., Tenn.) and C. C. Congdon. *Radiat Res* 52(1):68-81, 1972.

The presence or absence of leukemia, and the type of leukemia, in 629 control and irradiated guinea pigs observed from 1947 through 1960 was determined by a review of records and histologic slides prepared at autopsy. Of the 48 identified cases of leukemia, 28 were lymphatic and 20 were stem cell leukemia. Statistical evidence for radiation induction of lymphatic and stem cell leukemia was found for special conditions of limited, chronic gamma-ray exposure. Stem cell leukemia was seen only in irradiated animals. In eight of the cases, including both types of leukemia, transplantation of the disease to normal syngeneic pigs was demonstrated. Unusual "reactive changes" in the white pulp of spleen and other lymphatic tissues were seen at autopsy in five animals with stem cell leukemia. The pathology findings suggest that lymphatic leukemia originates in lymph nodes and stem cell leukemia in the bone marrow.

See also:

- * (Rev): 5013, 5019
- * (Chem): 5087, 5135
- * (Viral): 5276
- * (Epid-Biom): 5412

- 5203 ELECTRON MICROSCOPIC OBSERVATIONS OF THE BEHAVIOR OF THE RAUSCHER VIRUS IN THE SPLEEN OF INFECTED MICE. (Ger.) Voigt, W.-H. (Inst. Exp. Path., Bayer AG, Wuppertal, West Germany) and H. J. Seidel. *Beitr Pathol* 145(1):1-7, 1972.

Spleens from Rauscher virus-infected BALB/c mice were examined under the light and the electron microscope in an attempt to demonstrate the presence of the virus in splenic cells other than megakaryocytes. The light microscopic observations revealed cell nests in the red spleen pulp, with enlargement and increased basophilia. Cell population was heterogeneous, however, with numerous medium-size and small cells. The electron microscopic picture, 13 days postinfection, showed extensive virus replication in megakaryocytes. Virus replication was also observed in the proerythroblasts in the greatly enlarged spleen. While Rauscher cells from erythropoietic nests proliferated intensively, virus replication in mature erythropoietic cells was rare.

- 5204 ESTABLISHMENT OF A VIRUS-PERSISTENT CELL LINE AND DERIVATION OF MALIGNANT CELL CLONES FROM RAT OSTEOSARCOMA INDUCED BY A MURINE SARCOMA VIRUS (MOLONEY). (E.) Kano-Tanaka, K. (Aichi Cancer Ctr. Res. Inst., Nagoya, Japan), T. O. Yoshida, T. Tanaka and T. Hanaichi. *Gann* 63(4):459-469, 1972.

A new cell line, designated RMS-1N, was established from a primary osteosarcoma induced in a newborn female inbred Wistar-King-Aptekman rat following injection of a murine sarcoma virus (Moloney) (MSV-M) isolate. Electron microscopic observation of early passage cells established the presence of small quantities of C-type particles. After the seventh passage (5.5 months), morphologic transformation occurred and two clonal lines, RMS-1F1 and RMS-1F2, were initiated. A third line, RMS-1F3, was initiated from the transformed RMS-1N culture after 18 months. Two additional clones, RMS-1RF-1 and -2, were established from recultivated passage 16 (13.5 months) RMS-1N cells after growth in syngenic rats. The clonal lines (except for clone RMS-1F2) consisted of rounded cells which grew actively and adhered poorly to the glass surface of the culture flask. RMS-1F1 cells were malignant and released MSV with higher infectivity than did the parental RMS-1N line. Virus released from RMS-1F1 cells was able to induce tumors in rats and in three strains of mice. The tumors (osteosarcomas in rats and myosarcomas in mice) were identical to those induced in the animals by the parental MSV-M stock. *In vitro* transformation of REWKA-2 rat cells by MSV released from RMS-1N and RMS-1F1 cells showed one-hit kinetics. A characteristic type of titration curves was that the number of foci did not decrease with the dilution factor.

- 5205 REPRESSION AND INDUCTION OF SV40 VIRUS. (Fr.) Cassingena, R. (Inst. Sci. Res. Cancer, Villejuif, France), H. G. Suarez, G. E. Sonenshein, Ch. Lavialle and Ch. Cremisi. *Bull Cancer (Paris)* 59(1):33-38, 1972.

The presence of a specific inhibitor in cells transformed by SV40 virus was investigated together with the factors responsible for the induction of SV40 viral synthesis at the time of fusion of SV40 permissive cells with transformed cells. The inhibitor was found to be a protein, since it was sensitive to trypsin and to heat, and insensitive to RNase or DNase. The action of the inhibitor during the infection of monkey cells was to reduce the viral yield; it had no effect on neoantigen synthesis, T-SV40, but inhibited about 40% of the capsule antigens of the virus. Neutralization of the inhibitor action was effected by an extract of permissive cells. In the cells transformed by SV40 and in those where no autonomous replication of viral DNA nor of viral synthesis could be detected, infectious DNA SV40 could be demonstrated by treating the cells with an extract of permissive cells to which poly-L-ornithine was added.

- 5206 DEMONSTRATION OF INFECTIOUS DEOXYRIBONUCLEIC ACID IN TRANSFORMED CELLS: I. RECOVERY OF SIMIAN VIRUS 40 FROM YIELDER AND NONYIELDER TRANSFORMED CELLS. (E.) Boyd, V. A. L. (Baylor Coll. Med., Houston, Tex.) and J. S. Butel. *J Virol* 10(3):399-409, 1972.

A new method for rescuing virus from simian virus 40 (SV40)-transformed cells is described. Deoxyribonucleic acid (DNA) extracted from virus-free SV40-transformed hamster, mouse, and monkey cells was inoculated into simian cells in the presence of diethylaminoethyl (DEAE)-dextran; infectious SV40 was recovered by using DNA from cell lines which fail to yield virus by the fusion technique as well as from cell lines which readily yield virus by fusion. The rescued virus was identified as SV40 by three methods: neutralization of plaque formation by specific antiserum; induction of synthesis of viral-specific antigens detected by immunofluorescence; and presence of papovavirus particles seen by the electron microscope. Treatment of the transformed cell DNA with deoxyribonuclease or omission of the DEAE-dextran prevented the rescue of virus. Large amounts of transformed cell DNA were required (>10 µg/culture of 10⁶ cells) to effect rescue of SV40 by passage through monkey cells. A linear response was obtained between the input of DNA with inocula between 10 and 45 µg of DNA/culture and the yield of SV40 recovered. Biological activity was demonstrable irregularly when the transformed cell DNA was assayed directly in the presence of DEAE-dextran. The DNA induced plaque formation in about 50% of the trials as well as the synthesis of SV40 tumor and viral antigens in rare simian cells. The infectious DNA appeared to be associated with cellular DNA. The infectivity was found in the pellet of precipitated DNA obtained by the Hirt technique and was inactivated by boiling for 15 min. These properties are characteristic of linear cellular DNA and not of free, circular SV40 DNA.

- 5207 ROLE OF SUBUNITS OF 60 TO 70S AVIAN TUMOR VIRUS RIBONUCLEIC ACID IN ITS TEMPLATE ACTIVITY FOR THE VIRAL DEOXYRIBONUCLEIC ACID POLY-

MERASE. (E.) Canaani, E. (Dept. Molec. Biol., U. California, Berkeley) and P. Duesberg. *J Virol* 10(1):23-31, 1972.

RNA was prepared from Prague Rous sarcoma virus (RSV), extracted with phenol and fractionated by sucrose density gradient centrifugation. Samples of 60-70S RNA were heated at 50-75 C for three min. The 60-70S RNA dissociated into 30-40S subunits and smaller RNA molecules at exposure to 55 C (the midpoint of thermal transition or T_m). When samples of 60-70S RNA were exposed to various temperatures and incubated with RSV DNA polymerase, the template activity of 60-70S RNA was lost after heating (T_m of template loss = 70 C). Analysis by velocity sedimentation and isopycnic centrifugation of the primary DNA product obtained from 60-70S RNA and RSV DNA polymerase indicated that most DNA was linked to small (<10S) RSV RNA primers. About 60% of the 60-70S RNA template activity could be recovered by incubation under annealing conditions; annealing of 30-40S subunits of 60-70S RNA did not enhance the subunits' template activity. However, in the presence of <10S subunits isolated from 60-70S RNA, the template activity of 30-40S RNA subunits was increased to the level of restored 60-70S RNA. Apparently, neither the 30-40S nor the smaller 4S subunits of the 60-70S RNA contributed as primers to the DNA template activity of 60-70S RNA, the main primer being a component of the <10S subunit fraction of 60-70S RNA.

5208 LEUKEMIA-LIKE VIRUS ISOLATED FROM A PATIENT WITH HEMOCYTOBLASTOSIS IN EXPERIMENTAL SYSTEM IN SYRIAN HAMSTERS. I. GENERAL CHARACTERISTICS OF THE DISCOVERED EXPERIMENTAL SYSTEM. (Rus.) Andzhaparidze, O. G. (Moscow Res. Inst. Viral Preparations, USSR), A. L. Liozner and L. G. Stepanova. *Vopr Onkol* 17(1):12-17, 1972.

Newborn hamster kidney cells (BHK-21) were infected with leukemia-like virus (T-9 strain, isolated from a patient with hemocytoblastosis) and were inoculated into Syrian hamsters (*Mesocricetus auratus*) s.c. and i.p. in the dose of 0.5 ml (10^6 cells/animal). On the 15-20th day, palpable tumors appeared locally on the skin in all animals (10). In 16/29 animals inoculated with the infected BHK-21 cells, large encapsulated tumor nodes were found on the peritoneal wall. A tumorigenic strain (T-BHK-IP) was obtained from these tumor nodes. Inoculation of cultures of normal human diploid cells with materials obtained after introduction of the leukemia-like virus into Syrian hamsters produced transformed cells (T-BHK-L-58-1) in the cultures. The T-BHK cells (10^4 - 10^6) were administered i.p. to hamsters immunized with the T-9 or human diploid cell cultures. Tumors did not develop in 14 hamsters receiving T-9 cells, indicating the resistance of these animals. This result shows induction of a specific antigen of the leukemia-like virus in T-BHK cells.

5209 RESISTANCE OF AKR MICE TO THE ONCOGENIC EFFECT OF THE MOUSE MOLONEY SARCOMA VIRUS. (Rus.) Tsysina, E. N. (N. F. Gamaleya Inst. Epidemiol.

Microbiol., Acad. Med. Sci. USSR, Moscow) and I. S. Irlin. *Biul Eksp Biol Med* 72(10):85-88, 1971.

The oncogenic effects of Moloney sarcoma virus on mice of various lines were studied. Moloney mouse sarcoma virus strain msv(m), 0.1-0.2 ml of various dilutions, was injected into the thigh muscles of the hind paws of mice of the lines BALB/c De, C57B1/6 and AKR and hybrid F_1 from $AKR \times C57B1/6$ and $AKR \times B61/c$ De. The virus in a dilution of 10^{-1} induced tumors in all BALB/cDe mice (30/30) and C57B1/6 mice (30/30). The virus in a greater dilution, 10^{-3} , caused tumors in 13/26 BALB/cDe mice and 6/14 C57B1/6 mice. The virus in the dose of 10^{-1} caused tumors in 27/106² AKR mice; the dilution of 10^{-2} caused no tumors in AKR mice (12). The hybrid F_1 were as sensitive to the virus as their parent mice: The virus in a dilution of 10^{-1} induced tumors in all $AKR \times C57B1/6$ F_1 (6/6) and $AKR \times BALB/cDe$ F_1 (16/16). X-ray irradiation of AKR line mice in doses 350-450 R led to a sharp decrease in their resistance to the virus; large tumors appeared in 59% (32/55) of these mice one and a half wk after the introduction of the virus. Introduction of the virus into newborn and three- to five-day-old mice led to 100% incidence of tumors in adult AKR mice. From tumors of AKR line mice induced by the virus strain msv(m) of the irradiated and young mice, virus-inducing tumors characteristic for BALB/cDe and C57B1/6 lines were isolated as well as the virus with high pathogenicity, specific for AKR line.

5210 INTRACELLULAR NUCLEIC ACID METABOLISM IN RAUSCHER'S VIRAL LEUKEMIA. (Uk.) Butenko, Z. A. (Sci. Res. Inst. Exp. Clin. Oncol., Kiev, USSR), P. P. Verkhats'kyy, A. O. Voloboyeva, D. F. Gluzman, H. Z. Nehriy, I. A. Smirnova, V. O. Shlyakhovenko and O. I. Khymenko. *Mikrobiol Zh* 34(1):58-59, 1972.

Messenger RNA (mRNA) from normal BALB/c mouse spleen cells revealed two basic and eight minor fractions upon agarose-polyacrylamide (0.5 and 3.0%, resp.) electrophoresis. Preparations from Rauscher virus-induced leukemia-altered spleen cells revealed a third major fraction in addition to the two major fractions corresponding to those of mRNA from normal mice; some of the minor fractions did not correspond to minor fractions in control preparations. Nuclear histone electrophoresis on 15% polyacrylamide gel, containing 2.5% of N,N'-methylenebis-acrylamide, revealed six main and a variable number of minor fractions in preparations obtained from normal mouse spleen cells. The histones from related leukemic mouse preparations lacked one of the less mobile fractions and presented an additional high electrophoretic mobility fraction. All major histone fractions exhibited RNase activity. Electrophoresis of cellular RNases from leukemic spleen preparations revealed an additional nuclear RNase fraction as compared to the control samples. Liver and spleen cells from leukemic mice exhibited decreased nuclear acid DNase and increased cytoplasmic acid and alkaline RNase activities as compared to normal cells. The alterations in intracellular localization and activity of nucleases in Rauscher virus-infected

mice were observed before the onset of patho-morphological symptoms of leukemia and preceded a positive immunofluorescence reaction. The latter permitted detection of a type-specific surface antigen at a later stage.

- 5211 COMPARATIVE INVESTIGATIONS ON MAMMARY TUMOR VIRUS DETECTION IN MURINE BREAST CANCER OF STRAIN CBA/B1n. (Ger.) Müller, M. (Med. Acad. Carl Gustav Carus, Dresden, East Germany), S. Zotter, H. Wagner and H. Grossmann. *Arch Geschwulstforsch* 38(3-4):221-231, 1971.

Six mammary tumors (MT) syngeneically grafted into mammary tumor virus (MTV)-bearing CBA/B1n mice were investigated for their MV content. MTV-associated antigens were determined by the indirect immunofluorescent technique on frozen cut slices and by the immunodiffusion technique (micro test) using two specific rabbit anti-MTV sera. A and B particles were detected electron microscopically on ultra-thin slices. Although these methods are not directly comparable, the results obtained by the three techniques were in relatively good agreement. As determined by immunofluorescence tests, five MT contained in a rather constant manner mutually graduated amounts of MTV-associated antigens and virus particles through succeeding transplantations generations (through the 21st generation in one tumor). In the 6th passage, one MT showed no demonstrable MTV following sarcomatous transformation. A sixth MT was free of any detectable virus in the first and second generations, though it had the characteristic histologic feature of other CBA MT. The immunofluorescent technique is recommended for rapid determination of the MTV content of MT.

- 5212 STUDIES ON MOUSE MAMMARY TUMOR VIRUS (MTV) AND MOUSE LEUKEMIA VIRUS (MuLV) BY IMMUNO-ELECTRON MICROSCOPY. (E.) Shigematsu, T. (U. Texas M. D. Anderson Hosp. Tumor Inst., Houston), L. Dmochowski and W. C. Williams. *Cancer Res* 31(12):2085-2097, 1971.

Mouse and rat cell lines which harbored type B (mouse mammary tumor virus or MTV), type C (mouse leukemia virus or MuLV) and/or type A intracytoplasmic virus particles were reacted with each of three anti-MTV rabbit antisera and with each of two anti-MuLV antisera; ferritin labeling in reaction mixtures was observed in immunoelectron microscope studies. Test cell lines included three mouse mammary tumor cell lines, a mouse reticulum cell sarcoma line and a rat bone tumor line. All three anti-MTV sera (designated Dmochowski, Nowinski and Verna) gave ferritin labeling of B particles in mouse mammary tumor lines; only Dmochowski serum stained C particles, but all three sera also stained A particles. Since the three sera were originally prepared against MTV from mice of different origins, the stained MTV were thought to contain common surface or membrane antigens. Absorption of anti-MTV sera with different antigenic material (including sheep erythrocytes,

guinea pig kidney tissue and mammary tumor-bearing mouse embryo tissue) confirmed the specificity of ferritin labeling of B particles. Two anti-MuLV sera (designated Dmochowski and Geering) gave ferritin labeling of A and C, but not of B particles in the various cell lines. MuLV particles apparently shared common surface or membrane antigens. Absorption of anti-MuLV sera with different antigenic materials confirmed the specificity of labeling of C type particles. Verna and Dmochowski anti-MTV sera showed high titers of ferritin labeling of B and A particles.

- 5213 COMPARISON OF THE STRUCTURE AND POLYPEPTIDE COMPOSITION OF THREE DOUBLE-STRANDED RIBONUCLEIC ACID-CONTAINING VIRUSES (DIPLORNAVIRUSES): CYTOPLASMIC POLYHEDROSIS VIRUS, WOUND TUMOR VIRUS, AND REOVIRUS. (E.) Lewandowski, L. J. (Stanford U. Sch. Med., Calif.) and B. L. Traynor. *J Virol* 10(5):1053-1070, 1972.

The structure and polypeptide composition of three double-stranded RNA-containing viruses, reovirus, cytoplasmic polyhedrosis virus (CPV), and wound tumor virus (WTV), were compared using the combined techniques of electron microscopy, polyacrylamide gel electrophoresis, and buoyant density centrifugation. Each of the three virus preparations could be separated into three fractions by centrifugation: 1) a rapidly migrating "major virus band" (V); 2) a somewhat slowly migrating "satellite virion band" which was deficient in some of the RNA components; and 3) a very slowly migrating "top component" composed of empty, intact shells. CPV and reovirus cores resembled each other in density ($\rho = 1.435$ and 1.440 gm/cm, resp.), ultrastructure and polypeptide composition. Both were icosahedrons and each contained numerous, regularly spaced projections which were revealed by chymotrypsin treatment. The major band and satellite band virions of both viruses showed no structural differences. Samples from each of the three bands were dissociated with urea-SDS, labeled with I^{125} , and subjected to electrophoresis. CPV was found to be composed of five polypeptides (molecular wt = 151,000, 142,000, 130,000, 67,000, and 33,000). The labeling pattern of the polyhedral bodies of CPV, which encapsulate the cores, suggested that they were composed of two major polypeptides (molecular wt = 29,500 and 19,500) and several minor components which were probably direct products of the CPV genome. WTV virions were hexagonal and did not appear to contain projections analogous to those on reovirus or CPV cores. The proteins of WTV consisted primarily of four species (molecular wt = 156,000, 122,000, 63,000, and 44,000) with several additional minor polypeptide components. These results suggested, as with CPV, that the viral proteins of WTV were coded for by messenger originating directly from the viral genome.

- 5214 SEROLOGICAL ANALYSIS OF THE DEOXYRIBONUCLEIC ACID POLYMERASE OF AVIAN ONCORNAVIRUS I. PREPARATION AND CHARACTERISATION OF MONOSPECIFIC ANTISERUM WITH PURIFIED DEOXYRIBONUCLEIC ACID POLYMERASE.

(E.) Watson, K. F. (Coll. Phys. Surg., Columbia U., New York, N.Y.), R. C. Nowinski, A. Yaniv and S. Spiegelman. *J Virol* 10(5):951-958, 1972.

Antiserum was prepared against purified DNA polymerase from the BAI strain A of avian myeloblastosis virus (AMV). Immunodiffusion assays with purified DNA polymerase showed that the anti-DNA polymerase generally formed only one precipitation band, indicating that it was monospecific. Anti-DNA polymerase showed no activity against any of the seven purified major AMV structural proteins. The antiserum showed enzyme neutralization activity which was associated with the IgG fraction. Optimal neutralizing activity was obtained with a preincubation of antiserum and polymerase for 15 min in the presence of bovine serum albumin. The antiserum showed no differences in its ability to neutralize polymerase activity directed by RNA, DNA, or RNA-DNA hybrid templates.

5215 DISTRIBUTION OF DEOXYRIBONUCLEIC ACID COMPLEMENTARY TO THE RIBONUCLEIC ACID OF AVIAN MYELOBLASTOSIS VIRUS IN TISSUES OF NORMAL AND TUMOR-BEARING CHICKENS. (E.) Baluda, M. A. (Sch. Med., U. California, Los Angeles) and W. N. Drohan. *J Virol* 10(5):1002-1009, 1972.

³H-labeled 70S ribonucleic acid (RNA) from purified avian myeloblastosis virus (AMV) was used as a probe in deoxyribonucleic acid (DNA)-RNA hybridization experiments to detect the presence of DNA complementary to the AMV genome in various tissues from noninfected normal chickens and from chickens infected with AMV. There was a remarkable constancy in the average cellular concentration of virus-specific DNA (3.3 genome equivalents/cell) found in every tissue from the same uninfected chicken, and even in different chickens from the same strain. In contrast, different tissues from chickens bearing AMV-induced kidney tumors (embryonal nephromas) revealed an unequal distribution in the average virus-specific DNA content/cell. The increase was limited to tumor cells and to tissues that contain target cells for AMV, i.e., red blood cells, kidney cells, and possibly leukocytes. The red blood cells from AMV-infected chickens suffering from acute myeloblastic leukemia, although producing no virus, contained as many viral genome equivalents/cell (about 6/cell) as did leukemic myeloblasts known to produce large quantities of AMV. An increased viral DNA content was observed in the target cells of chickens that did not show any sign of tumor formation six months after infection with AMV. This study demonstrates that vertically transmitted viral DNA is uniformly and stably distributed among all tissues of the offspring, but that horizontal infection after hatching results in an increase in viral DNA content only in some dividing, target tissues that may or may not give rise to neoplasias.

5216 SIMIAN VIRUS 40 DEOXYRIBONUCLEIC ACID SYNTHESIS: THE VIRAL REPLICON. (E.) Tegtmeyer, P. (Dept. Pharmacol., Case Western Reserve U., Cleveland, O.). *J Virol* 10(4):591-598, 1972.

Temperature-sensitive (ts) mutants of SV40 (tsA7, tsA28 and tsA30) were used to infect African green monkey kidney cells and DNA production by ts mutants at 41 C was observed. The three ts mutants were deficient in DNA production at this temperature. It appeared that a host cell function could not substitute for the ts restricted virus function. Temperature-shift studies were undertaken to detect variations in kinetic characteristics of the three ts mutants and to determine the effects of temperature changes on their functions. The results indicated that the initiation of replication in the ts viruses ceased at the time of, or shortly after, temperature shifts, and that mutant replicative intermediate DNA molecules which had already been initiated before temperature shifts continued the replication process to completion. The synthesis of mutant DNA molecules themselves was initiated by a nonmutant gene product in viral complementation studies at 41 C.

5217 COMPARISON OF THE 3'TERMINI OF DISCRETE SEGMENTS OF THE DOUBLE-STRANDED RIBONUCLEIC ACID GENOMES OF CYTOPLASMIC POLYHEDROSIS VIRUS, WOUND TUMOR VIRUS, AND REOVIRUS. (E.) Lewandowski, L. J. (Dept. Molecular Biol., U. California, Berkeley) and S. H. Leppla. *J Virol* 10(5):965-968, 1972.

The 3' terminal nucleosides of the isolated components of double-stranded RNA (dsRNA) of reovirus, wound tumor virus (WTV) and cytoplasmic polyhedrosis virus (CPV) have been determined. Purified dsRNA from each virus was oxidized with periodate and reduced with ³H-labeled sodium borohydrate. The terminally labeled dsRNA genomes were then separated into their components by polyacrylamide gel electrophoresis and the labeled terminal residues were identified by paper chromatography using authentic trialcohol standards. All WTV and CPV components contained equal amounts of UOH and COH termini. The WTV components also contained small amounts of AOH and GOH termini. Reovirus components contained essentially only COH termini. Pretreatment of the viral RNAs with alkaline phosphomonoesterase did not appreciably alter either the total level or the relative amounts of ³H incorporated into the individual fractions, thus indicating that none of the three virus genomes contained phosphorylated 3'termini. It is, therefore, probable that the viral dsRNA molecules are replicated as discrete subunits.

5218 EXPERIMENTAL ALTERATION OF THE ONCOGENICITY OF FROG TUMOR CELL-VIRAL FRACTIONS. (E.) Tweedell, K. S. (Dept. Biol., U. Notre Dame, Ind.). *Proc Soc Exp Biol Med* 140(4):1246-1251, 1972.

Tissue from five spontaneous frog renal adenocarcinomas were homogenized and centrifuged to separate cytoplasmic and nuclear fractions; each fraction contained nuclear herpes-type virus (HTV). HTV-containing cytoplasmic and nuclear material was injected into frog embryos and adenocarcinoma formation was observed in adults developed from the treated embryos. Between 40-53% of embryos given cytoplasmic fractions developed renal tumors and 62% of frogs given nuclear fractions

developed renal tumors. Sonication of injected cytoplasmic or nuclear material reduced slightly the incidence of renal tumors induced by these fractions in embryos. Pretreatment of cell fractions with a proteolytic enzyme, lyophilization of these fractions before injection into embryos, or heating injected embryos (30 C), destroyed all oncogenic action of nuclear or cytoplasmic cell fraction inocula. Post-injection cooling of embryos (9 C) resulted in the formation of renal adenocarcinomas rich in intranuclear inclusions.

- 5219 COVALENT LINKAGE BETWEEN RIBONUCLEIC ACID PRIMER AND DEOXYRIBONUCLEIC ACID PRODUCT OF AVIAN MYELOBLASTOSIS VIRUS DEOXYRIBONUCLEIC ACID POLYMERASE. (E.) Verma, I. M. (Dept. Biol., Massachusetts Inst. Tech., Cambridge), N. L. Meuth and D. Baltimore. *J Virol* 10(4):622-627, 1972.

Initiation of deoxyribonucleic acid (DNA) synthesis by the avian myeloblastosis virus DNA polymerase was previously suggested to involve a ribonucleic acid (RNA) primer, the initial product being a DNA molecule joined by a phosphodiester bond to the RNA primer. The existence of such an RNA-DNA joint was investigated by assaying for transfer of a ^{32}P atom from an α - ^{32}P -deoxyribonucleotide to a 2'(3')-ribonucleotide after alkaline hydrolysis of the polymerase product. A transfer was observed, but from α - ^{32}P -deoxyadenosine triphosphate to 2'(3')-adenosine monophosphate. The transfer was seen in the endogenous AMV DNA polymerase reaction of purified virions and the reconstituted reaction of purified AMV DNA polymerase together with purified viral 60-70S RNA.

- 5220 DEOXYRIBONUCLEIC ACID POLYMERASE ACTIVITIES IN NORMAL AND LEUKOVIRUS-INFECTED CHICK EMBRYO CELLS. (E.) Weissbach, A. (Roche Inst. Molecular Biol., Nutley, N.J.), A. Bolden, R. Muller, H. Hanafusa and T. Hanafusa. *J Virol* 10(3):321-327, 1972.

DNA polymerases were studied in normal chick embryo cells, in chick cells infected with Rous-associated virus (RAV-2), and in chick cells infected with Rous sarcoma virus, type α , a noninfectious Rous virus mutant deficient in viral RNA-dependent DNA polymerase (R-DNA polymerase). The R-DNA polymerase of the RAV-2 virion could utilize (dG) $_{12}$ ·rC as a template, while the cellular R-DNA polymerase of the chick embryo cell could not copy this template under any circumstances. Chicken cells transformed by RSV α lacked detectable viral R-DNA polymerase, though cellular R-DNA polymerase was present in normal amounts.

- 5221 PREDETERMINED SEQUENTIAL CHROMOSOME CHANGES IN SERIAL TRANSPLANTATION OF ROUS RAT SARCOMAS. (E.) Mitelman, F. (Inst. Path., U. Lund, Sweden). *Acta Pathol Microbiol Scand (A)* 80(3):313-328, 1972.

Sarcoma induced in male and female inbred rats, resp., by inoculation of Schmidt-Ruppin Rous sarcoma virus, were passaged repeatedly *in vivo* and cells from different passages were examined karyologically. Cells of the female tumor initially presented normal diploid karyotypes. In passages two through seven, cells with 43 chromosomes began to appear. All these variant cells had the same karyotype. They differed from the normal cells by the loss of one St $_2$ and the gain of one St $_3$ and one large submedian chromosome. The heteroploid variant cells increased in prominence in successive passage generations. As the heteroploid cell line evolved, changes in the St $_5$ chromosome were seen. Cells of the male sarcoma showed a similar progressive change to heteroploidy. Variant cells, first seen in passages two and three, had 44 chromosomes, and differed from normal cells in having gained two t chromosomes. In both tumors, frequency of the normal diploid cells decreased with successive *in vivo* passages, but the decrease was nonlinear. In both tumors, the evolution to a heteroploid condition accompanied a progressive lack of histological differentiation.

- 5222 VIRUS DEOXYRIBONUCLEIC ACID SEQUENCES IN SUBDIPLOID AND SUBTETRAPLOID REVERTANTS OF POLYOMA-TRANSFORMED CELLS. (E.) Shani, M. (Weizmann Inst. Sci., Rehovot, Israel), Z. Rabinowitz and L. Sachs. *J Virol* 10(3):456-461, 1972.

Polyoma-transformed hamster cells which had reverted from the properties of transformed cells, while continuing to produce polyoma-specific T antigen and virus-specific RNA, were examined. These variant cells were subdiploid (with modal chromosome numbers of 39-42) or subtetraploid (modal numbers of 73-76). The number of polyoma DNA equivalents in DNA from revertants was determined and compared with that in polyoma-transformed cells (modal chromosome numbers of 44 and 45). Both transformed and revertant cells had an average of eight viral DNA copies/cell. The results indicate that duplication of chromosomes in subtetraploid revertants does not include chromosomes carrying the viral genome. Viral DNA in the revertants was associated with high-molecular wt cell DNA, as in the transformed cells.

- 5223 SYNTHETIC RNA AND DNA POLYNUCLEOTIDES: *IN VIVO* AND *IN VITRO* ENHANCEMENT OF ONCOGENESIS BY A MURINE SARCOMA VIRUS. (E.) Gazdar, A. F. (Nat'l. Cancer Inst., Bethesda, Md.) and Y. Ikawa. *Proc Soc Exp Biol Med* 140(4):1166-1169, 1972.

AL/N mice were pretreated with i.p. injections of 200 μg of one of several polyribonucleotides or polydeoxyribonucleotides 24 hr before inoculation with a preparation of Moloney murine sarcoma virus (MSV). Pretreatment with rI·rC, rA·dT, rA·rU, d(A-T), dG·dC and dT enhanced tumor induction by MSV, as demonstrated by shorter latent periods, larger mean tumor size, higher tumor incidence and longer time for complete regression. Pretreatment with calf thymus DNA, rI, rC, dA, rA·rU·rU, AMP, ATP, cAMP and dbcAMP had no effect on MSV tumor induction. Pre-

treatment with rI_rC and d(A-T) enhanced focus formation by MSV 10- 30-fold in mouse tissue cultures.

- 5224 VIRUS-LIKE PARTICLES IN METASTASES OF HUMAN MALIGNANT MELANOMA. (E.) Birkmayer, G. D. (Inst. Cell Biol., U. Munich, West Germany), B.-R. Balda, F. Miller and O. Braun-Falco. *Naturwissenschaften* 59(8):369-370, 1972.

Primary human malignant melanomas and lymph node metastases from the melanomas were examined electron microscopically for virus particles. Virus-like particles were seen in all metastatic tumors. The particles occurred only in cytoplasm and had an electron-dense nucleoid of 50-70 nm diameter and a 100 Å membrane composed of three layers.

- 5225 EPSTEIN-BARR VIRUS DNA IN HUMAN TUMOR CELLS. (Ger.) Schulte-Holthausen, H. (Inst. Virol., U. Würzburg, West Germany) and H. zur Hausen. *Zentralbl Baktériol (Orig)* 220:47-51, 1972.

Three types of tests to identify a virus with a certain type of tumor are described: the examination of tumor cells for new antigens which are tested to discover whether they are specific to a given virus, to what extent they can be induced, and the extent to which the host reacts against these viruses; and analysis of the ribonucleic acids in the tumor cells; and a direct examination of the tumor cell DNA. The attempt to demonstrate a virus-specific RNA in tumor cells was more successful in animal experiments than in human investigations, since in the former, viral genes are preferentially transcribed over the cell genome. A study using the Epstein-Barr (EB) virus was conducted based on the working hypothesis that it is a true DNA tumor virus and that it is a precursor of the Burkitt lymphoma or the Schmicke lymphoepithelioma. Labeled EB virus DNA was used in hybridization experiments with DNA from Burkitt tumor cells, as well as DNA isolated from biopsy material. It was not possible to demonstrate an EB-virus-nucleic acid sequence in Burkitt's lymphoma or a causal role for lymphoepithelioma in human tumors. However, the conclusion that EB virus can behave as a typical DNA tumor virus is warranted when test results are combined with the serological data showing the presence of viral DNA and RNA in virus particle-free cells.

- 5226 ROUS SARCOMA VIRUS NUCLEOTIDE SEQUENCES IN CELLULAR DNA: MEASUREMENT BY RNA-DNA HYBRIDIZATION. (E.) Neiman, P. E. (Dept. Med., U. Washington, Seattle). *Science* 178(4062):750-753, 1972.

RNA from Prague strain Rous sarcoma virus (Pr RSV) was hybridized with excesses of DNA from Pr RSV-induced chicken sarcoma cells or with excess DNA from normal chick embryo cells. The 71S Pr RSV RNA fraction was used. Most of the viral 71S genome was present in DNA of virus-induced sarcoma cells; a major fraction had a very low frequency/cell. One

third of the viral RNA reacted with at least partially complementary cellular DNA with kinetics suggesting an average of 100 copies of these DNA sequences/cell. Normal chick embryo DNA contained sequences at least partially homologous to some fraction of Pr RSV RNA.

- 5227 SIMIAN VIRUS 40 DEOXYRIBONUCLEIC ACID SYNTHESIS: ANALYSIS BY GEL ELECTROPHORESIS. (E.) Tegtmeyer, P. (Dept. Pharmacol., Case Western Reserve U., Cleveland, O.) and F. Macasaet. *J Virol* 10(4):599-604, 1972.

SV40 DNA labeled with ¹⁴C-thymidine was extracted from purified virions and subjected to electrophoresis through 2% agarose gels. Accurate estimates of the relative quantities of radiolabeled DNA I, DNA II and DNA replicative intermediate molecules (RI) could be made using this method of analysis. RI molecules in different stages of the replication process could be identified, given the assumption that RI molecules in early stages of the replication process migrate more slowly than DNA I, while RI in later stages migrates more slowly than DNA II.

- 5228 RAPID IMMUNOLOGICAL INDUCTION OF MURINE LYMPHOMAS: EVIDENCE FOR A VIRAL ETIOLOGY. (E.) Cornelius, E. A. (Yale U. Sch. Med., New Haven, Conn.). *Science* 177(4048):524-525, 1972.

A graft-versus-host reaction (GVHR) was induced in 16 (SJL/J x C57BL/1)F₁ hybrid mice by five weekly i.p. injections of spleen cells from SJL/J mice. All mice given spleen cells developed reticulum cell sarcomas which involved spleen, lymph nodes, liver and lungs but not thymus. Tumors from the hybrid mice could be transplanted to syngeneic hybrid recipients. Tumors from hybrid donors also grew on C57BL/1 recipients, but not on SJL/J, (NZB x SJL/J)F₁ or NZB recipients. This indicated that the sarcomas induced by the GVHR were antigenically C57BL/1. Since both SJL/J and C57BL/1 mice carry tumorigenic viruses, viruses were thought to be implicated in the immunological induction of these tumors.

- 5229 A REPLICATING RNA MOLECULE SUITABLE FOR A DETAILED ANALYSIS OF EXTRACELLULAR EVOLUTION AND REPLICATION. (E.) Kacian, D. L. (Coll. Phys. Surg., Columbia U., New York, N.Y.), D. R. Mills, F. R. Kramer and S. Spiegelman. *Proc Nat Acad Sci USA* 69(10):3038-3042, 1972.

In examining the products of Q β phage RNA-directed RNA polymerase, one variant RNA replicase molecule (MDV-1) was singled out. It was 218 nucleotides long and had a strand structure consisting of an anti-parallel complementary duplex. The MDV-1 replicase molecule replicated in a manner similar to phage Q β RNA, and could mutate to previously determined phenotypes. The MDV-1 molecule was suitable for study of RNA replication.

- 5230 STRUCTURAL PROTEINS OF SIMIAN VIRUS 40: PHOSPHOPROTEINS. (E.) Tan, K. B. (Wistar Inst. Anatomy Biol., Philadelphia, Pa.) and F. Sokol. *J Virol* 10(5):985-994, 1972.

The structural proteins of purified SV40 were analyzed by polyacrylamide gel electrophoresis following labeling of infected secondary African green monkey cultures with ^{32}P -orthophosphate and ^3H -amino acids. All five SV40 structural proteins were phosphorylated. The ^{32}P was not present as an acylphosphate. No phosphohistidine was detected. Alkaline phosphatase treatment resulted in a significant dephosphorylation of and an increase in the heterogeneity in the molecular size of viral polypeptide I but had no effect on the other viral polypeptides. All five proteins were degraded by NaOH or pronase. The results indicated that the main polypeptide (#1, molecular wt = 49,000) of SV40 contained o-phosphoserine and/or o-phosphothreonine residues; however, the nature of the bond between phosphate and the other viral peptides remained obscure. The proteins of "empty" virus, which contains little or no DNA, showed phosphorylation patterns similar to infectious virus. Neither empty virus particles nor infectious virus was able to stimulate incorporation of ^{32}P -orthophosphate into protein, indicating that SV40 lacks its own protein kinase.

- 5231 ORIGIN AND DIRECTION OF SIMIAN VIRUS 40 DEOXYRIBONUCLEIC ACID REPLICATION. (E.) Fareed, G. C. (Natl. Inst. Allergy Infect. Dis., Bethesda, Md.), C. F. Garon and N. P. Salzman. *J Virol* 10(3):484-491, 1972.

Replicating SV40 DNA molecules fractionated on the basis of extent of replication were examined. Double-labeled replicating DNA molecules from SV40 were prepared and cleaved by the replicative intermediate (R_1) restriction endonuclease from *E. coli*. The site of cleavage on the replicating DNA molecule was used to position the origin of replication on the molecule and the two branch points. Analysis of cleavage products was performed by velocity gradient centrifugation on neutral and alkaline sucrose as well as by electron microscopy. The R_1 cleavage site was 33% of the genome length from the origin of replication. Both branch points were growing points. The results indicate that the origin of SV40 DNA replication is specific and the orientation is bidirectional.

- 5232 ISOLATION OF TEMPERATURE-SENSITIVE MUTANTS OF MURINE SARCOMA VIRUS. (E.) Scolnick, E. M. (Natl. Cancer Inst., Bethesda, Md.), J. R. Stephenson and S. A. Aaronson. *J Virol* 10(4):653-657, 1972.

Kirsten murine sarcoma viruses mutagenized by bromodeoxyuridine or azacytidine were used to infect mouse cells. Three temperature-sensitive (ts) mutant virus cell lines were recovered from the infected cells. The ts mutants did not spontaneously release

virus and did not show murine or rat viral group-specific antigens when grown at 39-40 C. The temperature sensitivity of the transformed morphology of the three ts mutant lines was due to temperature sensitivity of a viral rather than a cellular gene product. The ts mutant virus-transformed cells formed colonies on cell monolayers at 32 C but not at 39-40 C. Superinfection with Kirsten virus restored colony-forming ability at 39-40 C in one of the three ts mutant lines.

- 5233 ABSENCE OF POLYMERASE PROTEIN IN VIRIONS OF ALPHA-TYPE ROUS SARCOMA VIRUS. (E.)

Hanafusa, H. (Publ. Hlth. Res. Inst., New York, N.Y.), D. Baltimore, D. Smoler, K. F. Watson, A. Yaniv and S. Spiegelman. *Science* 177(4055):1188-1191, 1972.

Noninfectious α -type Bryan strain Rous sarcoma virus (RSV α), derived from RSV-transformed chicken cells, was examined for DNA polymerase with different template-primer complexes. No DNA polymerase could be demonstrated in RSV α in assays with poly(A) \cdot oligo(dT), poly(C) \cdot oligo(dG) or poly(A) \cdot poly(dT). In related experiments, RSV α was tested for its ability to absorb antibody from a monospecific rat anti-avian myeloblastosis virus DNA polymerase antiserum. RSV α was negative in this test, indicating that the virus does not even contain DNA polymerase as a latent but immunologically active protein.

- 5234 SEROLOGICAL ANALYSIS OF THE DEOXYRIBONUCLEIC ACID POLYMERASE OF AVIAN ONCORNAVIRUSES II. COMPARISON OF AVIAN DEOXYRIBONUCLEIC ACID POLYMERASES. (E.) Nowinski, R. C. (McArdle Lab. Cancer Res., U. Wisconsin, Madison), K. F. Watson, A. Yaniv and S. Spiegelman. *J Virol* 10(5):959-964, 1972.

Monospecific antiserum prepared against the isolate DNA polymerase of avian myeloblastosis virus (AMV) was used to study the RNA-directed DNA polymerase activity of several detergent-disrupted C-type viruses. The antiserum was able to neutralize the RNA-directed DNA polymerase activity of all avian leukemia-sarcoma viruses tested irrespective of viral antigenic subtype. The DNA polymerase activity of avian reticuloendotheliosis virus and of a variety of mammalian oncornaviruses was not affected by antipolymerase antiserum. The anti-polymerase antiserum showed no activity against the seven major structural AMV proteins or normal cellular DNA polymerases. The RSV $\alpha(0)$ mutant, which lacks DNA polymerase activity, showed a 60-fold decrease in the demonstrable polymerase antigen level. Indirect immunofluorescence studies showed that the viral polymerase was a cytoplasmic constituent of virus-producing chicken cells. Polymerase antigen was absent in uninfected chicken cells.

- 5235 LOSS OF SIMIAN VIRUS 40 DNA-RNA HYBRIDS FROM NITROCELLULOSE MEMBRANES: IMPLICATIONS FOR THE STUDY OF VIRUS-HOST DNA INTERACTIONS. (E.)

Haas, M. (Salk Inst., San Diego, Calif.), M. Vogt and R. Dulbecco. *Proc Nat Acad Sci USA* 69(8):2160-2164, 1972.

SV40 viral DNA, isolated from monkey cells infected with SV40 at high and low multiplicities of infection, was hybridized with SV40 complementary RNA (cRNA). Hybridization mixtures were incubated for 16-18 hr and maintained on nitrocellulose membranes. Extensively hybridized DNA was not retained by the membranes; the amount of viral DNA retained by membranes dropped rapidly, especially with DNA from cells infected at high SV40 multiplicities. The loss of DNA-RNA hybrid molecules was not prevented by addition of hamster or *E. coli* DNA to incubation mixtures. SV40-transformed hamster cell DNA-RNA hybrids were retained on membranes if DNA fragments were relatively long. They were not retained if DNA fragments were sheared to 100,000 daltons/single strand (less than the length of the SV40 DNA molecule). Apparently, each of the six genomes/cell in SV40-transformed cells was individually integrated.

5236 TRANSMISSION OF LYMPHOSARCOMA FROM CATTLE TO SHEEP. (E.) Olson, C. (Dept. Vet. Sci., U. Wisconsin, Madison), L. D. Miller, J. M. Miller and H. E. Hoss. *J Nat Cancer Inst* 49(5):1219-1480, 1972.

Thirteen one- to two-week-old lambs were inoculated with cultured lymphocytes from a spontaneous, C-type virus-producing lymphosarcoma from a 2.5-year-old cow. Sixteen other lambs were inoculated with material from a generalized, C-type virus-negative lymphosarcoma from a six-month-old cow. Eleven of the 13 lambs given lymphocytes from adult-type bovine lymphosarcoma became infected with C-type bovine virus. Five of the 13 died of lymphosarcoma in 24 1/2-27 1/2 months. All five sheep dying from lymphosarcoma had lymphoid tumor involving thymic tissue. One had fibroblastoma in lymphosarcomatous thymic tissue; another had skin lesions composed of an infiltrating mass of neoplastic lymphoid cells. Only one of the 16 sheep given cells from juvenile lymphosarcoma developed C-type virus infection.

5237 INTRACRANIAL FIBROBLASTIC NEOPLASMS IN THE HAMSTER FROM BOVINE PAPILLOMA VIRUS. (E.) Robl, M. G. (Dept. Vet. Sci., U. Wisconsin, Madison), D. E. Gordon, K. P. Lee and C. Olson. *Cancer Res* 32(10):2221-2225, 1972.

Twenty-four hamsters were inoculated in the right cerebral hemisphere with a suspension of bovine papilloma virus (BPV) prepared from a bovine fibropapilloma. Ten other hamsters were inoculated with BPV heated at 92° for 30 min. Intracranial tumors developed in 16 of 19 surviving hamsters given untreated BPV; meningeal tumors were evident in these hamsters by 30 days postinoculation. These tumors invaded the adjacent brain via the vascular system. Intracranial tumor cells did not contain virus particles; the tumors were made up of immature active fibroblasts. Fibroblasts of the cranial

cavity and subcutis were more susceptible to tumorigenesis by BPV than were other fibroblasts. No hamsters inoculated with heat-treated BPV developed tumors.

5238 EARLY REPLICATION OF HERPESVIRUSES IN NATURALLY OCCURRING FROG TUMORS. (E.)

McKinnell, R. G. (Dept. Zool., U. Minnesota, Minneapolis), V. L. Ellis, D. C. Dapkus and L. M. Steven, Jr. *Cancer Res* 32(8):1729-1733, 1972.

Fifteen renal adenocarcinomas were collected from leopard frogs in Kandiyohi County, Minnesota, prior to and 4, 7, 13 and 16 days after entry of host frogs into lakes for winter hibernation. Each tumor was fixed and thin sections were observed under the electron microscope for the presence of herpesvirus. No virus particles were seen in the four tumors from prehibernating frogs or in the two tumors from frogs autopsied on day four of overwintering. Mature herpesviruses were observed in two tumors of frogs that had been in the water for seven days. Three of seven tumors from frogs in the water for more than seven days contained no detectable virus particles. All tumors from frogs which had been in the water for over one month contained herpesviruses. Since oocytes and sperm cells are fully formed at the time mature, tumor-bearing frogs enter lakes for overwintering, the gametes are potentially exposed to mature viruses throughout the overwintering period. This could enable vertical transmission of herpesviruses.

5239 GROWTH OF ROUS SARCOMAS IN BURSECTOMIZED CHICKENS. (E.) McArthur, W. P. (New York U. Med. Ctr., N.Y.), E. A. Carswell and G. J. Thorbecke. *J Nat Cancer Inst* 49(3):907-909, 1972.

Chickens were bursectomized before hatching or shortly after hatching; by four to five wk of age, bursectomized birds were demonstrably hypogammaglobulinemic or agammaglobulinemic with respect to IgG and IgM. When injected with Bryan Rous sarcoma virus (10^{-3} - 10^{-5} dilution), bursectomized chickens showed an incidence of sarcoma development similar to that shown by unbursectomized normal birds. Tumor growth was also similar in the two groups. The results suggest that "blocking" or "enhancing" antibodies are not essential for growth of Rous sarcoma.

5240 DIFFERENTIAL ENHANCEMENT OF R-TYPE VIRUS PARTICLES IN POLYOMA-TRANSFORMED BHK-21 CELLS BY DIMETHYL SULFOXIDE. (E.) Kisch, A. L. (U. New Mexico Sch. Med., Albuquerque), R. O. Kelley and B. J. Eberle. *J Nat Cancer Inst* 49(3):911-914, 1972.

R-type virus particles (RTP) were examined by electron microscopy in untransformed hamster fibroblasts (BHK-21) and in a cloned line (Cl-1) of BHK-21 cells transformed by polyoma virus. Significantly more RTP were seen in Cl-1 cells than in BHK-21 cells, five

BHK-21 cells having two or more RTP, and 14 Cl-1 cells having two or more RTP. Propagation in medium containing 2% (v/v) dimethyl sulfoxide increased the number of RTP in Cl-1 cells but not in BHK-21 cells. The results suggest that RTP may interact with DNA viruses in the induction, maintenance or expression of functional alterations associated with cell transformation.

- 5241 COMPOSITION AND SIZE OF SHOPE FIBROMA VIRUS DEOXYRIBONUCLEIC ACID. (E.) Jacquemont, B. (Natl. Inst. Hlth. Med. Res., Lyon, France), J. Grange, L. Gazzolo and M. H. Richard. *J Virol* 9(5):836-841, 1972.

Rabbit kidney cells were inoculated with Shope fibroma virus (SFV) and labeled with ^3H - or ^{14}C -thymidine; SFV DNA was extracted from infected cells and its composition and size were calculated. Buoyant densities of cellular DNA, SFV DNA and vaccinia virus DNA were determined by analytical centrifugation in CsCl gradients, *M. lysodeikticus* DNA being used as a density marker. SFA DNA had a density of 1.6696 ± 0.0003 g/ml, similar to that of cellular DNA; vaccinia virus had a density of 1.6948 ± 0.004 g/ml. Guanine plus cytosine content values (G + C) calculated from these densities were 40.9 ± 0.4 for cellular DNA, 40.4 ± 0.3 for SFV DNA and 35.5 ± 0.4 for vaccinia virus. When SFV virions were treated with Pronase and detergent and cosedimented in sucrose density gradients, the molecular wt of SFV DNA was found to be 153×10^6 daltons. Only one of 65 SFV DNA molecules appeared to have this molecular wt under the electron microscope; the length average for SFV DNA was 49.8 ± 0.9 μm .

- 5242 OBSERVATIONS ON SUCCESSIVE GENERATIONS OF TUMORS PRODUCED IN HAMSTERS BY INOCULATION OF SV40-TRANSFORMED CELLS. (E.) Menezes, J. (Fac. Med. U. Ottawa, Ontario, Canada). *Tumori* 58:95-106, 1972.

SV40-transformed hamster cells, inoculated s.c. into hamsters, produced sarcomas in all of 90 five wk old recipients and in 95% of 40 15 wk old recipients. These tumors developed within three to 20 wk post-inoculation, and frequently metastasized to lymph nodes. Tumor cells which had undergone successive passages *in vivo* were more likely to produce metastasizing tumors on inoculation into recipients. Two other factors were associated with metastatic potential of tumor cell inocula: increased capacity of tumor cells for fusion, and increased number of polykaryocytes in tumor cell cultures. The percentages of polykaryocytes in tumor cell cultures increased in successive *in vivo* generations; however, the polykaryocytes appeared not to multiply, for their numbers decreased in *in vitro* passages. Polykaryocytes died or became drastically reduced in number in tumor cells which were frozen, centrifuged or trypsinized. Rescuability of SV40 and presence of T antigen persisted in tumor cells passaged *in vivo*.

- 5243 ELECTRON MICROSCOPIC STUDIES OF REPLICATING SV40 DNA. (E.) Yamamoto, S. (Okayama U. Med. Sch., Japan) and T. Oda. *Acta Med Okayama* 25(4):237-243, 1971.

VERO monkey cells were infected with SV40 and SV40 DNA was extracted and subjected to equilibrium density gradient centrifugation on CsCl. Fraction 17 on the CsCl gradient contained twisted or open circular DNA molecules, circular molecules with two branch points (θ form DNA), and circular molecules with a single tail (σ form DNA). θ and σ form DNA molecules were thought to represent replicating SV40 DNA, and were examined under the electron microscope. θ and σ DNA comprised 8.9% and 4.3% of all viral DNA, resp. at 54 hr after infection. Of 16 σ form DNA molecules, 11 had rings of viral DNA length and five had rings twice this length. The replication rate of these molecules ranged from 10% to 95%. The smallest molecule of replicating SV40 DNA observed was 1 μ in contour length.

- 5244 EXPRESSION OF THE SARCOMA GENOME IN A ROUS MOUSE TUMOR CELL LINE, SR-C3H-2127. (E.) Hino, S. (Inst. Med. Sci., U. Tokyo, Japan) and T. Tamamoto. *Cann* 62(6):539-544, 1971.

Cells of the line SR-C3H-2127, derived from a C3H mouse ascites tumor induced by Schmidt-Ruppin Rous sarcoma virus (SR-RSV), were fused with chicken embryo cells. Other chicken cells were infected with the supernatant of the fusion culture medium. The procedure permitted rescue of the SR-RSV genome from the SR-C3H-2127 cells. SR-C3H-2127 itself produced a murine C-type RNA virus (2127). This virus could infect DDD mouse embryo cells, but could not infect chicken cells. Cell fusion studies showed that there was no phenotypic mixing between the SR-RSV genome and the murine C-type virus. Active transport of 2-deoxy-D-glucose was observed in SR-C3H-2127 cells, and compared with that seen in a contact-inhibition-sensitive, murine leukemia virus-free, 2127 virus-infected cell line (C3H2K). Glucose transport was accelerated in SR-C3H-2127 cells but not in C3H2K cells. This confirmed the expression of the SR-RSV genome in SR-C3H-2127 cells.

- 5245 MURINE LEUKEMIA VIRUS: RESTRICTION IN FUSED PERMISSIVE AND NONPERMISSIVE CELLS. (E.) Tennant, R. W. (Oak Ridge Natl. Lab., Tenn.) and C. B. Richter. *Science* 178(4060):516-518, 1972.

Human WI38 cells, which were nonpermissive for Moloney leukemia virus replication, were fused with inactivated Sendai virus and exposed to Moloney virus. Moloney virus replication could not be detected, nor were typical C-type virus particles visible intracellularly. When Moloney virus was used to infect heterokaryons produced by fusion of WI38 cells with permissive 3T3 mouse cells, virus synthesis was still absent, though 3T3 synkaryons were permissive for virus synthesis. When clones of human mouse hybrid cells, produced by fusing KL strain human cells and

BT3-43 mouse cells, and lacking as much as half the human chromosome complement, were infected with Moloney virus, all clones were permissive. This suggested that the nonpermissive state of human cells was due to a gene functioning as a director of a repressor of mouse leukemia replication.

5246 RAPID IMMUNOLOGICAL INDUCTION OF MURINE LYMPHOMAS: EVIDENCE FOR A VIRAL ETIOLOGY. (E.) Cornelius, E. A. (Yale U. Sch. Med., New Haven, Conn.). *Science* 177(4048):524-525, 1972.

A graft-versus-host reaction was produced in (SJL/J x C57BL/1)F₁ mice (SB)F₁ by five weekly injections i.p. of spleen cells from SJL/J mice. By 40 wk post-injection, all recipients had developed reticulum cell sarcomas in spleen, lymph nodes, liver and lungs. Tumors from eight mice were transplanted by i.p. injection into mice of the following strains: (SB)F₁, SJL/J, C57BL/1, (NZB x SJL/J)F₁ and NZB. Tumor implants grew only in (SB)F₁ and C57BL/1 mice. Since SJL/J and C57BL/1 mice carry tumorigenic virus, the evidence suggests a viral etiology for the tumors, which were antigenically C57BL/1.

5247 NUCLEOTIDE COMPOSITION OF THE RNA FROM RD-114 VIRIONS. (E.) Roy-Burman, P. (U. Southern California Sch. Med., Los Angeles) and M. B. Kaplan. *Biochem Biophys Res Commun* 48(6):1354-1361, 1972.

RNA was extracted from two feline viruses: RD-114, virus released from a human rhabdomyosarcoma cell line (RD) which was virus-free until passaged through a fetal cat; and RD-FeLV, released from RD cells after infection with Gardner-Arnstein feline leukemia virus (FeLV). RNA was layered onto a linear 5-20% sucrose gradient and centrifuged to yield a 4S and a 70S fraction. These RNA fractions were subjected to enzymatic hydrolysis and their nucleotide compositions were studied by chromatography. Minor nucleotides were seen in 4S RNA only. This RNA contained 5,6-dihydro-UMP and pseudo-UMP as minor nucleotides. The base compositions of RD-114 and RD-FeLV were different; the former virus resembled strain 5 FeLV in base composition.

5248 CHANGES IN ACYL GROUP COMPOSITION OF PHOSPHOLIPIDS FROM CHICKEN EMBRYONIC FIBROBLASTS AFTER TRANSFORMATION BY ROUS SARCOMA VIRUS. (E.) Yau, T. M. (Cleveland Psychiat. Inst., Ohio) and M. J. Weber. *Biochem Biophys Res Commun* 49(1):114-120, 1972.

Phospholipids isolated from normal chicken embryo cells and from cells infected with Schmidt-Ruppin Rous sarcoma virus (RSV) were analyzed by gas-liquid chromatography. Each of the phospholipids analyzed showed acyl group specificity. Significant differences in acyl group composition were also seen in individual phospholipids isolated from untransformed

and RSV-transformed cells. Specifically, arachidonate was decreased in transformed cells while oleate was increased.

5249 GROWTH OF WOUND TUMOR VIRUS IN VECTOR CELL MONOLAYERS. (E.) Kimura, I. (Dept. Botany, U. Illinois, Urbana) and L. M. Black. *Virology* 48(3):852-854, 1972.

Vector cell monolayers from *Agallia constricta* were inoculated with preparations of wound tumor virus (WTV), a plant virus, and the appearance of transformed foci was observed. Foci first appeared in monolayers four hr after inoculation; the number of foci increased exponentially from 4-14 hr and leveled off between 14-22 hr. When the virus content of infected monolayers was determined by assaying the infectivity of infected monolayers, the doubling time for WTV was found to be about 58 min between 6-12 hr after inoculation.

5250 ACTIVATION OF C-TYPE RNA VIRUS MARKERS IN THE MOUSE UTERINE TISSUE. (E.) Fowler, A. K. (Natl. Cancer Inst., Bethesda, Md.), C. D. Reed, G. J. Todaro and A. Hellman. *Proc Natl Acad Sci USA* 69(8):2254-2257, 1972.

The effects of natural (estradiol-17 β) and synthetic steroidal estrogens, synthetic nonsteroidal [diethylstilbestrol and dichlorodiphenyltrichloroethane (DDT)] estrogenic compounds, and whole-body irradiation (1000 and 5000 rad) were studied on the *in vivo* activation of two C-type RNA virus markers in the uteri of ovariectomized adult NIH Swiss Mice. *In vitro* complement fixation assays, Ouchterlony diffusion tests and C-type virus-specific RNA-directed DNA polymerase assays were able to detect group-specific viral antigen and RNA-directed DNA polymerase within four days after stimulation. Uterine hypertrophy was not a prerequisite for viral antigen expression and the response was not accompanied by an increase in protein concentration. The hormonal and X-irradiation-induced activation of virus marker expression may represent two physiological means of viral genome derepression.

5251 PRESENCE OF VIRUS-SPECIFIC RNA IN HAMSTER CELLS TRANSFORMED BY SIMIAN ADENOVIRUS SA7: BRIEF REPORT. (E.) Mäntyjärvi, R. A. (Milton S. Hershey Med. Ctr., Pennsylvania State U., Hershey). *Arch Gesamte Virusforsch* 37(2/3):288-292, 1972.

Three lines of hamster cells transformed *in vitro* by simian adenovirus 7 (SA7) and one line derived from an SA7-induced hamster tumor were used in RNA-DNA hybridization tests to determine the presence of SA7-specific RNA in transformed hamster cells. Binding of RNA from SA7 to DNA from SA7 was 2.2-4.4 times higher than binding of SA7 RNA to DNA from untransformed control cells. This indicated that virus-specific RNA was present in the SA7-transformed hamster cells.

- 5252 INDUCTION OF INTRACRANIAL TUMORS IN MICE BY HUMAN ADENOVIRUS TYPE 12. II. ENHANCEMENT BY N,N'-DIMETHYLNITROSOUREA. (E.) Murao, T.. (Okayama U. Med. Sch., Japan). *Acta Med Okayama* 25(4):261-268, 1971.

C₃Hf/Bi (Zb) mice were divided into three groups and treated as follows: 27 mice inoculated intracranially with 0.015 ml fluid preparation of adenovirus type 12 (group 1); 23 mice inoculated with virus and ten days later inoculated s.c. with 20 mg/kg N,N'-dimethylnitrosourea (group 2); 18 mice inoculated s.c. with the carcinogen alone (group 3). Intracranial tumors developed in 12 of 25 surviving mice in group 1, in 19 of 21 group 2 survivors and in none of group 3 mice. Latent periods averaged 124 days for group 1 mice and 108 days for group 2 mice. Most tumors were made up of spindle-shaped cells arranged irregularly with scanty stroma.

- 5253 SPONTANEOUS PRODUCTION OF MURINE TYPE C VIRUS PARTICLES BY MOUSE ROUS SARCOMA CELLS AFTER LONG-TERM *IN VITRO* CULTIVATION. (E.) Oda, T. (Okayama U. Med. Sch., Japan), N. Yamaguchi and T. Yamamoto. *Gann* 62(6):535-538, 1971.

Electron microscopic observations revealed that a long-term cultured clonal cell line from an ascites sarcoma of C₃H/He mice induced by chicken Rous sarcoma cells spontaneously produced murine C-type virus particles. The cells contained no demonstrable Rous sarcoma virus (RSV) but did not contain RSV genome in a form transmissible to chicken cells. While the virogene of the murine C-type virus may have been present originally in the mouse ascites sarcoma cells, the oncogene of the cultured cells was not associated with the virogene but with the RSV genome.

- 5254 INCIDENCE OF SPONTANEOUS NEOPLASMS IN BREEDING AND RETIRED BREEDER BALB/cCr MICE THROUGHOUT THE NATURAL LIFE SPAN. (E.) Peters, R. L. (Microbiol. Assoc., Inc., Walkersville, Md.), L. S. Rabstein, G. J. Spahn, R. M. Madison and R. J. Huebner. *Int J Cancer* 10(2):273-282, 1972.

Approximately 1300 weaning to 10-month-old (breeders) BALB/cCr mice and 4500 10- to 12-month-old (retired breeders) BALB/cCr mice were observed throughout the remainder of their natural life span to determine age-specific incidence of various spontaneous neoplasms. Over 2000 mice were necropsied and their tissues examined microscopically. In general, neoplasms of all types were rare in animals younger than one yr; however, an early life "peak" (one to six months) of acute lymphocytic leukemia was observed. After 23 months, lymphocytic neoplasms decreased in frequency and the incidence of reticulum cell tumors increased progressively. No cases of myelocytic or stem cell leukemias were observed. No epithelial tumors were diagnosed prior to seven months. From seven to 19 months most epithelial tumors were mammary adenocarcinomas or myoepitheliomas. Beyond

this age, other epithelial tumors, especially pulmonary alveologenic adenocarcinomas, predominated. Mesenchymal tumors, which were seen after six months of age, were most frequently hemangioendotheliomas located in the vessels of the liver, uterus, and ovaries. No benign tumors were observed prior to ten months of age after which time alveologenic adenomas of the lung were the most frequent. The frequencies of all neoplasms other than lymphatic increased progressively with age. Of 24 mice with multiple primary malignancies, six had multiple nonlymphomatous solid tumors, two had multiple hematopoietic type neoplasms, and the remainder had combinations of lymphatic or reticulum cell tumors and non-lymphomatous solid malignancies.

- 5255 SYNTHESIS OF TUMOUR ANTIGEN AND CHANGES IN ACTIVITIES OF GLYCOLYTIC ENZYMES INDUCED BY POLYOMA VIRUS. (E.) Guminska, M. (Med. Acad., Cracow, Poland) and Z. Porwit-Bobrz. *Acta Virol (Praha)* 16(3):183-190, 1972.

Titers of tumor (T) antigen and activities of hexokinase (HK), pyruvate kinase (PK), phosphofructokinase (PFK) and lactate dehydrogenase (LDH) were determined in primary cultures of mouse embryo (ME) cells and BHK 21 cells infected with polyoma virus. In the early phase of infection of both cell systems, polyoma virus-induced synthesis of T antigen resulted in changed activities of the glycolytic enzymes. In ME cells, the activities of HK, PFK, PK and LDH increased simultaneously following infection. In BHK 21 cells, only HK, PK and LDH activities increased at the onset of infection. PFK activity did not increase until four days postinfection. The activities of all enzymes dropped sharply in ME cells during the cytolytic phase of infection. Following a drop in activity 5-9 days postinfection, HK, PK and LDH showed a second stable rise of activity in BHK cells 7-14 days postinfection. PFK continued to increase gradually but steadily in BHK cells throughout the observation period. T antigen synthesis dropped during cytolytic interaction in ME cells but was continuous in the late phase of infection of BHK 21 cells.

- 5256 THETA PARTICLES: A STRUCTURE FOUND IN HAMSTER SARCOMA VIRUS. (E.) Albino, A. P. (Sloan-Kettering Inst. Cancer Res., New York, N.Y.), E. DeHarven and F. K. Sanders. *J Virol* 10(3):477-483, 1972.

Hamster sarcoma virus (HaSV), a newly isolated RNA tumor virus, was pelleted directly from tissue cultures of hamster cells into a capsule for electron microscopic examination. Under these circumstances, HaSV consisted of C-type particles. When HaSV was concentrated by polyethylene glycol or ammonium sulfate followed by density gradient banding, 30-40% of particles were not of the C-type morphology. These particles appeared as enveloped structures each containing a flattened core resembling the Greek θ . Cores of θ particles were in the form of flattened discs assumed to contain

RNA. Similarly treated feline leukemia virus and Rauscher murine leukemia virus did not show 0 particles.

- 5257 REVERSIBLE INACTIVATION OF DEOXYRIBONUCLEIC ACID POLYMERASE OF RAUSCHER LEUKEMIA VIRUS. (E.) Tronick, S. R. (Natl. Cancer Inst., Bethesda, Md.), E. M. Scolnick and W. P. Parks. *J Virol* 10(4):885-888, 1972.

DNA polymerase was isolated from Rauscher murine leukemia virus (RMuLV) and exposed to 6 M guanidine hydrochloride (GuHCl). RMuLV DNA polymerase exposed to GuHCl lost all detectable activity. Enzyme activity was restored by removing GuHCl by dialysis in the presence of Triton X-100. RMuLV DNA polymerase was studied by gel filtration on agarose equilibrated with 6M GuHCl. The viral RNA-directed DNA polymerase had a molecular wt of 70,000 and evidently consisted of a single polypeptide chain.

- 5258 GENETIC MAPPING OF A MURINE LEUKEMIA VIRUS-INDUCING LOCUS OF AKR MICE. (E.) Rowe, W. P. (Natl. Inst. Allergy Infect. Dis., Bethesda, Md.), J. W. Hartley and T. Bremner. *Science* 178 (4063):860-862, 1972.

The chromosomal location of one of the two murine leukemia virus-inducing loci of AKR mice was determined. Analysis of the locus was facilitated by its isolation in backcross generations (e.g., C57BR (C57BR x AKR) F_1). The locus was located on linkage group I, as was the locus for isozymes of glucose phosphate isomerase (*Gpi-1*). There was close linkage between the virus-inducing locus (designated *Akv-1*) and *Gpi-1*; the two loci were 12 map U apart. Gene order was *c-Gpi-1-Akv-1*.

- 5259 RABBIT KIDNEY VACUOLATING VIRUS IN SPONTANEOUS SHOPE PAPILLOMAS OF COTTONTAIL RABBITS. (E.) Goldman, P. M. (Milton S. Hershey Med. Ctr., Hershey, Pa.), C. M. Lang and J. W. Kreider. *J Nat Cancer Inst* 49(5):1277-1281, 1972.

Papillomas were excised from rabbits and examined for the presence of Shope papilloma virus (SPV) and rabbit kidney vacuolating virus (RKV). Of 18 spontaneous papillomas, six contained both viruses, five contained SPV, three contained RKV and four contained neither virus. Immunofluorescent SPV antigen was found in the nuclei of papilloma cells; SPV antigen was localized similarly in all papillomas, regardless of the presence or absence of RKV. No papillomas contained RKV antigen, despite the fact that rabbit kidney tissue culture cells infected *in vitro* with RKV stained readily with anti-RKV antibody. Titers of SPV in papillomas with recoverable SPV and in papillomas with both SPV and RKV were similar. There was no correlation

between papilloma morphology and presence or absence of either virus.

- 5260 IMMUNE RESPONSE IN THE HAMSTER: VI. ANTIBODY RESPONSE IN POLYOMA ONCOGENESIS. (E.) Coe, J. E. (Natl. Inst. Allergy Infect. Dis., Hamilton, Mont.) and K. K. Takemoto. *J Nat Cancer Inst* 49(1):39-44, 1972.

Sera were obtained from neonatal and adult hamsters inoculated s.c. with polyoma virus or polyoma tumor. The immunoglobulins containing tumor (T) and virus (V) antibody were detected in indirect fluorescent microscopy with fluorescein-labeled antisera specific for hamster 7S γ_1 -, 7S γ_2 -, γ A- and γ M-globulins. V antibody was seen in sera seven days after polyoma injection of neonates and was located in the 7S γ_2 -globulin only. T antibody was not seen until day 21 in neonates and was found in the 7S γ_1 - and 7S γ_2 -globulins. The IgM and IgA globulins contained no detectable antibody activity. 7S γ_1 anti-T activity was found both after virus inoculation of neonates and after tumor injection of adults. γ A antibody was never seen in hamster sera, but 7S γ_2 activity was always present. In young adult hamsters both V and T antibodies were detectable by seven days after virus inoculation. The T antibody in the 7S γ_1 -globulin may have enhanced tumor growth.

- 5261 POLYOMA PSEUDOVIRIONS. I. SEQUENCE OF EVENTS IN PRIMARY MOUSE EMBRYO CELLS LEADING TO PSEDOVIRUS PRODUCTION. (E.) Yelton, D. B. (U. Maryland Sch. Med., Baltimore) and H. V. Aposhian. *J Virol* 10(3):340-346, 1972.

Confluent monolayers of primary mouse embryo cells were infected with polyoma virus (0.1 plaque-forming U (PFU)/cell). At various times after infection, samples were taken and the temporal relationship of various intracellular events was determined. Synthesis of polyoma virus DNA began 18 hr postinfection. Formation of polyoma virus capsid protein began at 30 hr, as measured by an increase of empty capsids. Plaque-forming virus particles and pseudovirions appeared at 42 hr; by 96 hr, the synthesis of both was complete. Host cell DNA formation (16S DNA in alkaline gradients and 14S in neutral gradients) appeared 36 hr postinfection (16S DNA) or 72 hr postinfection (14S DNA). The amount of host cell 14S DNA produced was seven times greater than the amount of viral DNA produced. The relative pool sizes of polyoma DNA and 14S DNA at the time of virus assembly may dictate the amounts of polyoma virus and pseudovirus produced.

- 5262 REVERSE TRANSCRIPTASE-CONTAINING PARTICLES INDUCED IN ROUS SARCOMA VIRUS-TRANSFORMED RAT CELLS BY ARGININE DEPRIVATION. (E.) Kotler, M.

(Hebrew U.-Hadassah Med. Sch., Jerusalem, Israel), E. Weinberg, O. Haspel and Y. Becker. *J Virol* 10(3):439-446, 1972.

Incubation of Rous sarcoma virus-transformed B77 rat embryo cells R(B77) for five days in medium deficient in arginine and containing ^3H -uridine resulted in the release of ^3H -labeled particles into the culture medium. Such particles, which banded at 1.16 g/ml in sucrose density gradients, did not appear in the medium of R(B77) cells incubated in medium containing arginine or in the medium of uninfected primary rat cells incubated either in arginine-deficient or complete medium. Electron microscopic observation showed that these particles resembled C-type particles. The particles released from the arginine-deficient R(B77) cells contained 35S RNA and reverse transcriptase activity. DNA synthesized by the reverse transcriptase in these particles hybridized with purified RSV RNA. The cytoplasm of both arginine-deprived and undeprived R(B77) and untransformed rat cells contained virus particles which banded in sucrose gradients at 1.14 g/cm and contained a reverse transcriptase. The DNA synthesized by this enzyme did not hybridize with purified RSV RNA.

- 5263 PATTERN OF PROTEIN SYNTHESIS IN MONKEY CELLS INFECTED BY SIMIAN VIRUS 40. (E.) Anderson, C. W. (Cold Spring Harbor Lab., N.Y.) and R. Y. Gesteland. *J Virol* 9(5):758-765, 1972.

Monolayer cultures of CV-1, BSC-1 or MA-134 monkey cells were infected with SV40 labeled with ^{35}S -methionine. To examine protein synthesis patterns in infected cells, total cell extracts were made by SDS and dithiothreitol disruption and analyzed by SDS-polyacrylamide gel electrophoresis. Between 15-18 hr postinfection, four virus-induced protein bands appeared. These proteins had molecular wts of 15,000-40,000 daltons, and were correlated with viral capsid proteins in three cases. The four bands appeared only after onset of SV40 DNA synthesis; they failed to appear in SV40-infected cultures treated with cytosine arabinoside and 5-fluorodeoxyuridine, inhibitors of SV40 DNA synthesis. The fourth protein band, which did not correspond to any viral capsid protein, did not appear in SV40-infected MA-134 cultures.

- 5264 C-TYPE VIRUS ASSOCIATED WITH GIBBON LYMPHOSARCOMA. (E.) Kawakami, T. G. (Sch. Vet. Med. U. California, Davis), S. D. Huff, P. M. Buckley, D. L. Dungworth and S. P. Snyder. *Nature (New Biol)* 58(235):170-171, 1972.

C-type virus particles were identified by electron microscopy in sections from lymph nodes, liver, spleen and bone marrow of a gibbon with disseminated lymphosarcoma. Similar extracellular C-type virions were also identified in preparations made from cultures of the tumor cells. The virions were approximately 100 nm in diameter, had an electron-dense nucleoid measuring approximately

75 nm, and banded at a density of 1.16 g/ml in sucrose gradients. Normal bovine, human and simian cells in culture were susceptible to infection and produced virions identical in morphology to those replicating from gibbon cell cultures. The virus induced neither morphological transformation of cell cultures nor cytopathic effect. The agent was identified as an RNA virus from its ability to incorporate ^3H -uridine. Purified virus possessed DNA polymerase activity. Preliminary serological evaluation of the virus antigen by immunodiffusion with sera against known feline, murine, rat and hamster oncogenic viruses showed that the agent lacked the species-specific antigen common to the known viruses. It did, however, possess an interspecific antigen common to known mammalian oncogenic viruses.

- 5265 "SPONTANEOUS" NEOPLASTIC TRANSFORMATION *IN VITRO*: INFLUENCE OF ENDOGENOUS MURINE LEUKEMIA VIRUS AND SERUM FRACTIONS. (E.) Sanford, K. K. (Natl. Cancer Inst., Bethesda, Md.), S. L. Handleman, J. W. Hartley, J. L. Jackson and R. R. Gantt. *J Nat Cancer Inst* 49(4):1177-1189, 1972.

Cell lines from three pools of normal C3Hf mouse-embryo cells were examined, during long-term culture, for both "spontaneous" neoplastic transformation and presence of murine leukemia virus group-specific antigens. Tests for neoplastic transformation were made by implantation of cells into syngeneic hosts and examination for sarcomas at the injection site. Cells were also examined cytologically for evidence of neoplastic transformation. No correlation between presence of antigen and neoplastic transformation could be established among the 48 cell lines studied. Tumors were produced by cells either positive or negative for group-specific antigens. Also, cells that did not undergo neoplastic transformation were either antigen positive or negative. These results do not confirm the hypothesis of a viral etiology for spontaneous neoplastic transformation of mouse cells *in vitro*. Differences in susceptibility to neoplastic transformation between embryo cell pools were observed. In addition, the effects of various fractions of fetal bovine serum on neoplastic transformation were explored. Under the conditions of these experiments, no one fraction consistently delayed or accelerated neoplastic transformation as compared with whole unfractionated serum.

- 5266 ONCOGENIC ACTIVITY OF POLYOMAVIRUS IN THE RAT. (Ger.) Desselberger, U. (Med. U., Hanover, West Germany), A. Georgii, H. Zobl and H. Ostertag. *Zentralbl Bakteriol (Orig)* 219(1):28-38, 1972.

The effect of thymectomy on oncogenesis and on the formation of hemagglutination inhibitor (HAI) antibodies against polyoma virus (S.E. strain) suspensions was investigated with the aid of the ultracentrifuge. Nursing Wistar rats were infected 24 hr after birth by an injection (s.c.) of 0.3 ml of

dialyzed supernatant fraction sediment or starting material of the virus. The animals were sacrificed 30 days later and their kidneys examined for tumors by macroscopic and histological observations. The supernatant fractions of the virus suspensions showed a marked increase in both oncogenicity and antigenicity compared with the other forms of the injected virus. The reason for this was a relative decrease in the infectivity titer of the supernatant fraction in the presence of inhibitors, which mask a portion of the infectious virus. When dialyzed material was used, the sediment suspension contained much higher quantities of virus than the starting material, as calculated on the basis of the infection titer before dialysis. With ultracentrifugation, about 90% of the virus particles in suspension settled into the sediment. Antibody response and tumor rate correlated with the dose of infective virus inoculated per animal (except for the supernatant fraction), which suggests that the *in vivo* inhibitors do not act in the same manner as the *in vitro*. In most groups infected with the same viral dose, there were no differences in antibody response between animals with and without tumors. Thymectomy led to a decreased antibody formation. Thymectomized animals receiving the starting material as a virus suspension showed an increase in tumor formation compared with controls.

- 267 HORMONAL MODIFICATION OF ADENOVIRUS TRANSFORMATION OF HAMSTER CELLS *IN VITRO*. (E.)
 Milo, G. E. Jr. (Dept. Vet. Microbiol. Parisitol., Ohio St. U., Columbus), J. P. Schaller and D. S. John. *Cancer Res* 32(11):2338-2347, 1972.

Primary hamster embryo cells were grown *in vitro* with Dulbecco's minimal essential medium supplemented with 10% dialyzed, virus-screened fetal calf serum and adjusted to 0.1 mM Ca^{++} . Cultures were segregated according to sex. Human adenovirus type 12 (Ad-12) induced foci of morphologically transformed cells in both sexes 10-12 days postinfection. The number of foci in replicate cultures did not vary statistically. Consistently more foci developed in female cultures than in similarly infected male cultures. Transformation was more efficient in pooled cultures of the same sex than in cultures grown from a single embryo. Significant enhancement ($p < 0.01$) of transformation occurred in female cultures treated with cortisone acetate, 5 µg/ml, and in male cells treated with dexamethasone, 0.1 µg/ml. Marked inhibition ($p = 0.001$) of Ad-12 transformation occurred in female and male cells treated with estrovarin, 0.1 µg/ml, and of male cells treated with aldosterone, 10 µg/ml, or progesterone, 10 µg/ml. Estrone and testosterone inhibited transformation of male cells slightly less markedly ($p < 0.01$) and had no effect on female cells. The mechanisms of enhancement and of inhibition are not clear. Cortisone acetate did not prevent cytotoxic effects (cell killing) in female cells by Ad-12. It seemed unlikely that cortisone acetate acted directly on the virus. The efficiency of transformation of hamster cells by Ad-12 is influenced by interrelationships between calcium concentration in the media, glucocorticoid activity of the steroid, and cell sex.

- 5268 VIRUS-LIKE PARTICLES IN GUINEA PIG OOGONIA AND OOCYTES. (E.) Andersen, H. K.
 (Inst. Med. Microbiol., U. Aarhus, Denmark) and Th. Jeppesen. *J Nat Cancer Inst* 49(5):1403-1410, 1972.

Virus-like particles in oogonia and oocytes of fetal, neonatal, and adult albino guinea pigs of the short-haired British type were observed with the electron microscope. The particles were identical to the guinea-pig leukemia virus in morphology and intracisternal cytoplasmic location. Three types of spherical particles 800-900 Å, in different stages of maturity and one crescent-shaped type, presumably in the stage of formation by budding from cytoplasmic vesicles, were noted. The particles were seen only intracisternally in membrane-limited cytoplasmic areas (probably of the endoplasmic reticulum) or between the two nuclear membranes and were never found in germinal cell nuclei or in any other ovarian cell type. Attempts to cultivate the virus on tissue culture cells of fetal guinea pigs, rabbit kidney cells, and explant cell cultures have not been successful. Another virus, morphologically resembling herpesvirus, was isolated from two adult animals by these attempts.

- 5269 FATE OF INFECTING SIMIAN VIRUS 40-DEOXYRIBONUCLEIC ACID IN NONPERMISSIVE CELLS: INTEGRATION INTO HOST DEOXYRIBONUCLEIC ACID. (E.)
 Collins, C. J. (German Cancer Res. Ctr., Heidelberg, West Germany) and G. Sauer. *J Virol* 10(3):425-432, 1972.

A kinetic analysis of conformational changes of simian virus 40 (SV40) donor DNA on infection of nonpermissive 3T3 cells is reported. Nonpermissive 3T3 cells were infected with purified superhelical SV40 deoxyribonucleic acid I (DNA I). One hour after infection, approximately 60% of the intracellular SV40 DNA was converted to relaxed forms. One day after infection, all intracellular SV40 DNA was present as slow-sedimenting material, and no SV40 DNA I was detectable. At 2 days after infection there appeared viral DNA sequences cosedimenting with cellular DNA during alkaline velocity centrifugation. Furthermore, by both alkaline equilibrium gradient centrifugation and by DNA-ribonucleic acid hybridization analysis, covalent linkage of viral DNA sequences to cellular DNA was demonstrated. Integration of SV40 DNA into cellular DNA did not appear to require DNA synthesis, although DNA synthesis followed by mitotic division of the cells enhanced the amount of viral DNA integrated. Based on data obtained by two different methods, it was calculated that 1,100 to 1,200 SV40 DNA equivalents must be integrated per cell by 48 hr after infection.

- 5270 SOME RESULTS OF STUDIES ON SKIN HETEROGENIZATION PRODUCED BY A LATENT VIRUS FROM C57B1/6J MICE. (Rus.) Liozner, A. L. (Sci. Res. Inst. Vir. Prep. Moscow, USSR), G. Ya. Svet-Moldavskiy, D. M. Mkheidze, P. P. Sokolov, T. A. Litovchenko and A. F. Bykovskiy. *Vestn Akad Nauk SSSR* 26(7):74-81, 1971.

Skin heterogenization tests were done on mice of lines C57Bl/6J, BALB/c, CBA, C3H, C3HA, and T6T6. 7,12-dimethylbenzanthracene (0.5 mg) was injected i.m. in mice in order to induce tumors in three to five months. The tumors were implanted in syngeneic mice subcutaneously. The transplants were examined in five to six days after transplantation, when the primary adaptation or rejection of the transplants was seen. The rejection response of the skin transplanted from carriers of K-237 sarcomas to syngeneic recipients of C57Bl/6J line (320 mice) was identical to the rejection response of the allogeneic transplants. The heterogenization response appeared in 8-13 days. Histologically, there was a resemblance in the rejection response of syngeneic and allogeneic transplants, with dilation of the blood vessels, cellular infiltration, activation of the connective tissue. The heterogenizing activity of the virus-containing tumor extract was neutralized by hyperimmune sera of C57Bl/6J mice. Virus particles of approximately 180 Å size were seen in deposits of the centrifuged extract examined under the electron microscope. None of 87 primary sarcomas of C57Bl/6J mice, induced by 7,12-dimethylbenzanthracene, caused heterogenization of the skin in these mice. But the tumors of the same type and cell-free extracts of these tumors acquired the heterogenizing effect after two to five passages on syngeneic mice. These results indicate that the virus causing the heterogenization phenomenon is a virus latent in C57Bl/6J mice and activated in tumors. Sarcomas induced in other lines of mice did not cause heterogenization. Heterogenization developed in C57Bl/6J mice as the number of passages increased up to 22. After the 22nd passage, the heterogenizing effect decreased.

- 5271 VIRUS PRODUCTION INDUCED BY VARIOUS CHEMICAL CARCINOGENS IN A VIROGENIC HAMSTER CELL LINE TRANSFORMED BY ROUS SARCOMA VIRUS. (E.) Altanerova, V. (Cancer Res. Inst., Bratislava, Czechoslovakia). *J Nat Cancer Inst* 49(5):1375-1380, 1972.

Virus was produced by two chemical carcinogens and four mutagens in a hamster cell line transformed by the Schmidt-Ruppin strain of Rous sarcoma virus. This cell line does not produce infectious virus or any C-type particles. The chemical carcinogens were 3-methylcholanthrene and benzo[a]pyrene. The mutagens were 4-nitroquinoline-1-oxide, urethan, 5-azacytidine, and phytohemagglutinin. The transformed hamster cell line was treated with various concentrations of these agents administered at different frequencies. In subsequent passages of treated cells, virus production was investigated by the inoculation of cell-free medium into 1-day-old chickens. Virus was first seen in the tenth passage of the treated cells. Virus was induced in all treated cell lines except those treated with urethan and phytohemagglutinin. Tumors induced in chickens by virus obtained from treated cells were sarcomas, which produced fully infectious virus for chickens.

- 5272 ALKALINE PHOSPHATASE ACTIVITY IN SPONTANEOUS AND INDUCED LEUKEMIAS IN SJL/J MICE. (E.)

Haran-Ghera, N. (Weizmann Inst. Sci., Rehovoth, Israel), R. Hauch-Granoth and H. Neumann. *Cancer Res* 32(11):2475-2480, 1972.

Alkaline phosphatase levels were determined in the thymus, spleen, and liver and in the mesenteric and peripheral lymph nodes of SJL/J mice with spontaneous or induced types of leukemia. Lymphatic leukemia, whether spontaneous or induced either by a leukemogenic virus or by 7,12-dimethylbenz(a)anthracene, caused a marked elevation in alkaline phosphatase activity in the tissues tested. This enzymatic activity increase is not thymus dependent but, rather, is a characteristic feature of murine lymphatic leukemia development, since it also occurred in thymectomized mice treated with 7,12-dimethylbenz(a)anthracene. In SJL/J mice that developed spontaneous reticulum cell neoplasms or myeloid leukemia (induced by irradiation), the levels of alkaline phosphatase activity were similar to normal levels.

- 5273 COURSE OF INFECTION IN TISSUES OF SUSCEPTIBLE CHICKENS AFTER EXPOSURE TO STRAINS OF MAREK'S DISEASE VIRUS AND TURKEY HERPESVIRUS. (E.)

Phillips, P. A. (Poultry Res. Station, Houghton, Huntingdon, England) and P. M. Briggs. *J Nat Cancer Inst* 49(5):1367-1373, 1972.

A study was made of infection in tissues from highly susceptible chickens exposed by inoculation or contact with virulent (HPRS-16) and avirulent (HPRS-27) and attenuated (HPRS-16) strains of Marek's disease virus (MDV) and turkey herpesvirus (HVT). Virus of all strains was first detected in lung and lymphoid tissues, and one strain was found one day after inoculation. All viruses persisted in infected birds for the duration of the experiments (about 60 days) and produced high levels of cell-associated infectivity in the lung, spleen, and liver. The level of infectious virus in most tissues was significantly higher in birds infected with the HPRS-16 strain of MDV, which cause acute Marek's disease, than in birds infected with HVT, HPRS-27, and attenuated HPRS-16. Direct comparisons showed no significant difference in levels of cell-associated infectivity in most tissues of chickens infected with HVT, HPRS-27, and attenuated HPRS-16; other comparisons suggested that infectivity was lowest in chickens infected with attenuated HPRS-16. These findings correlated positively with the relative pathogenicity of the viruses in susceptible chickens. Attenuated acute MDV and HVT were not transmitted by contact exposure, but the apathogenic strain of MDV was transferred to susceptible birds by this means.

- 5274 NUCLEIC ACID METABOLISM IN CELLS DURING THE EARLY STAGES OF INTERACTION WITH ONCOGENIC VIRUSES. (Uk.) Nadhorna, N. Y. (Sci. Res. Inst. Epid., Microbiol., Parasit., Kiev, USSR), M. R.

Mednyk, L. D. Shkraba and A. M. Shcherbyns'ka.
Mikrobiol Zh 34(1):41-42, 1972.

Mouse and chicken embryo fibroblast (MEF and CEF) cultures were inoculated with Polyoma and Rous sarcoma viruses, and the dynamics of nucleic acid levels and mitotic activity were studied during the first 24 hr after viral infection. Rous sarcoma virus caused an increase in DNA levels and H^3 -thymidine-labeled cells in the CEF cultures between 2-11 hr postinoculation. A drop in these indexes on the 12th hr and a subsequent gradual increase through the 22nd hr of the experiment were observed. Mitotic activity of the infected cultures increased with respect to the control cultures on the 5th through the 18th hr of the experiment; its decrease toward the end of the 24 hr experiment appeared to be associated with increased RNA levels. Increased DNA levels, cellular label incorporation, and labeled cell amounts were observed in the MEF cultures upon inoculation with Polyoma virus; label indexes of the experimental cultures reached an average 68% as compared with 54% found in the related controls. All these parameters decreased between the 5th and 22nd hr of the experiment, then increased over control values at the end of the 24 hr period. The decrease of mitotic activity observed during the major part of the experiment was attributed to an inhibition of DNA synthesis. The different trends in nucleic acid metabolism and mitotic activity caused by the two viruses were interpreted as due to the different nature of the Rous oncorna and Polyoma DNA viruses.

5275 STRUCTURAL ROLES OF POLYOMA VIRUS PROTEINS.
(E.) Friedmann, T. (U. California San Diego Sch. Med., La Jolla) and D. David. *J Virol* 10(4):776-782, 1972.

Polyoma viruses were subjected to alkaline disruption and the protein composition of disrupted viruses was examined by electrophoresis in SDS-12.5% polyacrylamide gels. The released virion DNA was seen as a 25S peak associated with 4-6% of recovered virion protein (superhelical closed circular double-stranded DNA) and as a 17S peak of protein-free DNA (nicked viral or linear DNA). Most viral protein disruption was in the form of capsomeres, sedimenting mainly at 10S and 7S. Both these protein peaks contained proteins P_2 , P_3 and P_4 in molar ratios of 5:1:1 or 6:1:1. The 25S DNA-protein complex contained only a small amount of the major capsid protein in P_2 . Material found between 1-3S was rich in P_5 and contained some P_2 , P_3 and P_4 . Reassembled DNA-free shell-like particles contained P_1 , P_2 , P_4 and P_7 in amounts similar to those seen in native virions. Reassembled particles had reduced amounts of P_3 , virtually no P_5 and probably no P_6 .

5276 THE RADIO-LEUCOSIS VIRUS OF THE C57B1 MOUSE. (Fr.) Legrand, E. (Bergonie Fdn., Bordeaux, France) and P. B. Mistry. *Bord Med* 7:763-769, 1972.

The mechanisms for leukemogenesis in C57 B1 mice are reviewed. Frequency of spontaneous leukemias is less than 7%, but following X-ray radiation under controlled conditions, the percentage of leukemias is considerably increased (80-90%). Unless the whole body is exposed to the radiation, the leukemia may be inhibited. Inhibition also occurs following injections of cellular suspensions prepared from bone marrow, and from fetal liver or spleen. Experiments are described showing that a thymus grafted onto a thymectomized and irradiated animal becomes leukemic. However, it was demonstrated that a leukemogenic agent, of a viral type, existing in irradiated sarcoma tissues may be transmitted to neonates to induce lymphoid tumors. Irradiation apparently promotes an accumulation of target cells maximally susceptible to becoming leukemic cells. Thus, a minimal superinfection may contribute to the development of lymphosarcomas in animals who would otherwise not succumb to carcinogenesis.

5277 SUSCEPTIBILITY OF INBRED FISCHER RATS TO BRAIN TUMOR INDUCTION BY ROUS SARCOMA VIRUS. (E.) Wilfong, R. F. (Duke U. Med. Ctr., Durham, N.C.), D. D. Bigner and W. Wechsler. *Naturwissenschaften* 59(8):371-372, 1972.

Twenty-five neonatal, inbred rats were injected intracerebrally with 0.01 or 0.02 ml of a preparation of Rous sarcoma virus, Schmidt-Ruppin strain. Solitary or multiple tumor growth occurred in 24 rats three months after inoculation. A total of 57 microscopic or large macroscopic tumors were present. They were located in the meninges, the hemispheres, the basal ganglia, the cerebellum, and the ventricle. No extraneural tumors or metastases were found. The brain tumors fell into three main categories: gliomas (34); mixed tumors (gliosarcomas) (5); and sarcomas (18). The majority of tumors were of neuroectodermal nature and originated from the subependymal region and the white matter.

5278 CLEAVAGE OF SIMIAN VIRUS 40 DNA AT A UNIQUE SITE BY A BACTERIAL RESTRICTION ENZYME. (E.) Morrow, J. F. (Stanford U. Med. Ctr., Calif.) and P. Berg. *Proc Natl Acad Sci USA* 69(11):3365-3369, 1972.

5279 SPECIFICITY OF THE BREAK PRODUCED BY RESTRICTING ENDONUCLEASE R_1 IN SIMIAN VIRUS 40 DNA, AS REVEALED BY PARTIAL DENATURATION MAPPING (E.) Mulder, C. (Cold Spring Harbor Lab. Quantitative Biol., N.Y.) and H. Delius. *Proc Natl Acad Sci USA* 69(11):3215-3219, 1972.

5280 MORPHOGENESIS AND STRUCTURE OF ONCORNA VIRUSES: ELECTRONMICROSCOPIC STUDIES ON C-TYPE VIRUS PARTICLES. (Ger.) Gelderblom, H. (Max Planck Inst. Vir. Res. Tübingen, Germany), H. Bauer, D. P. Bolognesi and H. Frank. *Zbl Bakt (Orig)* 220:79-90, 1972.

- 5281 THE IDENTIFICATION OF THE 3' TERMINUS OF THE 70S RNA OF MURINE SARCOMA VIRUS (MOLONEY). (E.) Robin, J. (St.-Louis Hosp., Paris, France), C. J. Larsen, R. E. Ravicovitch, M. Bazilier, M. Mauchauffe and M. Boiron. *FEBS Letters* 27(1):58-62, 1972.
- 5282 LACK OF PATHOGENICITY OF MAREK'S DISEASE VIRUS AND HERPESVIRUS OF TURKEYS IN MARMOSSET MONKEYS. (E.) Sharma, J. M. (U. S. Dept. Agriculture, East Lansing, Mich.), R. L. Witter, G. Shramek, L. G. Wolfe, B. R. Burmester and F. Deinhardt. *J Nat Cancer Inst* 49(4):1191-1197, 1972.
- 5283 MURINE VIRUS CONTAMINANTS OF LEUKEMIA VIRUSES AND TRANSPLANTABLE TUMORS. (E.) Collins, M. J. (Microbiol. Associates, Inc., Bethesda, Md.) and J. C. Parker. *J Nat Cancer Inst* 49(4):1139-1143, 1972.
- 5284 STUDIES ON THE *IN VIVO* REPLICATION OF TURKEY HERPESVIRUS. (E.) Witter, R. L. (Reg. Poultry Res. Lab., U. S. Dept. Agriculture, East Lansing, Mich.), K. Nazerian and J. J. Solomon. *J Nat Cancer Inst* 49(4):1121-1130, 1972.
- 5285 INCREASE IN NUMBER OF SPLENIC TRANSPLANTABLE COLONY-FORMING UNITS IN THE SJL/J MICE AFTER INFECTION WITH RAUSCHER LEUKEMIA VIRUS. (E.) Okunewick, J. P. (Allegheny Gen. Hosp., Pittsburgh, Pa.), E. L. Phillips and P. Erhard. *J Nat Cancer Inst* 49(4):1101-1106, 1972.
- 5286 GROWTH CHARACTERISTICS OF TUMORS INDUCED BY BOVINE ADENOVIRUS TYPE-3 IN HAMSTERS OF VARIOUS AGES. (E.) Motoi, M. (Okayama U. Med. Sch., Japan), H. Fukui, T. Nomura and K. Ogawa. *Cann* 63:615-623, 1972.
- 5287 UNDIFFERENTIATED INTRAPERITONEAL TUMORS INDUCED BY HUMAN ADENOVIRUS TYPE 12 IN HAMSTERS. (E.) Mukai, N. (Wesley C. Bowers Lab. Pharmacology Exp. Path., Retina Fdn., Boston, Mass.) and S. Kobayashi. *Am J Pathol* 69(2):331-347, 1972.
- 5288 BASES METHYLATED *IN VITRO* BY CELL-FREE EXTRACTS OF ADENOVIRUS-18-INDUCED TUMOURS. (E.) McFarlane, E. S. (Dept. Microbiol., Dalhousie U., Halifax, N. S., Canada). *Biochem J* 129(3):513-517, 1972.
- 5289 A STUDY OF A LEUKEMOID VIRUS IN A TRANSPLANTABLE CULTURE OF HUMAN LEUKEMIA CELLS. (Rus.) Solov'ev, V. D. (Cent. Inst. Postgrad. Med., Moscow, USSR), A. K. Shubladze, A. F. Bocharov, A. M. Amchenkova, L. I. Blinova, E. P. Ugryumov, B. A. Emel'yanov, G. A. Delimbetova and I. F. Barinskii. *Vestn Akad Med Nauk SSSR* 6:3-9, 1972.
- See also:
- * (Rev): 5003, 5015, 5025, 5026, 5028, 5030, 5035, 5040, 5041, 5042, 5046, 5051, 5052
 - * (Chem): 5079
 - * (Immun): 5292, 5305, 5308, 5309, 5316, 5321, 5322, 5325, 5329, 5331, 5333, 5342, 5343, 5344, 5345, 5347, 5349, 5352, 5357, 5358, 5359, 5372, 5375, 5382, 5387, 5389
 - * (Path): 5398, 5402

- 5290 QUANTITATIVE ANALYSIS OF IgG, IgA AND IgM IMMUNOGLOBULINS IN LYMPHATIC LEUKEMIA AND LYMPHOSARCOMA. (E.) Lawkowicz, W. (Inst. Hematol., Warsaw, Poland), M. Kraj and S. Ciesluk. *Arch Immunol Therap Exp (Warsz)* 20:227-234, 1972.

Electrophoretic γ -fractions, and levels of IgG, IgA and IgM immunoglobulins were determined in blood sera from 42 patients with chronic lymphatic leukemia, lymphosarcoma, chronic lymphatic leukemia developing into lymphosarcoma, reticulosarcoma, reticulosis or lymphadenopathy. In lymphatic leukemia, the γ -fraction and mean immunoglobulin values were lower than in healthy persons. In lymphosarcoma and reticulosis, γ -fraction and immunoglobulin values were normal. M proteins, which in lymphoproliferative states may be a product of cells involved in the proliferative process, were seen in to cases of lymphosarcoma; one case showed M-IgGK and the other showed M-IgM. IgM protein was also seen in one leukemia patient. IgG and IgA were reduced, and IgM was slightly elevated, in patients with leukemia evolving into lymphosarcoma; in these patients, γ -fraction values were normal. In reticulosarcoma and lymphadenopathy, the results were variable.

- 5291 DETERMINATION OF β -NAPHTHYLAMINE AS A HAPTENE IN CANINE TISSUES IN EARLY STAGES OF CARCINOGENESIS. (Rus.) Korosteleva, T. A. (N. N. Petrov Res. Inst. Oncol., Min. Health USSR, Leningrad) and A. P. Skachkov. *Vopr Onkol* 18(7):69-73, 1972.

Formation of carcinogen-protein antigen complexes under the effect of β -naphthylamine was studied in the urinary bladder of dogs with cancer. The dogs received food containing 50 mg/kg β -naphthylamine. Blood from these dogs was collected 4, 15, and 30 days from the beginning of such diet for immunological examinations. Extracts of the liver, kidneys, spleen, urinary bladder and lungs were also used for detection of the carcinogen-protein antigens. β -naphthylamine-haptene was detected using rabbit immune sera to synthetic heterologous β -naphthylamine-azoproteins and agar gel filtration. β -naphthylamine-haptene complex was found in the sera of dogs which had received β -naphthylamine for 15-30 days. The number of animals with such complex in their sera increased in accordance with the number of days of administration of β -naphthylamine. The antigen complex was also found in the protein of kidney extracts of dogs which had received β -naphthylamine for 15-30 days, but not in other tissues.

- 5292 IMMUNOLOGIC REACTIVITY OF THE CAT: IMMUNOSUPPRESSION IN EXPERIMENTAL FELINE LEUKEMIA. (E.) Perryman, L. E. (Coll. Vet. Med., Ohio St. U., Columbus), E. A. Hoover and D. S. Yohn. *J Nat Cancer Inst* 49(5):1357-1365, 1972.

Cellular and humoral immune capabilities were evaluated in 18 cats inoculated at birth with feline leukemia virus and in 16 age-matched control cats.

The assays were performed at 2-week intervals between 5 and 19 weeks of age. All control cats rejected cutaneous allografts at 13.1 ± 1.4 days. Sixteen of eighteen FeLV-infected cats (89%) had significantly ($P < 0.01$) longer allograft retention times (≥ 18 days). These differences were first noted in 5-week-old cats. Humoral antibody responsiveness (measured by hemagglutination titers to sheep red blood cells) was not significantly altered during leukemogenesis. Marked thymic atrophy appeared in the infected cats as early as 5 weeks of age, and persisted into the neoplastic period (19 weeks of age). These results indicate that significant depression of cell-mediated immunity occurs in the preneoplastic phase of experimental feline lymphosarcoma, and that thymic atrophy is a preleukemic lesion.

- 5293 IMMUNE STATUS OF AUTOCHTHONOUS AND ADOPTIVELY PROTECTED MICE TOWARD SPONTANEOUS AND CHEMICALLY INDUCED TUMORS. (E.) Basombrio, M. A. (Inst. Cancer Res., Philadelphia, Pa.) and R. T. Prehn. *Cancer Res* 32(11):2545-2550, 1972.

The immune reactivity of mice toward their own primary tumors was evaluated immediately after surgical excision of the tumor, with or without procedures to establish adoptive tumor immunity. Methylcholanthrene (MCA)-induced sarcomas and "spontaneous" mammary carcinomas of C3H/He mice were used. Autografts of either of these tumors grew better than isografts into normal mice. This conditioned status of primary hosts bearing MCA tumors could not be transferred to syngeneic recipients by means of lymphoid cells or serum. On the other hand, attempts to transfer specific immunity from actively immunized mice to syngeneic recipients were successful. When mice bearing primary or transplanted tumors were lethally irradiated and repopulated with lymphoid cells from normal or tumor-immunized donors, tumor growth was markedly inhibited. This treatment was effective for MCA-induced sarcomas in both inbred and random-bred mice, but not for spontaneous mammary carcinomas. Procedures involving repopulation of tumor-bearing mice with lymphoid cells from normal or immunized mice seem to correct a decreased level of reactivity of the animals toward their own tumors.

- 5294 THE IMMUNODEPRESSIVE AND CARCINOGENIC ACTIVITY OF FOUR N-NITROSO-COMPOUNDS IN MALE SPRAGUE DAWLEY RATS. (Ger.) Scherf, H. R. (Inst. Exp. Toxicol. Chemother., Heidelberg, Germany). *Z Krebsforsch* 77(3):189-193, 1972.

The carcinogenic dimethylnitrosamine, ethyl-n-butyl-nitrosamine, N-nitrosomorpholine, and methylnitrosourea were administered to male Sprague-Dawley rats in four equitoxic doses each, once weekly, for 12, 18, and 24 wk. Following completion of each treatment period, the compounds were tested for their immuno-depressive properties by the Jerne plaque test. The four substances affected the immune competent system of the rats very differently.

A definite inhibition of the immune reaction was observed in rats treated with dimethylnitrosamine at the three higher dose levels, whereas only the highest dose level of N-nitrosomorpholine or ethyl-n-butyl nitrosamine inhibited an immune reaction. The immunodepressive effect of methylnitrosourea was already evident after 12 weeks of its administration but did not increase through further administration. No correlation could be found between the carcinogenic and immunodepressive properties of the compounds tested.

- 5295 STUDIES ON THE IMMUNOLOGY AND PROTEIN STRUCTURE OF CARCINOMA OF THE UTERINE CERVIX. (Ger.) Loskant, G. (Women's Clin. U. Homburg, West Germany). *Ann Univ Saraviensis Med* 18(4):207-303, 1971.

An attempt to interpret human carcinoma of the uterine cervix as an immune disease is made. In this connection tissue proteins as antigens are particularly relevant. Electrophoretic studies of the patients revealed a decrease in albumin peaks and an increase in globulin fractions, with a highly significant increase in total protein. In 12 carcinoma patients, there was an increase in serum protein acid alpha₁, -glycoproteins, ceruloplasmin, haptoglobin, gamma-alpha-globulin, and gamma-alpha-G-globulin, whereas the albumin, alpha₂-macroglobulin, transferrin and the gamma-M-globulin were decreased. The effect of beta irradiation on the serum was not clear-cut. Electrophoretic analyses by means of the ultracentrifuge confirmed the protein disorders in all the carcinomatous cells. It is possible to demonstrate the protein deficit in the carcinomatous organs by the use of specific plasma protein antisera. Antigen loss occurs particularly in the cell subfractions. The serum protein changes do not reflect the events in carcinoma tissue. (656 references).

- 5296 IMMUNOFLUORESCENT CHARACTERISTICS OF EXPERIMENTAL BLASTOGENESIS OF THE THYROID. (Rus.) Okulov, V. B. (N. N. Petrov Res. Inst. Oncol., Leningrad, USSR). *Vopr Onkol* 18(8):54-61, 1972.

Various stages of experimental oncogenesis in the thyroid gland were studied in white rats by an immunofluorescent method. A total of 30 hybrid white rats (2-3 months old and weighing 100-120 g) received 20 mg 6-methylthiouracil in 0.2 ml water through a gastric catheter five times a week. Fifteen white rats served as controls. Six to 25 months from the beginning of the experiment, the animals were killed with chloroform vapors and their thyroid glands were removed and prepared for immunofluorescent and microscopic analyses. A total of 28 epithelial tumors of varied structure and five local follicular proliferates were found in 22 animals receiving 6-methylthiouracil. Nine of the tumors were malignant. The microsomal antigen was determined utilizing chick gammaglobulin antisera labeled with a fluorescent color. The content of the microsomal antigen was significantly decreased in the

five local proliferates and even more decreased in the nine malignant tumors. In four vascular infiltrating tumors, the microsomal antigen was barely detectable. Thus, the different microsomal antigen levels reflect various stages of tumor development.

- 5297 IMMUNOLOGY OF LIVER CANCER IN JAPAN AND SOUTH EAST ASIA WITH SPECIAL REFERENCES TO AUSTRALIA ANTIGEN. (E.) Nishioka, K. (Natl. Cancer Ctr. Res. Inst., Tokyo, Japan). *Asian Med J* 15(2):47-49, 1972.

The occurrence of Australia antigen (Au-Ag) was observed in 467 hepatoma patients in Japan, Taiwan, Manila and Singapore. Between 33.6 and 70.0% of the hepatoma patients possessed Au-Ag, as determined by immune adherence hemagglutination; the percentages of Au-Ag positivity among subjects without hepatoma did not exceed 13.5%. No anti-Au antibody could be demonstrated in most Au-Ag-positive hepatoma patients. Seventy-four of 196 hepatoma patients who were α -fetoprotein-positive were Au-Ag-positive, while only seven of 40 α -fetoprotein-negative hepatoma patients were Au-Ag-positive.

- 5298 ALTERATIONS IN PLASMA RECOGNITION FACTOR ACTIVITY IN EXPERIMENTAL LEUKEMIA. (E.) Di Luzio, N. R. (Tulane U. Sch. Med., New Orleans, La.), E. Miller, R. McNamee and J. C. Pisano. *J Reticuloendothel Soc* 11:186-197, 1972.

Liver slices from normal rats were incubated with normal rat sera and heparin and exposed to particles of a gelatinized RE test lipid emulsion labeled with ¹³¹I-triolein. The expression of humoral recognition factor (HRF) by liver Kupffer cells was measured by observing phagocytosis of ¹³¹I-triolein labeled lipid emulsion by Kupffer cells. The incubation of liver slices with normal rat plasma resulted in a 17-fold increase in phagocytosis as compared to the degree of phagocytosis in mixtures of rat liver slices and lipid emulsion incubated with phosphate buffer. Serum from rats injected with normal leukocytes did not alter the expression of HRF by Kupffer cells. However, when liver slices and lipid emulsion were mixed with sera from rats given transplants of Shay chloroleukemia cells, HRF expression was depressed by 80%. The i.v. administration of leukemic cells to rat serum donors also depressed HRF expression; however, in the i.v. system, HRF was restored to normal values by 4 hr. The role of altered HRF activity in neoplasia is discussed.

- 5299 MALIGNANT CELLULAR TRANSFORMATION AND KARYOLOGIC MODIFICATIONS: THE CONTRIBUTION OF INTRASPECIFIC SOMATIC HYBRIDIZATION IN CHINESE HAMSTERS. (Fr.) Berebbi, M. (Regional Anti-Cancer Ctr., Marseilles, France) and G. Meyer. *Int J Cancer* 10(2):418-435, 1972.

Different characteristics of transformation were studied on subclones isolated from a hybrid cell line (HyC) obtained by fusion of two Chinese hamster sublines, similar in origin but differing in properties such as transplantability. Different sublines were derived by cloning in soft agar. Transplantability, plating efficiency in soft agar, agglutinability by Concanavalin A were studied in parallel with karyotypic evolution to establish a possible correlation. DC-3F, one of the parent strain, spontaneously transformed *in vitro*, produced tumors when inoculated in the cheek pouch of cortisone-treated Syrian hamsters, grew easily in soft agar and was highly agglutinable by Concanavalin A. In contrast, the second parent strain, DC-3F/ADX/Aza, had lost its tumor-producing ability; it did not grow in soft agar and was poorly agglutinated by Concanavalin A. The HyC population had intermediate cloning and agglutinability characteristics. Clones isolated from the HyC line showed differences in tumorigenicity that appeared to be correlated with modifications of their surface properties. A statistical chromosomal analysis was performed using the appearance of a distinctive abnormal subtelocentric chromosome (M2) as a marker for the HyC line. The arithmetical mean of the M2 marker (0.85) varied in the HyC subcultures and also in the clones studied. A relationship was observed between the marker and percentage of tumors, but comparative statistical analysis indicated that the M2 marker was not the unique chromosome responsible for malignancy. The marker is, however, involved in modifications of the cell surface.

5300 TRANSITORY CELL ANTIGENS OF RAT LIVER.
II. EFFECT OF SYNTHESIS INHIBITORS ON FETOSPECIFIC SERUM PROTEINS IN NORMAL YOUNG ANIMALS AND AFTER ACUTE HEPATIC INJURY. (Fr.) De Nèchoud, B. (Cancer Sci. Res. Inst., Villejuif, France) and J. Uriel. *Int J Cancer* 10:58-71, 1972.

Young Wistar rats were tested for the effect of protein synthesis inhibition on serum α -fetoprotein (FP) levels and on the *in vivo* synthesis of α -FP during acute liver injury. Actinomycin D and cyclohexamide were selected as the two inhibitors that intervene at different levels of expression of the cellular genome, blocking transcription and translation, resp. The inhibitors were administered i.p. in doses of 50-100 μ g/100 g body wt. Cyclohexamide decreased serum α -FP and lipoprotein-esterase in rats less than one month old but had no effect on α -FP or albumin. Actinomycin decreased α -FP but not α -FP in young animals. Until the age of two and a half months, a single i.p. injection of 1.25 or 2.5 mg of hepatotoxic N-dimethylnitrosamine induced the transitory secretion of significant quantities of α -FP. The *de novo* synthesis of α -FP and α -FP during liver injury was evidenced by incorporation of L-leucine- C^{14} and its inhibition by cyclohexamide. Reappearance of α -FP following dimethylnitrosamine injection was delayed by moderate doses of actinomycin D. The synthesis of α -FP in both the normal and liver-damaged rat in

the presence of actinomycin D indicates the presence of messenger RNA at time of administration of the inhibitor.

5301 THE INFLUENCE OF PARASITISM WITH *DIPETALONEMA VITAE* AND WITH *SCHISTOSOMA MANSONI* ON THE GROWTH OF EXPERIMENTAL TUMORS. (Fr.) Capron, A. (Fac. Med., Lille, France), P. Wattre, M. Capron and M.-N. Lefebvre. *C R Acad Sci [D] (Paris)* 275:719-722, 1972.

A study of the interaction between tumor cells and parasitic larvae is presented. The tumor cells were BHK 21 C 13, cultured *in vitro* and injected s.c. in a dose of 1×10^6 /animal (Syrian hamster) and 8629 T 1 C5⁽⁵⁾ from tumor nodules of the Fisher rat, administered at 5×10^6 /rat. The parasites were L III larvae of *Dipetalonema vitae* (D.v.) filaria; at 200/animal and the furcercous *Schistosoma mansoni* (S.m.) at 100/animal for inoculation in the hamster. In the rat, S.m. was inoculated at 800/animal. Parasitic infestation was carried out before, during, or following the administration of tumor cells, the controls receiving either the cells or the parasites. BHK 21 cells were administered to groups of five hamsters infected with parasites at different time intervals. In hamsters infected 75 days previously with D.v., there was an accelerated growth of tumors whose mean diameter in 42 days was twice that of the control; in animals infected with D.v. at the same time as injection of tumor cells, there was an inhibition of tumor growth. The other groups developed similarly to the controls. In hamsters given BHK 21 cells 30 days after infection with S.m., tumor growth was accelerated, tumors attaining at 50 days a weight six times that of the controls. With S.m. there was also an inhibition of tumor growth upon simultaneous administration of tumor cells and parasites, and no difference from controls was seen at other time intervals. The 8629 T 1 C5 cells were injected in groups of five rats 20 days before, 20 days after, or at time of parasite infection. With simultaneous administration, tumors developed which were similar to those in the controls; no tumors appeared in the other groups. The interaction between tumor cells and parasites is shown to depend on the sensitivity of the host to the specific parasite. A new approach to tumor development in countries where bilharziasis is endemic is indicated.

5302 IMMUNOCYTOLOGY OF CULTURED IgM-FORMING CELLS OF MOUSE I. REQUIREMENT OF PHAGOCYTIC CELL FACTOR FOR THE GROWTH OF IgM-FORMING TUMOR CELLS IN TISSUE CULTURE. (E.) Namba, Y. (Inst. Virus Res., Kyoto U., Japan) and M. Hanaoka. *J Immunol* 109(6):1193-1200, 1972.

Murine IgM-forming myeloma MOPC-104E cells induced in BALB/c mice were able to grow in tissue culture for only about one month when fed every three days with regular medium. Growth in culture was prolonged for as long as ten months when the cells were fed regularly with medium supplemented with a factor from

cultured mouse spleen cells or peritoneal macrophages. This factor was precipitated with ammonium sulfate. It was fairly heat labile, proteinaceous and had a molecular wt of about 5×10^4 as determined by Sephadex gel filtration. The factor was stable for two days at 37 C and for three months at -20 C. MOPC-104E cells grown in factor-deficient medium accumulated in the G₁ phase of the cell cycle, and transfer to factor-containing medium resulted in a synchronous wave of DNA synthesis and mitosis. The factor did not regulate IgM production by the tumor cells. Cyclic AMP (0.3 to 1.0 μ g/ml) could substitute for the factor, suggesting a possible role as second messenger in DNA synthesis of tumor cells. While sera of young adult A/Jax mice contained a small amount of the growth-promoting factor, activity was greatly increased by injection of Freund's complete adjuvant. L cells and mouse embryo cells did not produce the factor, and sera from rabbit, horse or cattle showed no detectable activity.

- 5303 THE IMMUNE RECOGNITION OF TA3 TUMORS, ITS FACILITATION BY ENDOTOXIN, AND ABROGATION BY ASCITES FLUID. (E.) Grohsman, J. (Temple U. Sch. Med., Philadelphia, Pa.) and A. Nowotny. *J Immunol* 109(5):1090-1095, 1972.

TA3-St and TA3-Ha mouse mammary tumors, maintained in A/J mice, were exposed to 10,000 R X-irradiation and injected i.p. into mice to immunize them against subsequent tumor challenge. A/J, A/St and C57BL/10Sn mice rejected TA3-St or TA3-Ha tumor challenges of from ten to 100 times the TD₅₀ for these tumors following repeated immunization with 10⁸ or 10⁷ irradiated tumor cells. TA3 tumor resistance was achieved in ICR mice by engrafting them with strain A mouse skin. Following rejection of the skin grafts, ICR mice were resistant to TA3-Ha challenge. Endotoxin, injected into C57BL/10Sn mice before TA3-Ha challenge, resulted in three of ten mice developing tumors; all of ten mice given TA3-Ha cells but not endotoxin developed tumors. A/St mice were protected against TA3-St cells when simultaneously injected with spleen cells from syngeneic TA3-St tumor-bearing mice. However, ascites fluid from spleen cell donors promoted TA3-Ha growth.

- 5304 CYTOTOXIC ANTIBODY IN NORMAL HUMAN SERUMS REACTIVE WITH TUMOR CELLS FROM ACUTE LYMPHOCYTIC LEUKEMIA. (E.) Bias, W. B. (Johns Hopkins U. Sch. Med., Baltimore, Md.), G. W. Santos, P. J. Burke, G. M. Mullins and R. L. Humphrey. *Science* 178(4058):304-306, 1972.

Complement-dependent cytotoxic sera specific for acute lymphoblastic leukemia cells were found in three normal unimmunized subjects. The sera were reactive with tumor cells from 514 (514 tested) acute lymphocytic leukemia patients, and three of 12 patients with acute myelocytic leukemia; they did not react with cells from two patients with acute monocytic leukemia, two patients with chronic lymphocytic leukemia, or two patients with

leukolymphosarcoma. The sera were also negative with normal lymphocytes from 52 different donors, lymphocytes from four acute lymphocytic leukemia patients in remission, and lymphocytes from a patient with Hodgkin's disease. Absorption studies suggested that the cytotoxic activity of the sera could be removed by incubation with leukemia cells but not by incubation with remission leukocytes.

- 5305 AN ANTIGEN IN HUMAN BREAST CANCER SERA RELATED TO THE MURINE MAMMARY TUMOUR VIRUS. (E.) Muller, M. (Inst. Path., Dresden, East Germany) and H. Grossmann. *Nature New Biol* 237:116-117, 1972.

Thirty-six sera from women with mammary carcinoma were reacted in micro-double-diffusion tests with three highly specific rabbit hyperimmune sera against the mammary tumor virus (MTV). Ten of 36 sera reacted with each of the three anti-MTV sera, whereas 35 sera from donors without mammary carcinoma failed to react with the anti-MTV sera. The factor detected in ten human breast cancer sera appeared to share common antigenicity with a constituent of the outer MTV-particle coat.

- 5306 THE FORMALINIZATION OF ANTIBODY TO TUMOR CELLS IN ALTERING THE IMMUNE RESPONSE. (E.) Ungaro, P. C. (Nat'l. Cancer Inst., Bethesda, Md.), W. P. Drake and M. R. Mardiney, Jr. *Cancer Res* 32(10):2241-2247, 1972.

EL-4 lymphoma cells from C57BL/6 mice were exposed to anti-C57BL/6 spleen cell sera or to anti-EL-4 sera from rabbits; formalin was added to mixtures to fix serum antibodies to lymphoma or spleen cell membranes. Formalin fixation of antibodies did not lead to nonspecific binding of antibody to the cell surface, nor did it alter the specificity or strength of immunofluorescence reactions of various antisera with formalinized cells. The amount of elution of radiolabeled antibody from formalinized EL-4 cells was observed. The proportion of total radiolabel that eluted from formalinized tumor cells was much greater than the proportion that eluted from cells that did not have antibody fixed to the membrane. In related experiments, rabbits were immunized with formalin-fixed EL-4 or C57BL/6 spleen cells and their sera were examined for cytotoxicity for EL-4 or spleen cells. Sera from rabbits immunized with formalin-fixed cells had relatively high titers of cytotoxic activity to EL-4 cells and C57BL/6 spleen cells. Sera from rabbits immunized with formalinized EL-4 or C57BL/6 spleen cells which had been preincubated with anti-C57BL/6 spleen antibody had a markedly reduced titer against EL-4 and C57BL/6 cells.

- 5307 REJECTION OF ASCITES TUMOR ALLOGRAFTS: I. ISOLATION, CHARACTERIZATION, AND *IN VITRO* REACTIVITY OF PERITONEAL LYMPHOID EFFECTOR CELLS FROM BALB/c MICE IMMUNE TO EL4 LEUKOSIS. (E.) Berke, G.

(5308-5312)

(Duke U. Med. Ctr., Durham, N.C.), K. A. Sullivan and B. Amos. *J Exp Med* 135(6):1334-1350, 1972.

BALB/c mice were inoculated i.p. or s.c. with EL-4 mouse leukemia cells. Ten days later, cells were harvested from thymus, lymph nodes, Peyer's patches, spleen, blood and peritoneal cavity, and tested for their cytolytic effect on ^{51}Cr -labeled EL-4 target cells *in vitro*. In mice given EL-4 i.p., peritoneal exudate cells (PEC) were much more cytolytic than the cells from other sites; however, in mice given EL-4 cells s.c., PEC were relatively inactive against target cells, and spleen and blood cells were most active. Most cytolytic activity of PEC cells resided in nonadherent as opposed to adherent cells; and most of the active nonadherent cells were lymphocytes rather than macrophages. Trypsin treatment of PEC cells temporarily abolished the cytolytic activity of the cells.

5308 KARYOTYPIC, VIROLOGIC, AND IMMUNOLOGIC ANALYSES OF TWO CONTINUOUS LYMPHOCYTIC LINES ESTABLISHED FROM NEW ZEALAND BLACK MICE: POSSIBLE RELATIONSHIP OF CHROMOSOMAL MOSAICISM TO AUTOIMMUNITY. (E.) Lerner, R. A. (Scripps Clin. Res. Fdn., La Jolla, Calif.), F. Jensen, S. J. Kennel, F. J. Dixon, G. Des Roches and U. Francke. *Proc Nat Acad Sci USA* 69(10):2965-2969, 1972.

Two lymphoid cell lines derived from a spontaneous NZB mouse fibrosarcoma and from an NZB spleen, resp., were examined. Fibrosarcoma-derived cells (SCRF60_A) produced budding C-type virus particles with buoyant densities of $1.16 \text{ g} \times \text{cm}^{-3}$. These particles exhibited 70S viral RNA, and RNA-dependent DNA polymerase. The virus from SCRF60_A cells infected NRK, NZB embryo, (NZB x NZW)_{F1} embryo, (NZW x NZW)_{F1} embryo, and BALB/c 3T3 cells, but did not infect NIH Swiss cells. The θ antigen was present on surfaces of spleen-derived cells, but was not seen on tumor-derived cells. Both cell lines showed chromosomal abnormalities, including an extra telocentric.

5309 SUSCEPTIBILITY AND RESISTANCE TO VIRAL LEUKEMOGENESIS IN THE MOUSE: IV. MECHANISMS OF HOST RESISTANCE TO LEUKEMIA EXPRESSION. (E.) Tennant, J. R. (Sloan-Kettering Inst., New York, N.Y.). *J Nat Cancer Inst* 49(5):1257-1267, 1972.

C57BR/cd mice were injected i.p. with 0.2 ml of B/T-L or BR-Bc mouse leukemia virus when one to four days old and challenged one to five months later with 10^3 cells of a transplantable C57BR/cd leukemia. Infant C57BR/cd mice were very susceptible to leukemia induction by BR-Bc virus. At six wk of age, only 6% of virus-inoculated mice rejected tumor cell transplants. By five months of age 34% of mice inoculated as infants with BR-Bc virus rejected tumor cell transplants. In contrast, infant mice resisted leukemia induction by B/T-L virus. By four wk of age, 50% of B/T-L-inoculated mice resisted tumor transplants and by five months, 95% rejected transplants. When mice were inoculated with BR-Bc virus as adults, there was moderate

resistance to viral leukemia induction; 90% of these mice rejected transplants four wk after virus inoculation. Adult mice were totally resistant to induction of leukemia by B/T-L virus, though only 12% of B/T-L-treated mice resisted tumor transplants.

5310 *IN VIVO* STUDIES OF THE ROLE OF CYTOTOXIC T CELLS IN TUMOR ALLOGRAFT IMMUNITY. (E.)

Freedman, L. B. (Swiss Inst. Exp. Cancer Res., Lausanne), J.-C. Cerottini and K. T. Brunner. *J Immunol* 109(6):1371-1378, 1972.

Intraperitoneal growth of (DBA/2) P-815 mastocytoma cells in heavily irradiated (800 and 950 R) C3H male and female mice was prevented for at least 21 days by i.v. or i.p. injection of syngenic immune, but not normal, spleen cells. Tumor growth was also inhibited in mice receiving a pure population of immune thymus-derived (T) cells which were free of bone marrow-derived (B) lymphocytes and allo-antibody-forming cells. No protection was achieved with transfer of immune B cells (i.e., immune spleen cells treated with anti- θ serum and C). Intravenous injection of immune T cells also prevented s.c. growth of P-815 cells in heavily irradiated C57BL/6 mice. It was concluded that immune T cells played a primary role in the rejection of allogenic tumor cells in heavily irradiated C3H and C57BL/6 mice.

5311 ANTI-HUMAN IMMUNOGLOBULIN G ACTIVITY OF MEMBRANE-BOUND MONOCLONAL IMMUNOGLOBULIN M IN LYMPHOPROLIFERATIVE DISORDERS. (E.) Preud'homme, J. L. (Hosp. St.-Louis, Paris, France) and M. Seligmann. *Proc Nat Acad Sci USA* 69(8):2132-2135, 1972.

Lymphocytes from blood and bone marrow of Waldenström's macroglobulinemia patients and from blood of chronic lymphocytic leukemia patients were reacted with antisera to the five immunoglobulin polypeptide chains (μ , γ , α , κ , or λ) and studied by membrane immunofluorescence. Freshly drawn lymphocytes showed membranes positive for γ , κ , γ and μ chain determinants; all four determinants being present on single cells. Surface immunoglobulins were redistributed by antibody treatment or by trypsinization of cells, after which the presence of a newly synthesized monoclonal IgM immunoglobulin was observed. This IgM had features of an antibody to human IgG. It specifically bound normal human IgG molecules devoid of aggregated material. IgG molecules could be removed from cell surfaces by lowering the pH.

5312 QUANTITATION OF *IN VIVO* GROWTH OF PLASMA-CYTOMA X5563 BY IMMUNOASSAY FOR ITS PARAPROTEIN WITH INDIVIDUAL ANTIGENIC SPECIFICITY. (E.) Yutoku, M. (Osaka U. Med. Sch., Japan), H. Senoh, S. Watanabe, Y. Matsuoka and M. Kitagawa. *J Nat Cancer Inst* 49(5):1395-1402, 1972.

An experimental tumor model system was designed to

follow quantitatively the *in vivo* fate of tumor cells. A transplantable plasmacytoma, X5563 of the C3H/He mouse, was inoculated s.c., i.p., or i.v. into syngeneic C3H/He mice and allogeneic C57BL and ddO mice. The serum concentration of the paraprotein γG_{2a} , produced by X5563 cells, was quantitated by an immunoassay with the use of antiserum against the individual specific determinant(s) of X5563 γG_{2a} . The level of the X5563 γG_{2a} in serum of C3H mice receiving s.c. the X5563 cells increased progressively as the tumor grew and correlated well with the increase in tumor diameter. The X5563 γG_{2a} level in serum of allogeneic mice increased only temporarily and then decreased; it also correlated with the growth and regression of tumors, as assessed by the diameters of the tumors. Thus, the fate of tumor cells *in vivo* can be assessed by the estimation of the level of X5563 γG_{2a} in serum. This method revealed that the growth of X5563 inoculated i.v. was markedly suppressed, even in the syngeneic C3H mice (temporarily early after inoculation) and completely and permanently suppressed in the allogeneic ddO mice. This assay system may be valuable for the study of such problems as metastases, tumor immunity, and carcinostatic agents.

- 5313 EFFECTS OF INFANT THYMECTOMY AND ANTILYMPHOCYTE SERUM ON XENOTRANSPLANTATION OF A HUMAN LEUKEMIA IN THE HAMSTER. (E.) Mark, L. P. (Harvard Med. Sch., Boston, Mass.) and R. A. Adams. *Cancer Res* 32(7):1580-1583, 1972.

The effects of antilymphocyte serum (ALS) (0.05 ml i.p.) and neonatal thymectomy on the transplantability of a human leukemia (H-HM-1 tumor) were studied in hamsters of varying ages. Unthymectomized hamsters received one of three ALS regimes: ALS at time of tumor inoculation, ALS at birth, or ALS at birth and again at time of tumor inoculation. Thymectomized hamsters received no ALS, ALS at time of tumor inoculation, or ALS on day of thymectomy and on day of tumor inoculation. Multiple doses of ALS prolonged the period of susceptibility to tumor implantation as compared with a single dose at time of tumor inoculation. Neonatal thymectomy did not substitute for ALS administration, but a combined program of thymectomy and multiple ALS treatment greatly depressed host resistance to the tumor xenograft, allowing successful transplantation as late as 20 days after birth. These results suggest that a thymic-dependent immune mechanism is involved in the rejection of a human tumor xenograft by hamsters.

- 5314 STRUCTURAL DIFFERENCES IN MOUSE IgA MYELOMA PROTEINS OF DIFFERENT ALLOTYPES. (E.) Warner, N. L. (Hall Inst. Med. Res., Melbourne, Australia) and J. J. Marchalonis. *J Immunol* 109(4):657-661, 1972.

Sera from BALB/c, NZB and (BALB/c x NZB) F_1 mice bearing plasma cell tumors were subjected to starch block gel electrophoresis or DEAE chromatography to purify IgA myeloma proteins. The proteins were

examined electrophoretically for the presence of L-H disulfide bonds. No disulfide bonds were detected in IgA proteins from three BALB/c mice; however, IgA proteins from each of three NZB mice and from five of ten hybrid mice contained L-H disulfide bonds. IgA proteins were also tested for reactions in the Ig-2^e allotype antigen-specific assay. All BALB/c proteins failed to react, while all NZB proteins and five of ten hybrid proteins did react. The reactive proteins from hybrid mice were the same proteins that showed no dissociation in tests for L-H disulfide bonds.

- 5315 SYNERGISTIC INHIBITION OF MAMMARY CARCINOMA TRANSPLANTS IN A-STRAIN MICE BY ANTI-TUMOUR GLOBULIN AND *C. PARVUM*. (E.) Woodruff, M. F. A. (Dept. Surg., U. Edinburgh, Scotland) and M. P. Inchley. *Br J Cancer* 25(3):584-593, 1971.

Female A/HeJ mice were injected s.c., i.v. or i.p. with *C. parvum* two days before receiving an s.c. intrastrain transplant of mouse mammary carcinoma cells. Tumor growth was inhibited to a moderate extent by i.v. injection of *C. parvum*. Intra-peritoneal injection gave similar results but s.c. injection was less effective. Incubation of tumor cells with antitumor globulin (ATG) prepared from rabbits immunized with tumor cells appeared to facilitate tumor growth in mice not pretreated with *C. parvum*. However, incubation of tumor cells with ATG potentiated the tumor-inhibiting effect of *C. parvum* in treated mice. By 60 days after transplantation, tumors in mice given tumor cells preincubated with ATG, but not given *C. parvum*, had a mean diameter of 11 mm, while tumors in mice given ATG-treated cells and pretreated with *C. parvum* had mean tumor diameters of 6 mm. The synergistic effect of ATG and *C. parvum* is discussed in relation to phagocytic activity in A/HeJ mice.

- 5316 TUMORIGENESIS IN STRAIN DW/J MICE AND INDUCTION BY PROLACTIN OF THE GROUP-SPECIFIC ANTIGEN OF ENDOGENOUS C-TYPE RNA TUMOR VIRUS. (E.) Chen, H. W. (Jackson Lab., Bar Harbor, Me.), H. Meier, H.-J. Heiniger and R. J. Huebner. *J Nat Cancer Inst* 49(4):1131-1137, 1972.

The dwarf mutation (gene symbol *dw*), maintained in the inbred strain DW/J, causes primary anterior pituitary endocrine defects. These defects were remedied by prolactin, which reversed growth retardation and organ hypoplasia or atrophy, stimulated RNA and protein synthesis, and also induced the intraspecies group-specific antigen (gs-AG) of endogenous C-type RNA tumor virus. No tumors were observed in dwarf mice. In young normal littermates, prolactin caused precocious appearance of gs-AG. Thus prolactin increased expression of genetic information, including viral gs-AG. Both mesenchymal and epithelial tumors occurred in DW/J heterozygotes (*dw*/+) and homozygous normal (+/+) mice. The development of two types of tumors in six mice indicated separate and possibly independent events of malignant transformation. Normal mice of either genotype had a high incidence (85%) of gs-AG expres-

(5317-5321)

sion, which increased with age. The closely associated development of reticulum cell sarcomas and gs-AG in these mice indicated an etiologic relationship.

- 5317 MEASUREMENT OF THE ANTITUMORAL IMMUNE REACTIONS AGAINST A STRAIN-SPECIFIC CHEMICALLY-INDUCED SARCOMA IN SYNGENEIC AND F₁ HYBRID MICE. (E.) Oth, D. (INSERM, Vandoeuvre, France), M. Donner and C. Burg. *Eur J Cancer* 7(5):479-482, 1972.

Swiss/B mice and (Swiss/B x C3H/He)F₁ hybrids were immunodepressed by exposure to whole body irradiation (500 rads); other mice were specifically immunized against the dibenzanthracene-induced rhabdomyosarcoma TP10, a tumor which is specific to Swiss/B mice. Transplantability of TP10 challenge grafts in immunodepressed, specifically immunized, and untreated Swiss/B and hybrid mice was observed. Percentages of tumor takes in immunodepressed and immunized Swiss/B mice were not significantly different from percentages of takes in untreated Swiss/B mice. In hybrid mice, however, immunodepression markedly enhanced tumor transplantability, while specific immunization markedly diminished it. Similar differences between Swiss/B and hybrid mice were seen when mean survival time of tumor-bearing mice was observed.

- 5318 UMBILICO-PLACENTAL ANTIGENS AND MALIGNANT NEOPLASMS. (E.) Mori, W. (Tokyo Med. Dent. U., Japan) and H. Asakawa. *Bull Tokyo Med Dent Univ* 18(4):281-293, 1971.

Rabbits were inoculated with homogenates of human placental or umbilical cord tissue to obtain anti-placental and anti-umbilical cord tissue antisera. Antigen-antibody reactions between the anti-placental antiserum and sera from 576 patients with various diseases were observed using the micro-Ouchterlony method. A relatively high incidence of positive reactions was noted with cases of malignant tumors (57.5%), leukemia (63.65%), myocardial infarction (41.2%) and hepato-biliary diseases (43.3%). Among the malignant tumors tested, multiple myeloma and malignant lymphoma showed an extremely high incidence of positive reactions. Other neoplasms with a high incidence of positive reactions were tumors of the stomach, colon, liver and pancreas. In general, sera from patients with advanced malignant tumors showed positive reactions more frequently than sera from patients in the early stage of cancer. The active factor was located in the β -area by immunoelectrophoresis. Antigen analysis using a double diffusion method on agar plate showed a similarity between umbilical cord and placental tissue extracts.

- 5319 SMOOTH MUSCLE ANTIBODY IN MALIGNANT DISEASE. (E.) Whitehouse, J. M. A. (Chester Beatty Res. Inst., Sutton, England), E. J. Holborow, G. H. Fairley and P. Alexander. *Novu Rev Fran Hemato* 12(3):383-386, 1972.

Indirect immunofluorescence was used to detect smooth

muscle autoantibody (SMA) and anti-nuclear factor (ANF) in serum of 113 patients with malignant disease and in 46 healthy controls. Malignant patients included cases of malignant melanoma, neuroblastoma, and bronchial, mammary and ovarian carcinoma. Sixty-eight percent of these patients had SMA-positive sera, while 20% of healthy subjects' sera were SMA-positive. SMA occurred at higher titers in cancer patients' sera than in normal sera. ANF was found in 27% of cancer patients and in one of the 46 healthy controls. A new IgG antibody was seen in seven cases (six from cancer patients and one from a normal subject); this agent stained liver in a pattern similar to that produced by SMA.

- 5320 FURTHER PURIFICATION OF PERCHLORATE-SOLUBLE ANTIGENS FROM HUMAN COLONIC CARCINOMATA. (E.) Turner, M. D. (U. Rochester Sch. Med. Dent. N.Y.), T. A. Olivares, L. Harwell and M. S. Kleinman. *J Immunol* 108(5):1328-1339, 1972.

Carcinoembryonic antigen (CEA) was isolated from human colonic carcinoma by perchloric acid extraction and its structure and determinants were studied. Radioiodine-labeled CEA (¹²⁵ICEA) behaved like a homogenous substance in G-200 Sephadex gel filtration, electrofocusing, and sucrose gradient centrifugation. On cesium chloride density gradient ultracentrifugation, however, ¹²⁵ICEA showed three components with densities of 1.47 (UCP-1), 1.42 (UCP-2) and 1.28 (UCP-3), resp. UCP-2 appeared to represent purified CEA; it reacted vigorously with absorbed goat and rabbit anti-CEA sera in precipitation tests. UCP-1 reacted, though not so vigorously as UCP-2, with rabbit and goat anti-CEA sera and with human anti-A blood group antiserum. UCP-2 reacted only weakly with human anti-A. The precipitation of UCP-1 and UCP-2 by human anti-A serum was almost completely abolished by microgram quantities of mixed A and B blood substances. The A and B substances had no effect on the precipitation of UCP-2 by goat or rabbit anti-CEA anti-serum, but they markedly inhibited precipitation of UCP-1 by both these sera.

- 5321 THE TUMOR IMPRINT TECHNIQUE FOR DEMONSTRATING SV40 T ANTIGEN BY IMMUNOFLUORESCENCE. (E.) Diamandopoulos, G. T. (Harvard Med. Sch., Boston, Mass.) and M.-F. McLane. *Proc Soc Exp Biol Med* 141(1):62-66, 1972.

The tumor imprint technique has been adapted to the indirect immunofluorescence test for SV40 tumor (T) antigen in tumor tissues. Leukemia, lymphosarcoma, reticulum cell sarcoma and other tumors produced in hamsters by SV40 inoculation were excised and imprinted by applying the cut surface of the tumor to a cover glass. Indirect immunofluorescence tests were performed on these imprints using sera from hamsters bearing tumors known to contain SV40 T antigen. T antigen could be demonstrated readily in imprints from tumors and in imprints from lymph nodes and other organs. The advantages of this method of

demonstrating SV40 T antigen include the preservation of cytoplasmic and nuclear features of tumor cells and the preservation of *in vivo* spatial relationships between tumor cells and normal cells. The new tumor imprint T antigen test also obviates the necessity of culturing cells to be tested; this test is feasible even when it is impossible to culture SV40-transformed cells.

- 5322 IMMUNODEPRESSIVE EFFECT OF GRAFFI LEUKEMIA VIRUS. (Rus.) Ancheva, M. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow). *Vopr Virusol* 16(6):661-665, 1971.

The effects of Graffi leukemia virus on cellular and humoral immunological responses were studied in mice. Newborn BALB/c mice received s.c. injections of 0.2 ml 10% extracellular spleen extract from mice of the same line infected with Graffi leukemia. Four-week old mice received i.p. infusions of $2-3 \times 10^7$ leukemia cells. These mice were immunized with sheep 2×10^8 erythrocytes given i.p. at intervals after infection. The antibodies to sheep erythrocytes (19S- and 7S-hemagglutinins) were determined 4, 7, and 10 days postimmunization. The antibody-forming cells were determined by the Gerne and Nordin method. Graffi leukemia virus showed immunodepressive effects in these mice. In control mice, the antibody-forming cells ($652/10^6$ cells) and antibody titers (6.5) were maximal on the 4th day after immunization, while they were suppressed in leukemia-infected mice ($6/10^6$ cells and 1.4, resp.). The antibody-forming cells of the infected mice were 1% of those of the control animals. Thus, Graffi leukemia virus suppresses cellular and humoral immunity.

- 5323 A FETAL ANTIGEN ASSOCIATED WITH HUMAN NEOPLASIA. (E.) Edynak, E. M. (Sloan-Kettering Inst., New York, N.Y.), L. J. Old, M. Vrana and M. P. Lardis. *New Engl J Med* 286(22): 1178-1183, 1972.

Serum from patients with malignant and nonmalignant diseases was reacted in micro-Ouchterlony immunodiffusion tests with tissue antigens prepared from the same group of subjects. The serum of eight of 1518 cancer patients contained precipitating antibody defining a new antigen associated with human neoplasia. Named γ -fetoprotein (FP) because of its electrophoretic mobility and its occurrence in the serum and tissues of the normal fetus, the antigen was present 169 of 225 benign and malignant tumors, the serum of 23 of 210 cancer patients tested and two of 101 nonneoplastic human tissues. It was not present in any normal human tissue or in adult human serum. In immunoelectrophoresis tests, γ -FP showed a mobility similar to that of human fetal serum and fetal calf serum, and also to those of rectal, breast and osteogenic malignant tumors.

- 5324 INFLUENCE OF NEONATAL THYMECTOMY UPON THE CELL-MEDIATED TUMOR-SPECIFIC IMMUNITY

IN ROUS SARCOMA VIRUS TUMORIGENESIS IN RATS. (E.) Borum, K. (Inst. Path., U. Lund, Sweden) and N. Jonsson. *Cellular Immunol* 3:22-32, 1972.

Rats were thymectomized within 24 hr after birth. At four wk, some thymectomized and unthymectomized rats were inoculated with Schmidt-Ruppin Rous sarcoma virus (SR-RSV) preparation. The production of thoracic duct lymphocytes (TDL) and the yield of lymph node cells (LNC) were observed in these rats; the colony-inhibiting activity (CI) of TDL and LNC from rats was also observed. Thymectomy markedly reduced TDL output in rats without SR-RSV-induced sarcomas and in rats with small sarcomas; TDL output was not as affected in unthymectomized rats and in thymectomized rats with small sarcomas. LNC yield was not significantly changed by thymectomy. In rats without SR-RSV-induced lesions, TDL from thymectomized and unthymectomized rats had similar CI ability. However, thymectomy reduced CI ability of TDL from rats with large sarcomas (four of nine thymectomized rats showed a CI effect) relative to the CI ability of unthymectomized rats with large sarcomas (11 of 13 unthymectomized rats showed a CI effect).

- 5325 ACUTE LEUKEMIA IN IDENTICAL TWINS: SEARCH FOR VIRAL AND LEUKEMIA-ASSOCIATED ANTIGENS. (E.) Levine, P. H. (Nat'l. Cancer Inst., Bethesda, Md.), R. B. Herberman, E. B. Rosenberg, P. D. McClure, A. Roland, R. J. Pienta and R. C. Y. Ting. *J Nat Cancer Inst* 49(4):943-945, 1972.

Ten sets of identical twins, one member of each pair having leukemia, were studied for the presence of leukemia-associated antigens. All patients except one were less than 16 yr old at diagnosis. Three immunologic tests, lymphocyte cytotoxicity, skin tests for delayed hypersensitivity, and immunofluorescence studies were performed. Susceptibility of skin fibroblasts to transformation by simian virus 40 was measured as a possible indicator of genetic predisposition to development of leukemia. In seven families, lymphocytes from family members and unrelated controls were cytotoxic for cells from the leukemic twin but not for cells from the normal twin. Delayed hypersensitivity reactions were elicited by extracts of patients' leukemic cells but not by extracts of remission cells or the normal twins' cells.

- 5326 BEHAVIOR OF IMMUNOGLOBULINS IN MALIGNANT LYMPHOGRANULOMATOSIS AND THYMOMA. (E.) Kraj, M. (Inst. Hematol., Warsaw, Poland) and S. Ciesluk. *Arch Immunol Therap Exp (Warsz)* 20:235-241, 1972.

Immunoglobulin levels were determined in blood sera from 36 patients with malignant lymphogranulomatosis and in one patient with thymoma. Mean γ -fraction levels in lymphogranulomatosis patients were lower than in normals, but the difference barely achieved statistical significance. Mean IgG levels in lymphogranulomatosis patients were elevated relative to normal values (14.5 ± 5 mg/ml for patients and 11.8

(5327-5331)

± 2.48 mg/ml for normals). Mean IgA values for lymphogranulomatosis patients were within normal limits. IgM levels were reduced in 50% of patients, though the mean IgM level for patients was normal. Hypogammaglobulinemia was seen in four cases. In one case, low serum IgG and IgM values were associated with deposits of IgG and IgM at the dermoepidermal boundary. In another case, proliferation of hemacytoblasts and young reticulum cells was seen in bone marrow. The thymoma patient showed low γ -fraction values before removal of the tumor. After thymectomy, γ -fraction values continued to be depressed, as did levels of the three immunoglobulins. After splenectomy, all three immunoglobulins began to increase.

5327 CARCINOEMBRYONIC ANTIGEN: SYNTHESIS BY A CONTINUOUS LINE OF ADENOCARCINOMA CELLS.

(E.) Egan, M. L. (City Hope Natl. Med. Ctr., Duarte, Calif.) and C. W. Todd. *J Nat Cancer Inst* 49(3):887-889, 1972.

Human colonic adenocarcinoma cells were incubated for two wk to three months. After incubation, cells were treated with perchloric acid (PCA) and assayed for carcinoembryonic antigen (CEA). The culture medium of the carcinoma cells contained 17 ng/ml CEA activity after seven days of culture and 300 ng/ml after 29 days. Tenfold more CEA was found in culture medium supernatants treated with 1.25 M $(\text{NH}_4)_2\text{SO}_4$ than in carcinoma cell PCA precipitates. The CEA active material in culture fluids was a molecule which was stable in 1 M PCA and soluble in 1.25 M $(\text{NH}_4)_2\text{SO}_4$. This material eluted from a G200 column in the position as CEA extracted from tumor cells. Other tumor cell lines, including a laryngeal epidermoid carcinoma and a mesothelioma, were CEA-negative; a cervical adenocarcinoma cell line was CEA-positive.

5328 SEPARATION OF TWO DISTINCT TUMOR-ASSOCIATED ANTIBODIES IN THE SERUM OF MELANOMA PATIENTS.

(E.) Lewis, M. G. (Dept. Path., Memorial U. Newfoundland, St. John's, Canada) and T. M. Phillips. *J Nat Cancer Inst* 49(3):915-917, 1972.

Cytoplasmic and surface membrane reactions in human malignant melanoma were studied by cross-absorption, immunofluorescence and immunodiffusion techniques. Two different melanoma cell suspensions and their autologous positive sera were used to separate antibodies in the sera so that the common antibody against cytoplasmic contents was absorbed out, thus leaving a patient-specific antibody directed against the individual cell membrane. The results confirm the relative specificity of the antibody/antigen reaction in human malignant melanoma and offer a method for study of the relationship between the two antibodies and circulating antigen during the development of melanoma.

5329 THE SV40 S ANTIGEN: A CARCINOEMBRYONIC-TYPE ANTIGEN OF THE HAMSTER? (E.) Berman,

L. D. (Boston City Hosp., Mass.). *Int J Cancer* 10(2):326-30, 1972.

Further evidence is presented that the membrane-associated S antigen, originally demonstrated in tumor-bearing hamsters, is not identical to the SV40 T antigen. Indirect membrane fluorescent antibody tests revealed that, in addition to SV40-induced hamster tumor and SV40-transformed hamster embryo and thyroid cells, a variety of non-SV40-exposed hamster cell lines were also positive for S antigen. The reactive cells included transformed lines induced by heterologous DNA (adenovirus) and RNA (Murine Sarcoma) viruses, as well as four different lines of BHK 21 cells and a line of hamster embryo cells that were never exposed to virus. Anti-S antiserum titrated equally well on both the nonvirus-exposed BHK and the SV40-induced tumor cells. Absorption of anti-S antiserum to BHK, hamster tumor or hamster embryo cells significantly reduced activity to the hamster tumor cells. No S antigen was detected in cells from full-term embryos, newborn or adult hamsters or in SV40- or adenovirus-transformed mouse embryo cells.

5330 SERUM-MEDIATED BLOCKING OF CELL-MEDIATED ANTI-TUMOR IMMUNITY IN A MELANOMA PATIENT: ASSOCIATION WITH BCG IMMUNOTHERAPY AND CLINICAL DETERIORATION. (E.) N. L. Levy, (Duke U. Med. Ctr., Durham, N.C.), M. S. Mahaley, Jr. and E. D. Day.

Int J Cancer 10(2):244-248, 1972.

Evidence is presented for a close temporal association of BCG inoculation, the appearance of a blocking factor and the accelerated deterioration of a 66-year-old male patient with melanoma. Microcytotoxicity tests showed that on two occasions prior to BCG injection, the patient's lymphocytes were significantly cytotoxic to his tumor cells but not to autogenous or allogenic fibroblasts. The patient's serum showed no ability to block the *in vitro* cytotoxic effects of his lymphocytes. Three wk after BCG administration, the patient's lymphocytes were still cytotoxic, but his serum completely blocked their *in vitro* tumoricidal effects. Although this single case does not warrant the discontinuance of BCG therapy, its future use should be carefully monitored by adequate *in vitro* procedures.

5331 PREVALENCE OF THE GROUP-SPECIFIC (gs) ANTIGEN AND INFECTIOUS VIRUS EXPRESSIONS

OF THE MURINE C-TYPE RNA VIRUSES DURING THE LIFE SPAN OF BALB/cCr MICE. (E.) Peters, R. L. (Microbiol. Assoc., Inc., Walkersville, Md.), J. W. Hartley, G. J. Spahn, L. S. Rabstein, C. E. Whitmire, H. C. Turner and R. J. Huebner. *Int J Cancer* 10(2):283-289, 1972.

Incidences of C-type RNA tumor-virus gs antigen and infectious virion expression were determined, by complement fixation and CoMuL tests, resp., in BALB/cCr mice at various stages throughout their life span. The incidence of gs antigen was low (2.5%) in mice younger than six months, but increased progressively thereafter to 71% in mice

older than 24 months. The incidence of infectious virus isolated on mouse embryo cell cultures showed a similar pattern, being low (10%) in mice prior to six months and rising rapidly thereafter to a relatively stable value of 46-62% which was maintained for the rest of the lifetime. Eighteen of 19 isolations made prior to one yr were made on NIH Swiss mouse embryo cells as opposed to BALB/c mouse embryo cells. The number of isolations on BALB/c cells increased in older mice but did not overtake those made on NIH Swiss mice cells until after 24 months of age. Isolations from the spleens of malignant tumor-bearing mice were slightly more frequent than those from spleens of normal or benign tumor-bearing mice.

- 5332 EMBRYONIC ANTIGEN EXPRESSION IN CHEMICALLY INDUCED RAT HEPATOMAS AND SARCOMAS. (E.) Baldwin, R. W. (Cancer Res. Campaign Labs., U. Nottingham, England), P. Graves and B. M. Vose. *Int J Cancer* 10(2):233-243, 1972.

Indirect membrane immunofluorescence tests using sera from multiparous rats were employed to detect embryo-specific antigens on the surface of three 4-dimethylaminoazobenzene-induced rat hepatomas and two of four 3-methylcholanthrene-induced rat sarcomas. Sera from age-matched control virgin rats were nonreactive. These results were confirmed by tests in which the sera from multiparous rats showed complement dependent cytotoxicity for plated target tumor cells. Lymph node cells from multiparous rats also exhibited cytotoxicity when compared with the effects of cells from the virgin controls. These embryonic antigens could be demonstrated on embryonic cells but not on cultured normal adult rat liver cells or lung fibroblasts. The tumor-associated embryonic antigens were common to both hepatomas and sarcomas. Thus, they differ from the individually distinct tumor antigens responsible for eliciting specific immunologic responses in hosts.

- 5333 ON THE NATURE OF THE SV40 VIRAL ANTIGEN INDUCED IN BSC₁ TRANSFORMED CELLS: BRIEF REPORT. (E.) Margalith, M. (Hebrew U.-Hadassah Med. Sch., Jerusalem, Israel), E. Margalith and G. Spira. *Arch Gesamte Virusforsch* 36:398-400, 1972.

Monkey anti-SV40 serum fractionated by two methods was used in direct immunofluorescence on BSC₁ cells infected with SV40 and on BSC₁ transformed cells heated to 45 C for 30 min to induce synthesis of SV40 viral antigen. After filtration of the serum through Sephadex G 25, the γ -globulin fraction used for immunofluorescence was obtained by fractionation of serum on DEAE cellulose at pH 7.2 or by fractionation of dialyzed serum on DEAE cellulose at pH 9.6-7.2. Only the fraction obtained at pH 9.6 showed fluorescence in infected but not in transformed heat-treated cells. In infected cells there was no difference in the percentage of cells stained with anti-SV40 serum fractionated by the two methods; a marked difference was evident in the percentage of stained transformed

cells. These findings indicate that two types of antibody are presented in monkey anti-SV40 serum. The fraction obtained at pH 9.6 reacts with the viral antigen synthesized during the productive cycle of SV40 virus but not with the antigen induced by heating of the transformed cells. The fraction obtained at pH 7.2 reacts with both the viral antigen synthesized during the productive cycle and that induced by heating of the transformed cells.

- 5334 CIRCULATING LEVELS OF IMMUNOGLOBULIN E IN PATIENTS WITH CANCER. (E.) Jacobs, D. (Benenden Chest Hosp., Kent, England), M. Hourfi, J. Landon and T. G. Merrett. *Lancet* 2(7786):1059-1061, 1972.

Sera were collected from 100 healthy subjects, from 200 untreated cancer patients, from 200 cancer patients given cyclophosphamide, and from 50 allergy patients. Half the treated cancer patients had bronchial carcinoma; the others had myeloma, prostate cancer, mammary cancer, etc. A solid-phase radioimmunoassay and a radial immunodiffusion test were used to quantitate IgE immunoglobulin in these patients. Mean IgE levels determined by radioimmunoassay were 215 U/ml serum for normals, 1060 U/ml for allergic patients, and 125 U/ml for treated cancer patients. Half the untreated cancer group had mean IgE levels of > 100,000 U/ml, the other half had very low IgE values. Results of radial immunodiffusion studies were in agreement with results of the radioimmunoassay for IgE in all groups except untreated cancer patients. These patients had almost undetectable IgE values using the radial immunodiffusion technique. Additional studies indicated that the high IgE values observed in untreated cancer patients by radioimmunoassay were an artefact due to the presence of a circulating inhibitor.

- 5335 α -FOETOPROTEIN IN RATS WITH HEPATOMAS INDUCED BY AFLATOXIN B₁. (E.) Kroes, R. M. (Natl. Cancer Inst., Bethesda, Md.), J. M. Sontag, J. H. Weisburger, P. M. Newberne and G. N. Wogan. *Nature* 240(5378):240-241, 1972.

Male rats were given aflatoxin B₁ in diet (100 parts/10⁹, group 1) or by gavage (1 mg total dose, group 2). Controls were given saline solution. Hepatocellular carcinomas developed in all of six rats in group 1 at 20 months, and in all of four in group 2 at 12 months. Controls developed no tumors. α -Fetoprotein was detected in sera of two group 1 rats and in sera of all four group 2 rats. This report represents the first observation of α -fetoprotein-positive sera in animals with aflatoxin B₁-induced hepatocellular carcinomas.

- 5336 LOCATION OF THE SECOND GENE REQUIRED FOR EXPRESSION OF THE LEUKEMIA-ASSOCIATED MOUSE ANTIGEN G_{1X}. (E.) Stockert, E. (Sloan-

5337-5341)

ettering Inst. Cancer Res., New York, N.Y.), H. Sato, K. Itakura, E. A. Boyse, L. J. Old and J. Hutton. *Science* 178(4063):862-863, 1972.

The location of the *Gv-2* gene locus was established in a three-point cross with *Gpi-1* (glucose phosphate isomerase) and *Hbb* (β chain of hemoglobin). *Gv-2*, along with *Gv-1*, controls G_{IX} , a cell surface antigen, found on thymocytes of some (i.e., G_{IX}^+) mouse strains and not on others. Murine leukemia virus causes G_{IX} antigen to be expressed on cells of genotypes which normally yield the G_{IX}^- phenotype, that is, on cells of mice lacking either the *Gv-1*⁺ allele or the *Gv-2*⁺ allele, or both. *Gv-1* had been located on linkage group IX, 36 U from *H-2*. *Gv-2* was located on linkage group I (chromosome 7), 33.6 \pm 5 U from *Hbb*, with the gene order: *Gpi*, *Hbb*, *Gv-2*.

5337 LEUKOCYTE ANTIGENS AND DISEASE. II. ASSOCIATION OF HL-A5 AND LYMPHOMAS. (E.) Rege, V. (Rhode Island Hosp., Providence), R. Patel and W. A. Briggs. *Am J Clin Pathol* 58(1):14-16, 1972.

Forty-three healthy persons and 42 patients with biopsy-proven lymphoma (including 20 with Hodgkin's disease) were typed for eight histocompatibility antigens in a standard lymphocyte cytotoxicity test. The two groups differed only with respect to the HL-A5 antigen. Hodgkin's disease patients and patients with other lymphomas had about twice the incidence of positive reactions with anti-HL-A5 antisera ($p < 0.05$) as did the normal controls. The association of an histocompatibility antigen with human lymphomas is analogous to the association of the H-2 mouse histocompatibility antigen with leukemia. Whether the increased susceptibility is due to a genetic factor or to a viral component as in the mouse, or to both, is unknown.

5338 GENETIC REGULATION OF THE THYMUS DEPENDENT HUMORAL IMMUNE RESPONSE IN LEUKEMIA PRONE AKR (H-2^k) AND NONLEUKEMIC C3H (H-2^k) MICE. DESCRIPTION OF GENETIC CONTROL OF THE IMMUNE RESPONSE AT THE LEVEL OF PROLIFERATION. (E.) Gottlieb, C. F. (Oak Ridge Grad. Sch. Biomed. Sci., Tenn.), E. H. Perkins and T. Makinodan. *J Immunol* 109(5):974-981, 1972.

Adult AKR and C3H mice, F₁ and F₂ offspring from matings of these strains, and AKR- and C3H-back-cross progeny were exposed to 800 R X-irradiation and inoculated i.v. with AKR spleen cells and sheep erythrocytes (SRBC). Spleen wt and plaque-forming cells (PFC) in spleen of irradiated recipients were observed on day six after inoculation. PFC responses and spleen wt values were low in AKR recipients and high in C3H recipients. PFC and spleen wt values in progeny groups fell between the AKR and C3H values. These results provide evidence that immunocompetent cell proliferation is under host gene control, and the evidence for a genetic defect in the AKR environment is consistent with a single, apparently non-H-2, autosomal gene locus.

5339 PHOSPHORYLASE: A NEW ISOZYME IN RAT HEPATIC TUMORS AND FETAL LIVER. (E.) Sato, K. (Temple U. Sch. Med., Philadelphia, Pa.), H. P. Morris and S. Weinhouse. *Science* 178(4063):879-881, 1972.

Rat liver and skeletal muscle tissue, and Novikoff ascites hepatoma and Morris hepatoma 20 tissue, were homogenized and centrifuged and subjected to isoelectric focusing. In hepatoma tissues, a third form of glycogen phosphorylase isozyme was discovered; this isozyme differed kinetically from the rat liver type and immunologically from the rat muscle type. The tumor form phosphorylase isozyme was present in both a and b forms. Morris hepatoma possessed both tumor and adult liver form isozymes, as did fetal rat liver. The adult liver and tumor forms of the isozyme failed to react with antibody to rat muscle isozyme. These findings are another example of suppression of isozymes of adult liver coupled with the appearance of fetal isozymes in hepatomas.

5340 ALTERATION OF SKIN IN GROSS LEUKEMIA. III. QUANTITATION OF THE ROLE OF TUMOR CELLS. (E.) Mariani, T. (Pediat., Path., Radiat. Res. Lab., U. Minnesota, Minneapolis), Y. Maruyama and R. A. Good. *J Nat Cancer Inst* 48(2):363-366, 1972.

Normal (C3H/Bi x DBA/2)F₁ mice were transplanted with normal syngenic skin. Twenty-four hr later, suspensions containing log₁₀ titrations of 10⁶, 10⁵, 10⁴, 10³, 10², 10¹ and 4 tumor Gross lymphoma ascites cells were injected directly into the skin graft. The frequency of graft rejection in animals receiving titrations of 10⁶ to 10³ cells was 60-100% with mean rejection times of 14-16 days. The animals given injections of 10² tumor cells showed a lowered rejection rate (40%) and a longer mean rejection time (18 days). No animal injected with 10¹ and 4 tumor cells rejected the graft. As the number of tumor cells injected decreased, not only did the rejection rate decrease, but tumor development took longer and host survival time increased. The critical point for inducing skin-graft rejection was between 10-100 tumor cells. Some animals were given injections of the cell-free filtrate from leukemic tissues and all of these accepted the skin graft without developing tumors at the graft site. The data indicated that graft rejection is possibly due to some response elicited by the tumor cell itself.

5341 HOST RESPONSE DURING THE LATENT PERIOD AND THE GROWTH OF AN IMMUNOLOGICALLY INDUCED MOUSE LYMPHOMA. (E.) Krüger, G. F. (Nat'l. Cancer Inst., Bethesda, Md.). *Beitr Pathol* 146(2):132-144, 1972.

Female BALB/c and DBA/2N mice were injected i.p. with bovine serum albumin (BSA) and fed 15 mg/kg/day azathioprine (immunosuppressant). Lymphosarcoma development and serum anti-BSA antibody levels were observed.

Malignant generalized lymphosarcoma (stem cell type) developed in thymuses of 20% of BALB/c mice given BSA and azathioprine, and in 66% of thymuses of DBA mice given this treatment. Lymphosarcoma incidence among untreated rats did not exceed 4%. Circulating antibody titers were elevated during tumor latent periods, but no cellular immune reaction to the BSA antigen was detected. The impairment of cellular immunity was a consequence of the atrophy of thymus and thymus-dependent lymphoid tissues as obtained from immunosuppressive chemotherapy.

- 5342 IMMUNOLOGIC STUDIES ON VIRUS-INDUCED MOUSE AND RAT LEUKEMIAS. II. DEMONSTRATION OF A MEMBRANE-BOUND, GROUP SPECIFIC LEUKEMIA ANTIGEN IN GRAFFI AND GROSS LEUKEMIAS. (Ger.) Micheel, B. (Res. Ctr. Molecular Biol. Med., Berlin, West Germany), G. Pasternak and D. Bierwolf. *Acta Biol Med Ger* 28:167-175, 1972.

Experiments with mouse Graffi and Gross leukemias demonstrated that the cell membrane of mouse virus leukemias contains group-specific leukemia antigens, which, however, are not identical with the internal viral antigens. Primary Graffi virus-induced leukemias of the XVII/Bln strain and spontaneous Gross leukemias of the AKR/Bln strain, as well as transplanted rat Graffi leukemias, were used. Immune sera of both rat and mouse Graffi and Gross were used. In immunofluorescent tests, rat Graffi immune sera reacted with mouse Gross leukemia cells as well as with mouse and rat Graffi leukemia cells. No reaction was seen with normal mouse thymus and lymph-node cells. Leukemia-specific Graffi and Gross rat immune sera did not distinguish between Graffi and Gross leukemia cells, in contrast to mouse immune sera. The membrane-associated types and group-specific leukemia antigens must be located adjacent to the antigenic determinants, which are located on one molecule or two adjacent molecules. Another indication of the close association of the determinants is the fact that their antibodies elicit similar effects, such as virus neutralization.

- 5343 IMMUNOLOGIC STUDIES IN VIRUS-INDUCED MOUSE AND RAT LEUKEMIAS. I. DEMONSTRATION OF IDENTICAL ANTIGENS IN GRAFFI VIRUS-INDUCED MOUSE AND RAT LEUKEMIAS. (Ger.) Micheel, B. (Res. Ctr. Molecular Biol. Med., Berlin, West Germany) and G. Pasternak. *Acta Biol Med Ger* 28:157-165, 1972.

Identical virus-induced antigens in Graffi leukemias in the mouse and rat were demonstrated with the aid of serologic methods. The Graffi leukemias were induced by the injection of the XVII/Bln strain into newborn animals, mice receiving 0.1 ml of a 1:10 (G/V) and rats 0.4 ml of a 1:5 (G/V) filtrate mixture. The mouse Graffi immune sera were obtained from adult XVII/Bln mice. Since following absorption of mouse Graffi immune sera with rat Graffi leukemia cells, there was no evidence of Graffi antibodies, it is concluded that even in the membrane of rat leukemia cells both leukemia specific antigens exist. In the immunofluorescent test, rat Graffi

immune sera reacted just as well with mouse as with rat leukemia cells, and likewise neutralized Graffi leukemia virus. The results indicate that these antigens are coded by the viral and not by the cellular genome.

- 5344 PRESENCE OF ANTIBODY AGAINST MOUSE FETAL ANTIGEN IN THE SERA FROM C57BL/6 MICE IMMUNIZED WITH RAUSCHER LEUKEMIA. (E.) Ishimoto, A. (Aichi Cancer Ctr., Nagoya, Japan) and Y. Ito. *Cancer Res* 32(11):2332-2337, 1972.

The presence of a cross-reacting antibody against embryonic cells and Rauscher leukemia cells in sera from the C57BL/6 mice immunized with Rauscher leukemia cells was demonstrated by the indirect immunofluorescent test. Such cross-reacting antigenicity was also found in the SV40-transformed BLSV cells and AKR lymphoma cells. The antibody was completely absorbed with embryonic cells but not with adult spleen cells. Absorption tests showed that this antigen was different from Gross and Friend-Moloney-Rauscher antigens. However, the cross-reacting antibody was not detectable in the sera from 13-month-old mice in which the natural antibody against Gross antigen was clearly demonstrated.

- 5345 INTRACELLULAR AND MEMBRANE IMMUNOFLUORESCENCE INVESTIGATIONS ON CELLS INFECTED WITH HERPESVIRUS SAIMIRI. (E.) Pearson G. (Nat'l. Cancer Inst., Bethesda, Md.), D. Ablashi, T. Orr, H. Rabin and G. Armstrong. *J Nat cancer Inst* 49(5):1417-1424, 1972.

Herpesvirus saimiri (HVS)-induced intracellular and cell membrane antigens were demonstrated in infected owl monkey cells by indirect immunofluorescence methods. Sera from HVS-infected owl monkeys were the source of antibody. The fluorescent reagent was a fluorescein isothiocyanate (FITC)-conjugated caprine antihuman γ -globulin. The effectiveness of the procedure was evaluated on owl-monkey lymphoid cells infected with HVS. Intracellular antigens were detected in infected cells after *in vitro* cultivation but not in uninfected cells or fresh biopsy material from HVS-infected monkeys. These antigens were demonstrated with post-HVS infection sera from 6 owl monkeys but not with sera taken before or within 5 days after HVS infection. HVS-associated membrane antigens were shown in cells productively infected with the virus. The appearance of these antigens coincided with cytopathogenic changes associated with the viral infection. This was particularly evident in an infected owl-monkey kidney culture, where only the rounded cells, not the adherent monolayer, contained both intracellular and membrane antigens. Similar observations were obtained when vero cells, cocultivated with a non-virus-producing marmoset lymphoid cell line, showed cytopathology characteristic of HVS infection. These results demonstrate that membrane antigens are expressed in cells infected with HVS and suggest that their synthesis is a late event in the replicative cycle of this virus.

(5346-5350)

- 5346 DETECTION OF HL-A AND OTHER CELL-SURFACE ANTIGENS ON CULTURED CELLS BY A CYTOTOXIC PLATING INHIBITION TEST. (E.) Takasugi, M. (Sch. Med., U. California, Los Angeles) and P. I. Terasaki. *J Nat Cancer Inst* 49(5):1229-1237, 1972.

A cytotoxic plating inhibition test detected HL-A and other cell-surface antigens on cultured tumor and normal cells. Cultured target cells were typed for HL-A specificities to avoid misinterpretation of HL-A reactions for tumor-associated activity. The validity of the antigens detected was supported by comparisons with lymphocyte typing. When sera from cancer patients were analyzed for HL-A reactivity by being screened against lymphocyte samples from 80 different donors, between 5 and 10% possessed this activity. Aside from these HL-A reactions, a significant degree of cytotoxicity not associated with specific histologic types of tumors was found with sera from cancer patients on cells cultured from tumors and even from normal tissue. Moreover, antigens were detected with sera from normal individuals as well as patients. The demonstration of antigens on cell membranes of cultured cells other than tumor-associated HL-A antigens has implications for interpretations of tests on cultured tumor cells.

- 5347 IMMUNOLOGICAL STUDIES ON VIRAL POLYPEPTIDE SYNTHESIS IN CELLS REPLICATING MURINE SARCOMA-LEUKEMIA VIRUS. (E.) Shanmugam, G. (St. Louis U. Sch. Med., Mo.), G. Vecchio, D. Attardi and M. Green. *J Virol* 10(3):447-455, 1972.

The synthesis of viral polypeptides in the transformed, virus-producing rat cell line 78A1 was studied using antibodies to disrupted murine sarcoma-leukemia virus (MSV[MLV]). When cultures were labeled for 10 min with radioactive amino acids, about 9% of the total labeled proteins was precipitated with antiserum against purified MSV(MLV), and 3 to 4% was precipitated with the same antiserum after it had been absorbed with an extract from uninfected rat cells. The difference is due to the presence in the unabsorbed antiserum of antibodies to cellular proteins that are present in purified virus preparations. Intracellular viral proteins labeled with radioactive amino acids were isolated by immunoprecipitation and analyzed by electrophoresis in sodium dodecyl sulfate-polyacrylamide gels. The mobilities of intracellular viral polypeptides were identical to those of the purified virion. However, labeled polypeptides with electrophoretic mobilities lower than that of the major virion polypeptide, the group-specific antigen of molecular weight 31,000, were present in higher proportion in the total cell extract and in the membrane fraction than in the virion. These polypeptides appeared to be of cellular origin for they were present only in minute amounts in the immunoprecipitates obtained with the absorbed serum. After a 10-min labeling period, radioactive proteins were assembled into extracellular virions rapidly for the first 4 hr followed by a slower rate. More than 2% of the total proteins of the cell labeled in a 10-min pulse were assembled into virions at the completion of a 24-hr chase. The

high-molecular-weight polypeptides with the same mobilities as those detected in the immunoprecipitate of intracellular proteins were found in virions released from cells after a 10-min pulse. A larger proportion of these high-molecular-weight proteins was detected in virions released after short chase periods (30-120 min) than after longer chase periods (6-24 hr). These data suggest that the high-molecular-weight cell-derived polypeptides have a turnover rate higher than that of the major virion polypeptides or are cleaved proteolytically from the virions during long incubation in the culture media.

- 5348 THE POSSIBILITY OF MOLONEY SARCOMA VIRUS UTILIZATION TO INCREASE THE RESISTANCE OF BALB/c MICE AGAINST METHYLCHOLANTHRENE-INDUCED SARCOMA IMPLANTATION. (Uk.) Fedorovska, M. I. (Sci. Res. Inst. Exp. Clin. Onkol., Kiev, USSR), P. P. Verkhatsky, O. P. Vyetkova, L. P. Kaminska, and Yu. O. Umansky. *Mikrobiol Zh* 34(1):59-60, 1972.

The spectrum of Moloney sarcoma resorption-induced immunity was studied in two-month-old BALB/c mice subjected to Moloney sarcoma virus treatment by i.m. inoculation of a 10% Moloney sarcoma cell-free filtrate. Tumor resorption occurred 35-40 days after virus inoculation whereupon the mice were inoculated with 10^5 methylcholanthrene-induced sarcoma cells. A tumor incidence of 66.6% among intact control mice was observed 25 days later, while only 13.3% of the mice with a resorbed Moloney sarcoma history developed neoplasms. Two of these latter mice also had a recurrent Moloney sarcoma. Apparently, resorption of Moloney sarcoma virus-induced tumors promotes a non-specific tumor transplant immunity.

- 5349 NEOANTIGENS AND VIRUS-TUMORS: FINDINGS AND LOCALIZATION OF NEOANTIGENS IN VIRUS-TRANSFORMED FIBROSARCOMA CELLS OF THE GOLDEN HAMSTER. (Ger.) de Vaux St. Cyr, C. (Cancer Res. Inst., Villejuif, France) and G. P. Tilz. *Z Krebsforsch* 77(3):194-201, 1972.

The appearance of neoantigens in fibrosarcoma cells of the Syrian hamster during transformation with SV40 virus is described. Following the immunization with SV40, the following antibodies appeared: agglutinative, those reacting with T-antigen, and those which precipitated with TSV₅Cl₂-cell extracts. Immunoelectrophoretic analyses revealed three precipitation lines: two of a protein nature and one with a high glucose content. These new antigens differed from the T-antigen and transplantation antigens and were localized with the microsomes. The model described may be applied to the study of tumors with respect to antigen content and immunological defense system.

- 5350 TUMOR IMMUNITY AND THE MECHANISM OF POLYINOSINIC-POLYCITIDYLIC ACID INHIBITION OF TUMOR GROWTH. (E.) Kreider, J. W. (Milton S. Hershey Med. Ctr., Pennsylvania St. U., Hershey) and

S. A. Benjamin. *J Nat Cancer Inst* 49(5):1303--1310, 1972.

The hypothesis that polyinosinic-polycytidylic acid (poly I:C) inhibits tumor growth by stimulating tumor immunity was tested by giving varying doses of poly I:C to tumor-bearing hosts (rats with mammary adenocarcinoma or mice with B16 melanoma) treated with horse antirat or antimouse lymphocyte serum (ALS). These animals were immunosuppressed as demonstrated by their inability to reject skin allografts. Both the rat and mouse tumors in immunosuppressed hosts were retarded by poly I:C treatment, although higher doses were required to overcome the ALS-enhanced tumor growth rate. Poly I:C did not restore the ability of ALS-treated mice to reject skin allografts. To determine whether poly I:C could stimulate the immune response to an X-irradiated tumor cell vaccine, mice were pretreated with: poly I:C, X-irradiated B16 melanoma cells either alone or in combination with poly I:C, or nothing. Mice receiving only poly I:C showed no resistance to subsequent challenge with B16 cells, but mice given X-irradiated B16 cells were resistant. Addition of poly I:C treatment to mice receiving X-irradiated cells did not increase resistance. Thus poly I:C does not stimulate the lymphocyte-mediated immune response to tumor cells and can retard tumor growth in immunosuppressed hosts. Immunostimulation can be excluded as a significant component of the mechanism of poly I:C inhibition of tumor growth.

5351 USE OF THE MACROPHAGE MIGRATION INHIBITION TEST TO MONITOR FRACTIONATION OF SOLUBLE ANTIGENS OF CHEMICALLY INDUCED SARCOMAS OF INBRED GUINEA PIGS. (E.) Suter, L. (Albert Einstein Coll. Med., Bronx, N.Y.), B. R. Bloom, E. M. Wadsworth and H. F. Oettgen. *J Immunol* 109(4):766-775, 1972.

Soluble tumor antigen from 3-methylcholanthrene- and 9,10-dimethyl-1,2-benzanthracene-induced sarcomas grafted onto strain 13 guinea pigs was prepared by extraction with isotonic saline followed by ultracentrifugation. Further fractionation by ammonium sulfate precipitation, gel filtration on Sephadex G-150 or Biogel A-5m, and DEAE Sephadex chromatography was performed. Antigenic activity was assayed *in vivo* by skin tests and *in vitro* by the macrophage migration inhibition method. Antigenic activity was not restricted to a single species of molecules as defined by size or charge. The major part of the activity was associated with two fractions, one excluded by Sephadex G-150, and the other included in Sephadex G-150. The behavior of the antigen preparations in isopycnic sucrose gradient centrifugation indicated that they were truly soluble and not membrane associated. The active fractions were nontoxic for the skin and for peritoneal cells and stable under the conditions of the macrophage migration test. Their antigenic activity was specific for each of the two tumors. In terms of the amount of antigen required to give a positive reaction, the migration inhibition assay was more sensitive than the skin tests. The antigen preparations are potentially useful reagents in tests for tumor specific immunity.

5352 RESISTANCE TO FRIEND LEUKEMIA VIRUS IN MICE: EFFECT OF IMMUNOSUPPRESSION. (E.) Stutman, O. (U. Minnesota Med. Sch., Minneapolis) and J.-M. Dupuy. *J Nat Cancer Inst* 49(5):1283-1293, 1972.

Two types of resistance to Friend leukemia virus were demonstrated in 25 inbred mouse strains and sublines immunosuppressed by heterologous anti-lymphocyte serum (ALS). Sensitivity or resistance to two variants of Friend virus was measured by the capacity of each virus to produce macroscopic foci in the spleens of the infected animals. The first type of resistance (relative resistance) was overcome by effective immunosuppression with ALS, but the second type (absolute resistance) was not affected by ALS treatment. The first type of resistance was also overcome by increasing the virus input; the second type was not affected by large doses of virus. The variations were not due to the differential effects of ALS as an immunosuppressant in the mouse strains studied, since ALS was always effective in depressing cellular and humoral immunity. In the sensitive strains, ALS treatment facilitated virus replication. This increase in virus replication was also observed after ALS treatment in the relatively resistant strains. Conversely, only negligible virus replication was detected in the absolutely resistant mouse strains, and this was not modified by ALS treatment.

5353 ATTEMPTED INDUCTION OF TUMOR ANTIGENS IN CARCINOGEN-TREATED CELLS. (E.) Outzen, H. C. (Inst. Cancer Res., Philadelphia, Pa.), E. J. Andrews, M. A. Basombrio, S. Litwin and R. T. Prehn. *J Nat Cancer Inst* 49(5):1295-1302, 1972.

An attempt was made to confirm the hypothesis that tumor-specific antigens (TSTA) might be induced by chemical carcinogens in cells that otherwise remain normal. Skin from BALB/c or (BALB/c X DBA)F₁ mice treated with 3-methylcholanthrene (MCA) or 7,12-dimethylbenz(a)anthracene (DMBA) was grafted onto normal or immunodepressed syngeneic mice. In three experiments, the syngeneic skin grafts from donors treated with either carcinogen exhibited excessive amounts of graft contraction or rejection. Immunodepression by any of three methods did not reduce the amount of graft rejection to a point where immunologic surveillance of nontumorous cells could be postulated as the responsible mechanisms. The cytotoxicity of the carcinogens was the primary cause of the excessive rejection. In only one experiment did the data suggest a small immunologic component. Thus these experiments did not substantiate the hypothesis that TSTA could be induced by chemical oncogens in cells that otherwise remain normal.

5354 DETERMINATION OF C_3 (COMPLEMENT FACTOR 3) IN MALIGNANT LYMPHOMAS, MYELOMA, AND WALDENSTROM'S DISEASE. (Dut.) Meier, E. Ch. (Canton Hosp., Zurich, Switzerland) and P. J. Grob. *Dtsch Med Wochenschr* 97(25):967-971, 1972.

(5355-5358)

β_1A (a component of complement factor C'3) determinations are reported in a group of patients with malignant lymphomas, myeloma and Waldenstrom's disease and analyzed for their diagnostic and prognostic significance. The β_1A determinations were carried out in 144 sera from 71 hospitalized or ambulatory patients. In normal blood donors, this determination had a mean value of 143 ± 35.8 mg/100 ml. The results in Hodgkin's disease in remission were normal; patients in stages I-III showed normal or slightly increased β_1A values; and patients in stage IV showed low values. In chronic lymphatic leukemia, results were abnormally low in the active stage. In all cases of Waldenstrom's disease, very low results were observed, although, patients in remission following successful therapy also showed low β_1A values. A similar picture was seen with osteomyelofibrosis. In myeloma, a wide range of β_1A values was observed; only 8 out of 30 serum values were within normal range, 8 were increased and 16 were low. A wide range of results was also seen in reticulosarcoma. Although the β_1A determination in serum is of some diagnostic value, a normal value does not rule out malignant disease.

5355 STUDIES OF HUMORAL AND CELLULAR IMMUNOLOGIC DEFENSE REACTIONS IN LYMPHOGRANULOMATOSIS.

(Ger.) Patakfalvi, A. (Med. U. Pecs, Hungary), A. Gogl, M. Balazs, K. Simon and Z. Kovacs. *Folia Haematol (Leipz)* 96(1):59-67, 1971.

Patients with lymphogranulomatosis (Lg) were studied over a period of years in an attempt to discover to what extent Lg can cause immunological deficiency. In a group of 35 patients (subdivided into those with Lg for 0-5 yr and those with Lg for 5-15 yr), determinations of antibodies were obtained in 35, immunoglobulins in 25, cutaneous tests in 18, and lymphocyte transformation in 13 patients. In patients with a disease duration of 0-5 years (Group 1), the titer of normal antibodies was identical with that of the controls or very slightly increased. In patients with a disease of longer duration (Group 2), the titer values were significantly decreased; in some of these patients, terminally, no antibodies could be observed. The IgG and IgA values were slightly increased in Group 1, and the IgM was normal, although the individual IgM fractions varied considerably. Group 2 patients revealed a significant decrease in all three immunoglobulins. These patients also manifested fewer positive cutaneous reactions than normal controls. In most cases, the transformation of lymphocytes due to phytohemagglutinin also suffered some damage. The antibodies and immunoglobulins, before and after X-ray and cytostatic treatment, showed no marked changes in nine patients until two or three months after treatment, when the IgG and IgM as well as the titer values for some antibodies increased. Cumulative effects should be considered.

5356 THE INFLUENCE OF HETEROLOGOUS ANTILEUKEMIC RABBIT IMMUNE SERA ON THE GROWTH OF A TRANSPLANTABLE LEUKEMIA OF THE XVII/B1n MOUSE STRAIN.

(Ger.) Pasternak, G. (Res. Ctr. Molecular Biol. Med., Berlin, West Germany). *Arch Geschwulstforsch* 39(1):40-43, 1972.

Contradictory reports on the effects of heterologous immune sera on transplanted leukemias in the mouse led to a study of the chemically induced leukemia LME 8 (with nitrosomethylurea). For the production of rabbit immune sera, mouse cells of the XVII/B1n strain were used with leukemia LME 8, Graffi virus induced myeloid leukemia (Grm), Graffi virus-induced reticular leukemia (Grr), and normal lymphocytes from lymph nodes. Heterologous rabbit immune sera thus produced prevented the growth of 10^4 subcutaneously injected cells of LME 8 leukemia. This therapeutic effect was attributed to antibodies against virus-induced membrane-bound antigens. The existence of a leukemia antigen that is not of viral origin appears unlikely.

5357 APPLICATION OF IMMUNOHISTOCHEMISTRY TO STUDY OF AVIAN LEUKOSIS VIRUS. (E.) Dougherty, R. M. (State U. New York, Upstate Med. Ctr., Syracuse), A. A. Marucci and H. S. Distefano. *J Gen Virol* 15:149-162, 1972.

Chicken embryo fibroblasts were infected with serotype A or serotype B avian leukosis virus (ALV) and treated with chicken or hamster anti-type A or anti-type B virus antisera and chicken or hamster anti-peroxidase. A modified peroxidase-labeled antibody test was used to study virus antigens in infected cells. In reactions with unfixed infected cells and type-specific antisera, antibody reactions were localized at the cell surface and only cells infected with the homologous virus were stained. When ALV-infected cells were fixed before exposure to antisera, virus antigens in cell cytoplasm were stained along with plasmalemma antigens; both surface and cytoplasmic reactions were specific for virus envelope serotype. With both virus strains, cytoplasmic antigen was often concentrated in granules that were sometimes vesicular. Hamster group-specific (gs) antibody reacted strongly with fixed chicken cells infected with type A or type B virus. The distribution of hamster antigen was similar to that seen with chicken antisera. Intracellular gs antigen may have been present in a few cells. Unfixed infected cells did not react with hamster gs antibody. Some chicken antisera with specific reactivities for envelope antigen contained both types A and B gs antigens. These sera reacted with fixed cells infected with either type A or B virus, and stained surface and cytoplasmic antigens.

5358 RADIOIMMUNOASSAY OF MAMMALIAN TYPE C VIRAL PROTEINS. I. SPECIES SPECIFIC REACTIONS OF MURINE AND FELINE VIRUSES. (E.) Scolnick, E. M. (Natl. Cancer Inst., Bethesda, Md.), W. P. Parks and D. M. Livingston. *J Immunol* 109(3):570-577, 1972.

Preparations of Rauscher and Kirsten murine leukemia viruses and Snyder-Theilen and Gardner feline leukemia viruses were subjected to Sephadex G-100 chromatogra-

phy and isoelectric focusing to purify the viral group-specific (gs) antigens. Fractions from G-100 were subjected to polyacrylamide gel electrophoresis. These procedures revealed a viral polypeptide of murine and feline viruses; this polypeptide (VP3(gs)) had a molecular wt of about 30,000 daltons. Polyacrylamide gel electrophoresis analysis of VP3(gs) purified by G-100 chromatography and isoelectric focusing showed that the peptide migrated as a single band in three dissociation systems. The VP3(gs) protein from murine and feline viruses had species-specific antigenic reactivities which were not altered by chemical iodination. By employing limiting concentrations of antibody in a radioimmune precipitation assay, unlabeled murine or feline VP3(gs) antigen could be quantitated by competition with the labeled polypeptide. This double antibody VP3(gs) antigen assay was at least 500 times more sensitive than complement-fixation or immunodiffusion. Anti-VP3(gs) antisera detected anti-murine VP3(gs) antibodies at serum dilutions in excess of 1:25,600. The same sera at a 1:2 dilution reacted by immunodiffusion and had an endpoint titer of 1:64 by complement fixation.

- 5359 ISOLATION OF THE SV40 INDUCED TUMOR ("T") ANTIGEN FROM TRANSFORMED HAMSTER KIDNEY CELLS. (E.) Spira, G. (Hebrew U.-Hadassah Med. Sch., Jerusalem, Israel), M. Popescu, S. Cymbalista, N. Biezunski and N. Goldblum. *Arch Gesamte Virusforsch* 37(2/3):236-242, 1972.

A procedure for the isolation and partial purification of tumor ("T") antigen induced by SV40 virus in transformed hamster kidney cells is described. The method involves differential precipitation with ammonium sulfate, fractionation on a hydroxylapatite column and concentration by ultrafiltration. There is very little loss in activity as measured in total CF units and the degree of purification is about one hundredfold. Analysis of the purified preparation indicates four peaks of CF activity ranging in molecular weight from 70,000-400,000.

- 5360 LYMPHOCYTE BASTOGENESIS TO HUMAN LEUKEMIA CELLS AND THEIR RELATIONSHIP TO SERUM FACTORS, IMMUNOCOMPETENCE, AND PROGNOSIS. (E.) Gutterman, J. U. (U. Texas M.D. Anderson Hosp. Tumor Inst., Houston), E. M. Herish, K. B. McCredie, G. P. Bodey, Sr., V. Rodriguez and E. J. Freireich. *Cancer Res* 32(11):2524-2529, 1972.

Lymphocyte blastogenic studies to autologous leukemia cells were carried out in 35 patients with adult acute leukemia. The effects of serum on this response and correlation with studies of general immunocompetence were studied. Twenty-five of 35 patients had positive blastogenesis. Nine patients with acute myelogenous leukemia had complete or partial abrogation of this response in autologous serum. Five patients had facilitation of the blastogenic response in autologous serum compared to the response in allogenic serum. Patients with acute myelogenous leukemia had a more vigorous

response to their leukemia cells than patients with acute lymphoblastic leukemia. Although studies of general immunocompetence tended to correlate with the *in vitro* response to leukemia cells, only one patient who was unresponsive to autologous leukemia cells was immunoincompetent. A good prognosis was correlated with a vigorous response to leukemia cells, inhibition or facilitation of that response by autologous serum, and a persistently positive blastogenic response in remission.

- 5361 ANTIGENIC DIFFERENCES BETWEEN NORMAL MOUSE EPIDERMIS AND METHYLCHOLANTHRENE-INDUCED SQUAMOUS-CELL CARCINOMAS. (E.) Bhattacharaya, M. (Roswell Park Mem. Inst., Buffalo, N.Y.) and C. Carruthers. *Oncology* 26:1-15, 1972.

Urea- and alkali-extractable proteins were isolated from normal epidermis and methylcholanthrene hyperplasia, papillomas and squamous carcinomas of mice. Antisera against these proteins were prepared in rabbits and the IgG fractions were obtained from sera by DEAE-cellulose chromatography. In immunodiffusion tests with partially and extensively adsorbed IgG, urea-extractable carcinoma proteins and epidermal proteins contained some cross-reacting antigens and some non-cross-reacting antigens. The two types of urea-extracted protein contained antibodies against distinct antigens and traces of antibodies against common antigens not present in other tissues. Some urea- and alkali-extractable antigens were common to both epidermis and carcinomas. Urea-extractable antigens were the most distinctive for epidermis and carcinomas. In general, antigens common to epidermal proteins were different from antigens common to carcinoma proteins. Studies of the fixation of antibodies to tissue sediments showed that anti-epidermal antibodies raised against the epidermal urea-extracted antigens were directed against proteins characteristic of the epidermis, and that anti-carcinoma antibodies were directed against proteins characteristic of the carcinomas. There was no significant *in vivo* localization of ¹²⁵I-labeled antibodies against epidermal and carcinoma urea-extracted protein in spleen, kidney or liver, skin or carcinoma of normal or tumor-bearing mice.

- 5362 ONCOGENIC VIRUS RNA ANTIGEN IN HUMAN GLIAL TUMORS. ITS RELATIONSHIP TO CARCINOEMBRYONIC ANTIGENS. (Fr.) Trouillas, P. (Neurol. Hosp., Lyons, France). *Nouv Presse Med* 1(30):1979-1982, 1972.

The presence of antigen gs3 in tumors and sera of patients with gliomas is described. The anti-FelV Rickard and anti-FSV (feline sarcoma virus) sera precipitate the glioma extracts and reveal the same antigen as the anti-glioma sera. This antigen appears in other species as well as in humans (mouse, cat). Sera which do not precipitate antigen gs3 do not precipitate extracts of fetal brain; those that do precipitate gs3 react with fetal brains, which serves as a means of distinguishing between the gs3 antigen and the carcino-fetal glial antigen. The soluble antigen

(5363-5369)

from fetal intestine and brain and from gliomas constitutes one antigenic complex. In the presence of anti-FeLV Rickard serum, there is a reaction which is identical between the fetal cerebral antigen and the soluble extract of fetal colon. Evidence of gs3 was demonstrated in 20 tumors examined, including 15 glioblastomas and astrocytomas, 2 oligodendrogliomas, 2 ependymomas and 1 mixed glioma. This antigen was also found in the serum of nine patients, four of which were autoimmunized by their own tumor. The molecular identity between an antigen of virus RNA and a fetal antigen implies an identical genome.

5363 S 100 PROTEIN IN EXPERIMENTAL RAT TUMORS OF THE CENTRAL AND PERIPHERAL NERVOUS SYSTEM.

(E.) Wechsler, W. (Max-Planck Inst., Cologne, West Germany), S. E. Pfeiffer, J. A. Swenberg and A. Koestner. *Naturwissenschaften* 59(8):370-371, 1972.

Rat central and peripheral nervous system tumors caused by ethyl- and methyl-nitrosourea were examined for the nervous tissue-specific protein S-100. Central nervous system (CNS) tumors included 16 brain tumors and one spinal cord tumor. All but two of these tumors contained S-100 as detected by a complement fixation assay. Amounts of S-100 in CNS tumors ranged from 0-0.70% of total soluble protein. Twenty-one of 22 peripheral nervous system tumors, originating in trigeminal nerves, spinal roots or peripheral nerves, were S-100-positive. S-100 accounted for an average of 0.23% of total soluble protein in peripheral nervous system tumors.

5364 STUDIES OF IMMUNE RESPONSE TO A YOSHIDA HEPATOMA ASCITES TRANSPLANT IN RATS. (Ger.)

Boehmer, E. von (Max-Planck-Inst. Biochem., Munich, West Germany) and R. Bayer. *Z Krebsforsch* 77:45-56, 1972.

Sprague-Dawley, BD VI, and BDE rats were tested to determine the conditions required for a humoral immune response to Yoshida hepatoma ascites (YA) cells. Before transplantation of the YA cells, these cells were made isologous to the recipient animal through three passages. Under these conditions, tumor growth was produced in BD VI and BDE strains with the i.p. injection of 100,000 cells per animal. Tumor-bearing rats of these strains did not produce antibodies having cytotoxic action at 37 C against autologous or isologous grown ascites cells, if the ascites tumor has been grown through three passages in the corresponding isogenic strain before transplantation. In all three strains, antibodies with a cytotoxic reaction at 37 C occurred if the animals exhibited ascites tumors which had been grown through fewer than three passages in isogenic rats. Under these conditions, the BD VI and Sprague-Dawley rats showed a stronger antibody reaction than BDE rats. With oil-induced peritoneal exudates, as well as with the ascitic fluids, complement was demonstrated in all three strains. BDE rats could be immunized against the hepatoma by repeated injections of formalin-fixed YA cells,

but humoral antibodies against the YA cells could not be demonstrated in immune BDE rats, either by the cytotoxic test at 37 C or with the mixed antiglobulin reaction. Since it was not possible to establish the presence of humoral antibodies in the serum of these rats by the methods described, it is assumed that these particular strains react against YA tumors with a cellular immune response.

5365 DETECTION OF IgG ON THE SURFACE OF LYMPHOCYTES AND SEPARATION OF LYMPHOCYTE POPULATIONS WITH ANTISERA. (Fr.) Zagury, D. (Lab. Electron Microscopy Applied to Biology, Natl. Ctr. Sci. Res., Paris, France), S. Avrameas and Paul Zeitoun. *C R Acad Sci (Paris)* 273(7):719-722, 1971.

The electron microscope was used to detect IgG lymphocytes from the spleen and lymph nodes of non-immunized C57Bl mice. These cells were first incubated with serum from rabbits hyperimmunized with mouse IgG to block free aldehyde groups which might cause nonspecific fixation of peroxidase-labeled antibodies and then incubated with rabbit antibodies for mouse IgG which had been conjugated with peroxidase. The cytoplasmic membrane of about 3/5 of these lymphocytes had a positive reaction for IgG, while about 2/5 had a negative reaction. Incubation of lymphocyte suspensions with equal parts of antithymocyte serum and Eagle's medium resulted in the formation of an agglutinate consisting of cells, which had undergone reaction with the antithymocyte serum and referred to as T-cells, which showed no evidence of IgG, while the suspension consisted of lymphocytes giving a positive reaction for IgG. On the other hand, incubation of serum from rabbits hyperimmunized with mouse IgG with lymphocyte suspension and Eagle's medium also produced an agglutinate, but most of the cells in suspension had membranes which did not appear to contain IgG. In this population of lymphoid cells, plasmocytes were found which had IgG in their ergastoplasm.

5366 A HETERO-ORGANIC ANTIGEN OF A RAT ASCITES HEPATOMA. (E.) Satoh, S. (Sch. Med., Hokkaido U., Sapporo, Japan). *Gann* 63:579-590, 1972.

5367 CANCER ASSOCIATED SERUM PROTEINS. (E.) Geelhoed, G. W. (Natl. Cancer Inst., Bethesda, Md.), G. L. Wright and R. C. Hoyer. *Proc Am Assoc Cancer Res* 13(March):48, 1972.

5368 IMMUNOSUPPRESSIVE ACTIVITY OF CHROMATIN FRACTION DERIVED FROM NUCLEI OF EHRlich ASCITES TUMOR CELLS. (E.) Masaki, H. (Osaka U. Med. Sch., Japan), K. Takatsu, T. Hamaoka and M. Kitagawa. *Gann* 63:633-635, 1972.

5369 AN IMMUNO-ELECTRON MICROSCOPIC ANALYSIS OF EPSTEIN-BARR VIRUS-RELATED ANTIGENS IN

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- 5370 CARCINOEMBRYONIC ANTIGEN (CEA) IN INFLAMMATORY BOWEL DISEASE. (E.) Moore, T. L. (Thorndike Mem. Lab., Boston, Mass.), P. A. Kantrowitz and N. Zamcheck. *JAMA* 222(8):944-947, 1972.
- 5371 RADIOIMMUNOASSAY OF CARCINOEMBRYONIC ANTIGEN IN SERUM OF NORMAL SUBJECTS AND PATIENTS WITH COLONIC CARCINOMA. (E.) Kleinman, M. S. (U. Rochester Sch. Med. Dentistry, N.Y.) and M. D. Turner. *Gut* 13(5):390-394, 1972.
- 5372 REACTIVITY BETWEEN HERPESVIRUS TYPE 2-RELATED SOLUBLE CERVICAL TUMOR CELL MEMBRANE ANTIGENS AND MATCHED CANCER AND CONTROL SERA. (E.) Hollinshead, A. (Dept. Med., George Washington U., Washington, D.C.), O. B. Lee, W. McKelway, J. L. Melnick and W. E. Rawls. *Proc Soc Exp Biol Med* 141(2):688-693, 1972.
- 5373 THE EFFECT OF SERUM FROM PATIENTS WITH ACUTE GRANULOCYTIC LEUKEMIA ON GRANULOCYTE COLONY FORMATION *IN VITRO*: A SEARCH FOR INHIBITORS. (E.) Mangalik, A. (U. Colorado Med. Ctr., Denver) and W. A. Robinson. *Proc Soc Exp Biol Med* 141(2):515-518, 1972.
- 5374 INTERCHAIN DISULFIDE BOND FORMATION STUDIED IN TWO MOUSE MYELOMAS WHICH SECRETE IMMUNOGLOBULIN A. (E.) Bevan, M. J. (Natl. Inst. Med. Res., London, England). *Eur J Immunol* 1:133-138, 1971.
- 5375 IMMUNODEPRESSION BY VIRUSES: EFFECT OF FRIEND AND RILEY VIRUSES ON CONTACT SENSITIVITY. (E.) Asherson, G. L. (London Hosp. Med. Coll., England) and M. Bendinelli. *Giorn Microbiol* 17(3-4):179-188, 1969.
- 5376 THE RATIONALE OF IMMUNOSTIMULATION PROCEDURES IN THE THERAPEUTIC APPROACH TO MALIGNANT MELANOMA OF THE SKIN. (E.) Ikonopisov, R. L. (Oncological Res. Inst., Sofia, Bulgaria). *Tumori* 58:121-128, 1972.
- 5377 EHRlich ASCITES CARCINOMA GROWTH KINETICS STUDIES UNDER ALTERED IMMUNOLOGICAL CONDITIONS OF THE CARRIER ORGANISM. (Rus.) Gitlits, A. M. (Genetics and Cytol. Inst. BSSR Acad. Sci. Minsk, USSR), G. V. Kraskovskiy and A. Yu. Liss. *Dokl Akad Nauk SSSR* 16(5):464-467, 1972.
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- 5382 ACTIVATION OF GUINEA PIG HERPESVIRUS ANTIGEN IN LEUKEMIC LYMPHOBLASTS OF GUINEA PIG. (E.) Nayak, D. P. (U. California Los Angeles Sch. Med.). *J Virol* 10(5):933-936, 1972.
- 5383 LYMPHOCYTE SENSITIZATION TO CARCINOEMBRYONIC ANTIGEN (GOLD) WITH SPECIAL REFERENCE TO MULTIPLE SCLEROSIS. (E.) Field, E. J. (Newcastle Gen. Hosp., England) and E. A. Caspary. *Br Med J* 4(5835):261-263, 1972.
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- 5387 EPSTEIN-BARR VIRUS-ASSOCIATED ANTIGENS ACTIVATED IN HUMAN CELLS BY 5-BROMODEOXYURIDINE. (E.) Gerber, P. (Lab. Viral Immunology, Natl. Inst. Hlth., Bethesda, Md.) and S. Lucas. *Proc Soc Exp Biol Med* 141(2):431-435, 1972.
- 5388 IMMUNOLOGICAL CROSS-REACTIVITY OF ANTIGENS COMMON TO TUMOUR AND FOETAL CELLS. (E.)

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Salinas, F. A. (Carcinogenesis Program, Oak Ridge Natl. Lab., Tenn.), J. A. Smith and M. G. Hanna. *Nature* 240(5375):41-43, 1972.

5389 PRESENCE OF GROUP-SPECIFIC C PARTICLE ANTIGENS IN THE LIQUID PHASE OF MOUSE ASCITES TUMOR. (It.) Ribacchi, R. (Cancer Res. Div., U. Perugia, Italy). *Lav Ist Anat Istol Patol Perugia* 31(3):91-102, 1971.

5390 COMPARATIVE STUDY OF THE CYTOLOGICAL AND IMMUNOLOGICAL FINDINGS IN 40 CASES OF MULTIPLE MYELOMA. (Gr.) Voutsadakis, A. (Clin. Path. Athens, Greece) and A. Fertakis. *Iatriki* 20(5):437-442, 1971.

5391 INVESTIGATIONS ON IMMUNOLOGIC DYNAMICS IN THE COURSE OF ACUTE LEUKEMIA IN CHILDREN. (Rum.) Burdea, M. (Med. Pharmac. Sci. Inst. Iasi, Rumania), A. Bratianu, N. Polac, I. Rautu and S. Barna. *Rev Med Chir Soc Med Nat Iasi* 76(1):39-42, 1972.

5392 ANTIBODIES TO SPECIFIC INTRACITOPLASMIC ANTIGENS IN MALIGNANT MELANOMA. (Sp.) Moragas, J. M. de (Santa Cruz & San Pablo Hosp., Barcelona, Spain), A. Anguera and J. Vinas. *Med Clin* 58(7):556-560, 1972.

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5394 CELL-TO-CELL INTERACTION IN THE PROCESS OF IMMUNE INDUCTION AND OF MALIGNANT TRANSFORMATION. (Rum.) Berceanu, S. (N. G. Lupu Inst. Internatl Med., Bucharest, Romania). *Stud Cercet Med Interna* 13(3):207-218, 1972.

5395 ASSESSMENT OF THE MIXED LEUCOCYTE REACTION BY TARGET CELL DEATH: A STUDY OF LEUKAEMIC CELLS. (E.) Pergum, G. D. (Fulham Hosp., London, England), C. A. Evans., V. L. Middleton and I. C. Balfour. *Clin Exp Immunol* 10:251-256, 1972.

5396 INVESTIGATION ON THE ANTIGENIC PROPERTY OF LYMPHOCYTES FROM CHRONIC LYMPHOCYTIC LEUKEMIA. (E.) Astaldi, A. Jr. (U. Med. Sch., Pavia, Italy), D. Micu, G. Astaldi and G. R. Burgio. *Folia Allergol* 19:17-20, 1972.

5397 MYELOID MONOCYTIC LEUKEMIA IN INFANTS. CLINICAL, IMMUNOLOGICAL, AND CYTOLOGICAL FEATURES: ELECTRON MICROSCOPIC CONTRIBUTION. (Fr.) Jean, R. (St. Charles Clin., Montpellier, France), R. Senelar, H. Bonnet, J. M. Emberger, A. Serre, M. Navarro, D. Rieu, J. Clot and J. M. Rey. *Rev Pediat* 8(4):207-209, 1972.

See also:

- * (Rev): 5044, 5049, 5055, 5063, 5066, 5068, 5069
- * (Chem): 5098, 5168
- * (Viral): 5212, 5228, 5239, 5246, 5260, 5272

- 5398 ON FUSION OF NORMAL CELLS OF VARIOUS ORGAN-- AND TISSUE SPECIFICITY MUTUALLY OR WITH TUMOUR CELLS. (Rus.) Drize, O. B. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow), M. A. Shlyakevich, A. V. Sokolov, I. V. Osechinskii, S. I. Gorodetskii, V. P. Tyurina and L. B. Mekler. *Vopr Onkol* 18(5):72-78, 1972.

The oncogenic potential of artificial heterokaryons was studied. Mouse peritoneal macrophages, spleen lymphocytes, hepatocytes and transplantable kidney cells of mice (C57B1/6) and hamster Rous sarcoma tumors (HRT) and Sendai viruses were used. Heterokaryons were obtained by a modification of Harris's method. The cells were incubated with the virus, allowed to settle and centrifuged. Smears were then made. The heterokaryons obtained were studied with the aid of H^3 -thymidine and by observing synthesis of mouse serum albumin (labeled with fluorescent isothiocyanate) by these cells. The hepatocyte and HRT cell hybrids carried properties common to both parent cells. They were capable of multiplying in the culture and of synthesizing albumin. Heterokaryons of hepatocytes and spleen lymphocytes, of hepatocytes and peritoneal macrophages were not obtained. Heterokaryons of kidney cells and spleen lymphocytes were obtained maximally ($8.0 \pm 2.55\%$ of the kidney cells) when their parent cells were in the ratio of 1:10.

- 5399 RECURRENT HYPERPLASIA, ADENOMATOUS HYPERPLASIA AND INVASIVE CARCINOMA, DIFFUSION AND METASTASIZING, GRADING OF ENDOMETRIUM CARCINOMAS (PATHOLOGICAL ANATOMY). (Ger.) Dallenbach-Hellweg, G. (Fac. Clin. Med., Heidelberg, West Germany). *Schweiz Z Gynaekol Geburtsh* 2(4-6):330-341, 1971.

The development of endometrium carcinomas including adenomatous and glandular-cystic hyperplasias is described. The latter are in response to estrogen, which under certain conditions, causes an increase in mitosis, an increase in volume of the stroma and hyperplasia of glandular epithelium. Before the menopause, progesterone acts as a deterrent in the progression of this hyperplasia. Adenomatous hyperplasia is the first histological sign of an estrogen effect. It develops over several years, usually following the physiological menopause, and only rarely in continuous anovulation. If estrogen levels are diminished, the hyperplasia may regress; otherwise there is a progression toward carcinoma. The transition to an irreversible state can be determined histologically as an adenocarcinoma *in situ*, which precedes the invasive carcinoma. The invasive carcinoma can remain under estrogen influence even if estrogen levels decrease. In the adenomatous hyperplasia there is often an increased level of estrogen and concomitantly, a carcinoma.

- 5400 PROLIFERATION OF THE PARENCHYMA AND STROMA IN PRECANCEROUS HYPERPLASTIC NODULES OF MOUSE MAMMARY GLANDS. (Rus.) Belyaeva, N. N. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow)

and Yu. M. Vasil'ev. *Biul Eksp Biol Med* 72(10):75-77, 1971.

Proliferation of the parenchyma and stroma in various nodules of precancerous mouse mammary glands was studied *in situ*. Hyperplastic nodules of the mammary glands of female C3H mice (9-12 months old) which had received single or multiple (up to 100 times) injections of H^3 -thymidine were prepared for histological examinations. Labeled cells were counted for the parenchyma and stroma. According to the characteristic of the proliferation of the nodules, the following three types were classified: 1) nodules whose index of labeled nuclei of the parenchyma and stroma did not differ from that of other normal acini of the mammary glands; 2) nodules in which the index of labeled nuclei of the parenchyma exceeded that of the normal mammary gland, but that of the stroma did not differ from the normal mammary gland; and 3) nodules in which the index of labeled nuclei of the parenchyma and stroma was higher than that of other normal acini of the same mice. Most of the nodules studied belonged to the 3rd group. The capacity of parenchymal cells to proliferate intensively and the capacity of the cells to induce stromal responses are two different signs of carcinogenesis.

- 5401 EARLY HISTOLOGICAL AND HISTOCHEMICAL CHANGES DURING EXPERIMENTAL PRODUCTION OF LIVER CARCINOMA BY DIETHYLNITROSAMINE. (Ger.) Schmitz-Moormann, P. (Path. Inst. U. Marburg and Bonn, West Germany), P. Gedigk and A. Dharamadhach. *Z Krebsforsch* 77:9-16, 1972.

Metabolic changes in hepatocytes at the outset of experimentally induced carcinogenesis were studied by means of enzymatic histochemical procedures. Seventy-six Wistar rats were given drinking water containing diethylnitrosamine (DNA) as a 0.0075 % solution. There were 24 normal controls. The animals were sacrificed at intervals of 7-10 days, in groups of 3 experimental and 1 control, and the livers examined. Carcinogenesis of the liver, on the basis of histological and histochemical manifestations, revealed two distinct cell changes. In the first phase (up to 62 days), a coarse, succeeded by a fine, vacuolization was associated with glycogen and RNA depletion beginning in the center of the lobules. This process expanded with formation of a venous network. A decrease in activity of all enzymes was seen. During the fine vacuolization stage, this process was reversed for the glycogen, RNA, and enzyme activity. The second phase (63-86 days) islets of glycogen-storing hepatocytes appeared in the center of the lobules. These changed to basophilic cells and later became primary carcinoma cells, observed in the third phase (87-127 days). The basophilic cells increased, whereas the glycogen cells decreased. Some macroscopically demonstrable carcinomas were already evident in this phase. From the 128th day on, all the animals revealed one or more macroscopic carcinomas. Trabecular, solid, tubular, and anaplastic carcinomas differed markedly in enzyme profile. Differences in enzyme activity may be due to further mutations which affect the cell organization and metabolism, a preponderance of one particular strain of carcinoma, or the

presence of a variable regulative potential in the primary carcinoma cells which affects enzyme activity.

- 5402 INFECTIOUS MONONUCLEOSIS PRIOR TO ACUTE LEUKEMIA: A POSSIBLE ROLE FOR THE EPSTEIN-BARR VIRUS. (E.) Levine, P. H. (Natl. Cancer Inst., Bethesda, Md.), D. A. Stevens, P. F. Coccia, L. Dabich and A. Roland. *Cancer* 30(4):875-880, 1972.

Antibody titers to Epstein-Barr virus (EBV) "viral capsid antigen" (VCA) and to EBV-associated "early antigen" (EA) were measured by indirect immunofluorescence in sera of three patients in whom infectious mononucleosis (IM) preceded acute lymphocytic leukemia (ALL). Patients were males aged 19, 12 and 16 yr. In one case, ALL appeared in connection with a recurrence of IM 17 months after a prior diagnosis of IM. In the other two cases, ALL was diagnosed a month after appearance of IM. All three patients had anti-EBV VCA antibodies and two had anti-EBV EA antibodies. Although IM and ALL are likely caused by different viruses, EBV may activate an oncogenic process in a manner similar to that described for murine leukemia.

- 5403 OAT-CELL CARCINOMA OF THE LUNG: CLINICAL AND MORPHOLOGICAL STUDIES IN RELATION TO ITS HISTOGENESIS. (E.) Hattori, S. (Ctr. Adult Dis., Osaka, Japan), M. Matsuda, R. Tateishi, H. Nishihara and T. Horai. *Cancer* 30(4):1014-1024, 1972.

Twenty-four cases of oat-cell carcinoma of the lung and four cases of bronchial carcinoid tumor were studied electron microscopically. Serotonin levels of serum and tissue were determined in all cases, and ACTH was assayed in the tumor tissue of seven cases. Neurosecretory-type granules were usually observed in the tumor cells, and they were found concentrated in the pseudopod-like cytoplasmic processes. Serum and tumor tissue serotonin levels were frequently elevated and seemed to correlate to the number of neurosecretory-type granules in tumor cells. In five out of seven cases of oat-cell carcinoma, ACTH and serotonin were simultaneously detected in the tumor tissue. In 139 cases of other types of lung cancer, these granules were not observed, and neither serotonin level nor ACTH activity was elevated in the tumor. These results strongly suggest that oat-cell carcinoma is a special type of lung tumor producing neurosecretory-type granules and also a highly malignant variant of bronchial carcinoid tumor originating in Kulchitsky-type cells found in bronchial glands.

- 5404 FOREIGN-BODY TUMORIGENESIS IN MICE: ULTRASTRUCTURE OF THE PRENEOPLASTIC TISSUE REACTIONS. (E.) Johnson, K. H. (Coll. Vet. Med., St. Paul, Minn.), H. K. G. Ghobrial, L. C. Buoen, I. Brand and K. G. Brand. *J Nat Cancer Inst* 49(5):1311-1319, 1972.

Plastic films were implanted s.c. in the flanks of CBA/H or CBA/H-T6 mice. The implants with their surface-attached cells and surrounding capsules were excised at predetermined intervals (i.e., 1/2, 4, 6, 7, 8, 9, and 10 months post implantation) prior to the development of sarcomas. A portion of the excised implant-capsule complex from each animal was processed for electron microscopic study. Direct flat-face embedding in Spurr's epoxy resin facilitated ultrastructural analysis of film-induced preneoplastic cell and tissue reactions *in situ*. The same general reaction zones were observed in all specimens, regardless of the duration of implantation. The only cells seen in the film-attached monolayer were dormant-appearing macrophages, which also predominated in the space between the monolayer and capsule. The capsule consisted mainly of parallel planes of fibrocytes or fibroblasts separated by bands of mature collagen, but varying numbers of macrophages, neutrophils, eosinophils, and mast cells were also in some specimens. Blood vessels were always restricted to the outermost area of the capsule (i.e., 70-285 μ from the film surface). It was not determined whether the macrophage population is the source of foreign body-induced sarcomas. However, the morphologic appearance and functional reactivity of macrophages possibly reflect specific microenvironmental changes during preneoplastic development.

- 5405 ULTRASTRUCTURE AND HISTOGENESIS OF PERIPHERAL GIANT CELL REPARATIVE GRANULOMA OF THE JAWS.

(E.) Sapp, J. P. (Fac. Med. Dentistry, U. Western Ontario, London, Canada). *Cancer* 30(4):1119-1129, 1972.

- 5406 ELECTRON MICROSCOPIC STUDY OF SO-CALLED "PULMONARY SCLEROSING HEMANGIOMA". (E.)

Hill, G. S. (Johns Hopkins Hosp., Baltimore, Md.) and J. C. Eggleston. *Cancer* 30(4):1092-1106, 1972.

- 5407 THE FIBROCYTIC DERIVATION OF THE SO-CALLED EPITHELIOID SARCOMA. (E.) Fisher, E. R.

(Shadyside Hosp., Pittsburgh, Pa.) and B. Horvat. *Cancer* 30(4):1074-1081, 1972.

- 5408 CANCER OF THE MIDDLE EAR IN A YOUNG CHILD (ETHIOPATHOGENETIC CONSIDERATIONS). (Fr.)

Grimaud, R. (Nancy, France), B. Bodelet, Schlienger, C. Macinot, M. Pernot and M. F. Eschwege. *Ann Otolaryngol Chir Cervicofac* 89(7-8):435-439, 1972.

See also:

- * (Rev): 5001, 5013, 5058, 5061, 5070
- * (Chem): 5073, 5090, 5097, 5102, 5120, 5128, 5151, 5169, 5171
- * (Phys): 5201
- * (Viral): 5248, 5287
- * (Immun): 5291, 5360

- 5409 CHILDHOOD MALIGNANCIES IN CENTRAL INDIA. (E.) Grover, S. (Med. Coll., Nagpur, Maharashtra, India) and U. D. Hardas. *J Nat Cancer Inst* 49(4):959-967, 1972.

Cancer was diagnosed in 220 children under 15 yr (144 boys and 76 girls) treated at a hospital in central India from 1966-1971. There was a high frequency of Hodgkin's disease, chronic leukemia, retinoblastoma, and oropharyngeal carcinoma and a low frequency of neuroblastoma. The high frequency of retinoblastoma could be attributed partially to greater ease of diagnosis of this visible malignancy. The relatively high frequency of oropharyngeal carcinoma apparently represents the childhood counterpart of a well-known adult predisposition to this form of cancer in India. Analysis of data from the other part of the Indian subcontinent shows considerable variation in the frequency of childhood cancer according to cell type. Critical epidemiologic methods are required to incriminate genetic, environmental and other oncogenic factors for the variation in frequency of childhood malignancies in India.

- 5410 ANALYSIS OF VARIATIONS IN THE CELL POPULATION KINETICS WITH TUMOR AGE IN THE L1210 ASCITES TUMOR. (E.) Dombernowsky, P. (Finsen Inst., Copenhagen, Denmark) and N. R. Hartmann. *Cancer Res* 32(11):2452-2458, 1972.

L1210 leukemia cells were passaged in DBA/2 mice by weekly i.p. inoculation of 10^5 cells; the mice were killed at intervals between four and nine days after inoculation, and tumor cell cycle kinetics were measured and analyzed using a computer method based on three alternative mathematical models for cell cycle kinetics. Cell growth in L1210 cells was exponential from four to six days postinoculation and cell doubling time (T_D) was 10.1 hr. T_D increased over time, reaching 25 hr between six and seven days postinoculation and 75 hr by seven to nine days. Growth fractions of 1.0, 0.96 and 0.56, resp., were yielded by the three models for the same tumor ages. Cell cycle time (T_C), calculated from the models, was 13.0, 21.0 and 15.3 hr, resp., five, six and eight days postinoculation. The increase in T_C was probably due to an increase in the mean transit time for all phases of the cell cycle. Cell loss was undetectable in five-day tumors, 0.1%/hr in six-day tumors and 2.5%/hr in eight-day tumors. Computer analysis indicated that mode of cell loss was an age-specific elimination of noncycling cells with post mitotic DNA content.

- 5411 TRENDS IN SOME CANCER MORTALITIES IN NEW ZEALAND. (E.) Milne, R. J. (Wellington Hosp., New Zealand), J. W. Logan and N. E. Logan. *NZ J Med* 75(478):149-152, 1972.

Annual death rates per 100,000 population in New Zealand were calculated for leukemia, malignant lymphoma and multiple myeloma during the period

1950-1968. Death rates for leukemia and malignant lymphoma increased by 35 and 30%, resp., in this period, while death rates from myeloma increased 250%. Patterns of incidence were seen for leukemia and lymphoma deaths; a seasonal variation in mortality rates was evident, with peak rates in summer and fall and low rates in winter.

- 5412 URANIUM MILL TAILINGS AND CANCER MORTALITY IN COLORADO. (E.) Mason, T. J. (Natl. Cancer Inst., Bethesda, Md.), J. Fraumeni, Jr. and F. W. McKay, Jr. *J Nat Cancer Inst* 49(3):661-664, 1972.

County-specific mortality statistics for cancer in Colorado from 1950-1967 were studied to determine if reported excessive mortality from lung cancer and leukemia in the Western Slope counties was associated with residential exposure to γ -radiation from uranium mill tailings. No significant excess in mortality from lung cancer or leukemia in the Western Slope counties was detected. Since 1961 there has been a nonsignificant increase in lung cancer among male residents in the Western Slope, but this probably reflects a diluted rate of occupationally induced cancer among uranium miners. Mortality from malignant neoplasms other than lung cancer and leukemia was significantly greater among Western Slope males, but a relation to radiation exposure appears unlikely. Continued monitoring of the population for radiation effects is needed.

- 5413 U.S. CANCER MORTALITY: NONWHITE PRE-DOMINANCE. (E.) Burbank, F. (Natl. Cancer Inst., Bethesda, Md.) and J. F. Fraumeni, Jr. *J Nat Cancer Inst* 49(3):649-659, 1972.

A study of cancer mortality trends in the United States between 1950-1967 revealed an increasing nonwhite-to-white ratio of age-adjusted death rates. Non-white predominance began in 1950 for females and in 1956 for males. Since 1950 males of both races showed increased cancer mortality, but the increase was more rapid among nonwhites. Death rates among white females have declined, while death rates for nonwhite females have remained stable. Nonwhite predominance in cancer mortality was statistically significant for both sexes with nasal cancer, oral cancer, esophageal and gastric cancer and multiple myeloma. Mortality rates for nonwhites rose more rapidly with age than did rates for whites. These data suggest that nonwhites are more exposed or more vulnerable than are whites to carcinogenic factors.

- 5414 LUNG CANCER IN A STEEL CITY: ITS POSSIBLE RELATION TO FLUORIDE EMISSIONS. (E.) Cecilioni, V. A. (Hamilton Gen. Hosp., Ontario, Canada). *Fluoride* 5(4):172-181, 1972.

Between 1966-1968, 300 deaths from primary lung cancer

occurred in the industrial steel city of Hamilton, Ontario. This represents an annual death rate of 34/100,000 population. A breakdown of the city into zones revealed three distinctly different rates: a high of 65/100,000 in the northeast end of the city close to the steel mills; a low of 12/100,000 in the section farthest from the steel mills and 23/100,000 in the intermediate zone. A marked rise in steel production in Hamilton and a corresponding increase in the use of fluorspar (calcium fluoride) as a fluxing agent occurred during the same period. Thus, increased fluoride emissions from the mills may have contributed to causation of lung cancer. Contamination of vegetation and the atmosphere by fluoride was established. The male:female ratio of lung cancer deaths in the high-mortality areas was 14.7:1. A relationship between cigarette smoking and lung cancer was clearly evident.

5415 A SEQUENTIAL SPACE-TIME CLUSTER ANALYSIS OF CANCER MORTALITY IN THE UNITED STATES: ETIOLOGIC IMPLICATIONS. (E.) Burbank, F. (Natl. Cancer Inst., Bethesda, Md.). *Am J Epidemiol* 95(5):393-417, 1972.

A cluster analysis and a time-trend analysis were performed on cancer mortality figures for the United States from 1950-1967. For males, 33 tumor types fitted into one of five geographic clusters and 15 tumor types remained unclustered. For females, 34 tumor types were clustered and 16 unclustered. Time-trend analysis showed rising and falling incidences of tumor types (reticulum cell sarcoma was found to be the most rapidly rising tumor type). When cancer mortality in each of the five cluster areas was divided into rising and falling categories, it became possible to postulate 11 hypothetical carcinogens associated with the 33 clustering tumor types in men and women. One hypothetical carcinogen was postulated to be the causal agent for reticulum cell sarcoma, lung, hypopharynx, floor of mouth, pancreas and six other cancers with a rising incidence. These cancers clustered in the New England and Great Lakes regions. The carcinogen was postulated to be related to cigarette smoking. Solar radiation and "endocrine factors" were two other actual carcinogenic agents which were provisionally identified among the hypothetical carcinogens. Each hypothetical carcinogen was the cause of more than two diverse tumor types, and each had determined the predominant geographic and temporal distribution of the tumor types with which it was associated.

5416 STOMACH CANCER AMONG JAPANESE IN HAWAII. (E.) Haenzel, W. (Natl. Cancer Inst., Bethesda, Md.), M. Kurihara, M. Segi and R. C. K. Lee. *J Nat Cancer Inst* 49(4):969-988, 1972.

Data on food habits, tobacco use, birthplace and occupation were collected from 220 Hawaiian Japanese with stomach cancer and from 440 matched hospital controls. Relative risks for stomach cancer were determined for migrants (Issei) and Nisei and for

Japanese and Western foods. Issei from prefectures with the highest stomach cancer risks in Japan continued to display an excess risk in Hawaii, but this effect did not persist among their Nisei offspring. Lower risks were suggested for Nisei, but not Issei adhering to Western-style diets. These nativity distinctions are consistent with other studies suggesting that early exposures are critical. Associations of stomach cancer with consumption of specific foods were noted. Elevated risks were described for Issei and Nisei users of pickled vegetables and dried/salted fish, the most frequent consumers having the highest risks. Since similar associations did not appear for raw fish and unprocessed vegetables, suspicion is directed to methods of preparation. Low risks were suggested for several Western vegetables, many of which are eaten raw. The associations for uncooked vegetables appeared independent of those found for pickled vegetables; both persisted after control for other facets of vegetable consumption. Associations for tobacco, liquor, coffee, and milk were observed only in the Issei population. Points of consistency between the Hawaii findings and those assembled in Japan are cited. Experimental evidence bearing on the epidemiologic data for processed fish and vegetables is mentioned.

5417 LEUKEMIAS IN THE CRACOW REGION IN THE YEARS 1961-1968 AND CONTAMINATION OF THE ENVIRONMENT BY PESTICIDES. (E.) Janicki, K. (Med. Acad., Cracow, Poland). *Acta Med Pol* 13(1):49-71, 1972.

An attempt was made to correlate leukemia morbidity with intensity of use of chemical agents for plant protection in the Cracow, Poland, region. Data on leukemia incidence and use of chemical agents in this area between 1961-1968 were subjected to statistical analysis. Results indicated several statistically significant correlation coefficients between rural leukemia morbidity and use of chemicals, especially pesticides, seed dressing and herbicides.

5418 INCIDENCE OF LEUKEMIA AND NONLYMPHATIC TUMORS IN MICE WITH GLOMERULOSCLEROSIS AND ALLIED DISORDERS. (E.) Yuhas, J. M. (Oak Ridge Natl. Lab., Tenn.) and N. K. Clapp. *J Nat Cancer Inst* 48(2):367-373, 1972.

The pathology records of 311 RF female mice that died spontaneously were examined for possible non-random associations among five diseases: severe glomerulosclerosis, polyarteritis, arterial hyalinization, leukemia and nonlymphatic tumors. Significant deviations from expected nonrandom occurrence were observed in only two cases. The incidence of polyarteritis (17 of 311 mice) was four times and that of arterial hyalinization (8 of 311 mice) was eight times that expected ($P < 0.01$). The incidence of leukemia (primarily reticulum cell sarcoma) in each of the four disease combinations involving glomerulosclerosis was reduced to about half that expected from random occurrence. No deviations from expectation

could be demonstrated for the incidence of non-lymphatic tumors in glomerulosclerotic mice or in mice with leukemia. No significant differences were observed between leukemic and nonleukemic mice in terms of the site of the nonlymphatic tumors or the frequency of multiple tumors. It was postulated that the decreased incidence of leukemia in glomerulosclerotic mice may be the result of an immune reaction against the leukemia virus which reduces the incidence of leukemia while producing a glomerulosclerotic response.

5419 THE BASIS FOR A TUMOR EPIDEMIOLOGICAL STUDY ON CARCINOMA OF THE BREAST IN THE GDR. (Ger.)

Bauldauf, K. (Dept. Med., Humboldt U., Berlin, East Germany), S. Möpert and G. Mildner. *Radiobiol-Radiother* 12(6):695-714, 1971.

Data necessary for an epidemiologic study are reviewed. The basis for sample selection is often purely random, each of the factors in the study having an equal probability for selection. A study which encompasses a number of factors (age, sex, place of residence, etc.) may use various methods for the selection of a representative sample: pure chance; chance selection in various categories; selection in clumps (as with territorial sampling); and a selection based on sequential events. In the construction of a questionnaire aimed at establishing, for example the etiology of mammary carcinoma, it is important to select reliable individual contact through a semistandardized interview. The establishment of contact is effected by means of a nonstandard interview to begin with. A questionnaire used in an East German epidemiologic study of breast cancer is reproduced. Women from 55 districts were interviewed over a one-yr period by means of the questionnaire.

5420 EPIDEMIOLOGICAL INVESTIGATIONS OF RETICULUM-CELL-SARCOMA AND LYMPHOCYTOSARCOMA IN THE G.D.R.: REPORT ON 4048 CASES. (Ger.) Wolf, M. (Inst. Cancer Res., Ger. Acad. Sci., Berlin, East Germany), H.-J. Herold, W. Gibel and W. Stanezek. *Arch Geschwulstforsch* 39(3):229-239, 1972.

The incidence, organ distribution and sex-orientation, age effect, geographical distribution and comparison with international standards of occurrence of reticular cell sarcoma (RS) and lymphocyte sarcoma (LS), were obtained in 4048 cases in East Germany. Frequency of RS was 3.5 times that of LS. Occurrence in the lymph-node region was 43.2% for RS and 69.4% for LS, both occurring maximally in this region in comparison with other organs. The sex proneness, for all organ groups (for LS and RS), favors the females. Sex differences in susceptibility to RS shows the epipharynx, small intestine, retroperitoneum, respiratory organs and urinary system to be affected most often in males. Up to age 35, the incidence of both RS and LS is low; the maximum figures occur at age 75, men being more susceptible than women at this age. This long latent period is thought to be connected with cumulative exogenous toxic effects.

5421 CANCER MORTALITY AMONG AMERICAN INDIANS, 1950-67. (E.) Creagan, E. T. (Natl. Cancer Inst., Bethesda, Md.) and J. F. Fraumeni, Jr. *J Nat Cancer Inst* 49(4):959-967, 1972.

Between 1950-1967, 2703 American Indian males and 3194 females were reported to have died from cancer. Gallbladder cancer was the only tumor in which mortality among Indian males and females was significantly higher than that among both white and black males and females in the United States. Other surveys have noted increased susceptibility of Indians to a variety of gallbladder diseases: neoplastic, calculous, and inflammatory. Indian females had a significant excess in mortality from cancers of the thyroid, and the nose and paranasal sinuses. However, Indian mortality from all neoplasms combined was significantly lower than expected, especially among males. Deficits in Indian mortality were statistically significant for many cancer sites, particularly large intestine, rectum, lung, prostate, breast, ovary, bladder, and brain, and for Hodgkin's disease. The favorable cancer mortality reported for Indians may be related to their high frequency of diabetes, since other population groups have exhibited a negative correlation between these disorders. The unusual patterns of cancer mortality among Indians suggest advantages in the use of this population for etiologic studies of cancer.

5422 GEOGRAPHIC CLUSTERING OF BRAIN TUMORS IN KENTUCKY. (E.) Brooks, W. H. (U. Kentucky Med. Sch., Lexington). *Cancer* 30(4):923-926, 1972.

An attempt was made to determine the geographic distribution of 612 brain tumors reported in Kentucky from 1963-1969. A geographic cluster was revealed in the eastern section of the state when the tumors were grouped according to county and adjusted for population. The incidence of all brain tumors within these six counties was 3.37 times that of the remainder of the state; the incidence of gliomas within the area was 4.4 times that expected. Within the counties, 66.1% of cases were located along major tributaries of the Kentucky and Licking Rivers. The possibility of contamination of water with chemical carcinogens is suggested as an environmental factor in the production of primary intracranial neoplasms.

5423 SOME FEATURES OF THE MORBIDITY FROM OVARIAN CARCINOMA IN BULGARIA. (Bul.) Velkov, G. (Sci. Res. Inst. Oncol., Sofia, Bulgaria) and N. Monov. *Akush Ginekol (Sofia)* 10(5):382-386, 1971.

The incidence of ovarian carcinoma among Bulgarian women was studied during the 1953-1957, 1961-1964, and 1965-1968 periods. Average indexes of 3, 6.15, and 7.86/100,000 for each period in chronological sequence indicate an increasing trend and an almost threefold increase during the last period under consideration. While least prevalent among the genital carcinomas during the first period, the incidence of

ovarian cancer exceeded that of uterine corpus carcinoma during the second period and almost reached that of cervical carcinoma during the third period. The lowest incidence in ovarian carcinoma was ascertained in the below 29 yr age group; highest figures were found among the 50-59 yr age group with 9.44, 17.73, and 20.22/100,000 indexes for the three consequently considered periods. The incidence indexes increased from 2.7 to 5.8 and 7.4/100,000 among rural women and from 4.6 to 6.0 and 8.6/100,000 among urban women during the same three periods. Further studies are required to interpret the above findings.

- 5424 ALIMENTARY FACTORS IN THE EPIDEMIOLOGY OF GASTRIC CANCER. (E.) Graham, S. (Dept. Social Preventive Med., St. U. New York, Buffalo), W. Schotz and P. Martino. *Cancer* 30(4): 927-938, 1972.

One hundred and sixty male patients and 68 female patients with gastric cancer were compared with controls as to frequency of consumption of certain types of food and modes of food preparation. To control age and socioeconomic factors, the cancer patients and the controls, who had no neoplastic or gastrointestinal disease, were matched on age, birthplace, and ethnic background. Item-by-item analysis of diet for both sexes showed that patients more frequently ingested potatoes, ate lettuce less often, ate more irregularly, and used cathartics frequently. Because diets typically do not consist of single items of food, scaling techniques were used to distinguish differences between cases and controls in frequency of use of groups of food previously hypothesized to be related to the disease. No differences were observed in: 1. duration of use of the several fats used in frying; 2. frequency of ingestion of the various foods consumed fried, considered separately or together, weighting for the number used and the frequency of each; 3. frequency of eating all meats and fish considered separately or together, and 4. frequency of use of the various alcoholic beverages. There was a rather substantial difference in eating vegetables raw. Control patients ate larger numbers of vegetables raw than cancer patients. Low risk of gastric cancer was associated with ingesting in the uncooked state lettuce, tomatoes, carrots, coleslaw, and red cabbage, and risk declined with increases in the number of these vegetables eaten raw.

- 5425 DATA ON THE INCIDENCE OF LEUKEMIAS IN SOCHI AND TUAPSE (1960-1969). (Rus.) Lebedev, V. N. (Sochi Oncol. Clin., USSR), S. G. Belikova, B. A. Betskii, L. A. Korneeva, Yu. L. Lebedeva, M. I. Moiseenko and R. Kh. Yunicheva. *Probl Gematol Pereliv Krovi* 17(2):30-32, 1972.

A total of 360 cases of hemoblastoses was reported in Sochi and Tuapse for 1960-1969. This corresponds to a mean annual incidence index of 14.11/100,000 population. The mean annual index for male (14.54)

exceeded that (13.74) for female patients. The mean annual index of mortality from hemoblastoses was 10.08/100,000 population. The mortality index for acute leukemia was 3.65/100,000; for chronic leukemia, 3.53; for leukemias with destructive growth, 2.90. The incidence of leukemias in 1960-1969 was 51.7/100,000 for Sochi and 60.1/100,000 for Tuapse.

- 5426 LUNG CANCER AND GASTRO-INTESTINAL CANCER IN MINERAL OIL WORKERS. (E.) Waterhouse, J. A. H. (Reg. Cancer Registry, U. Birmingham, England). *Ann Occup Hyg* 15:43-44, 1972.

Evidence is presented which suggests that mineral oil mist is capable of inducing skin, pulmonary, and upper GI tumors in man. Previous studies had shown that the incidence of epitheliomas of the scrotum was increased in men working in the light engineering works of Birmingham, England, where there was exposure to mineral oils. A review of the records of the Birmingham Regional Cancer Registry for the period 1936 to 1967, which included 228 cases of scrotal epithelioma, has shown that the incidence in these patients of second primary tumors of the skin, respiratory system, and upper digestive tract was 3.34 times that expected.

- 5427 INCIDENCE OF LEUKEMIA IN CHILDREN FROM THE BIALYSTOK PROVINCE AND THE CONTENT OF ABSORBABLE MAGNESIUM IN SOIL AND ITS ACIDITY. (Pol.) Rudobielska, M. (Dept. Pediat., Acad. Med. Bialystok, Poland), J. Kurpios, M. Kaczmarzski and I. Krasowska. *Pediatr Pol* 47(6):695-701, 1972.

- 5428 AUSTRIAN REGISTER FOR TUMORS IN INFANCY AND CHILDHOOD. (Ger.) Brandesky, G. (Inst. Cancer Res., U. Vienna, Austria), F. Helmer, H. Henkel, K. Karrer, W. Kovac, R. Rauhs, H. Sauer and P. Wurnig. *Paediatr Paedol* 7(3):235-239, 1972.

- 5429 CANCER IN CONNECTICUT, 1969. (E.) Christine, B. W. (Connecticut Tumor Registry), J. T. Flannery and P. D. Sullivan. *Conn Hlth Bull* 86(4):103-114, 1972.

See also:

- * (Rev): 5013, 5022, 5038, 5050, 5065
* (Immun): 5312

- 5430 SEARCH FOR GENETIC INFLUENCES ON NEOPLASTIC TRANSFORMATION AND CHROMOSOMAL STABILITY OF MOUSE CELLS CULTURED IN MEDIUM SUPPLEMENTED WITH HORSE OR FETAL BOVINE SERUM. (E.) Parshad, R. (Nat'l. Cancer Inst., Bethesda, Md.) and K. K. Sanford. *J Nat Cancer Inst* 49(4):1155-1163, 1972.

Embryonic cells from three inbred mice strains differing in incidence of spontaneous tumors and susceptibility to induction of tumors were studied for serum effects on neoplastic transformation and chromosome stability. The three mouse strains were A/HeN, germfree ALBM-2, and I/An. The cells were cultured in chemically defined medium NCTC 135 supplemented with horse or fetal bovine serum. A differential effect of these two sera on spontaneous neoplastic transformation was found in the cell lines from the A and ALBM-2 mouse but not in cells from the I mouse. Cells from all three inbred strains showed the differential serum effect on chromosome stability. Cells in horse serum shifted more rapidly from diploidy and had a higher frequency of abnormal chromosomes than those in fetal bovine serum. Greater karyotypic stability, particularly with respect to structural alterations, was observed in the cultured cells from the germfree ALBM-2 mouse than in any other mouse strain studied.

- 5431 TESTICULAR TUMORS IN CHILDHOOD: REPORT OF 545 CASES. (Ger.) Bachmann, K. D. (Pediat. Clin. Westphalia, Wilhelm U., Münster, West Germany) and H. von Grawert. *Monatsschr Kinderheilkd* 120(1):40-46, 1972.

Three children with testicular tumors (a Leydig cell tumor, a reticular sarcoma, and an embryonal teratoma, resp.) are presented, and an additional 542 cases of childhood testicular tumors reported in the literature are analyzed. Sixty-five percent of the reported tumors originated in the germ cells; of these, the most frequent were embryonal carcinomas (24.6%), followed by differentiated teratomas (16%) and adenocarcinoma (15.8%). Among the testicular tumors that did not originate in the germ cells, 10% were Leydig cell tumors and 5% were Sertoli cell tumors. According to the literature, malignancy is more likely to occur in the undescended testicle, although this has not been proven. Some authors claim that tumor formation is associated with trauma; this again has not been substantiated by factual data. Almost invariably, therapy consists of an orchidectomy. Preoperative irradiation is contraindicated for reasons of loss of valuable time; changes in the histological picture which complicate classification and subsequent therapy; inadvertent radiation of benign tumors; and possible effects on spermiogenesis of the healthy testicle. Postoperative irradiation may be helpful in the palliative effects on metastases. The prognosis is better for children under three yr.

- 5432 LONG-TERM SERUM COPPER STUDIES IN ACUTE LEUKEMIA IN CHILDREN. (E.) Tessmer, C. F. (M. D. Anderson Hosp. Tumor Inst., Houston, Texas),

M. Hrgovcic, F. B. Thomas, J. Wilbur and D. M. Mumford. *Cancer* 30(2):358-365, 1972.

Twenty-five children with acute leukemia were studied for the extent of correlation between serum copper levels (SCL) and bone marrow blast cell counts. "Correlation" implies that the serum copper and the blast percentage are both within or both outside their defined clinically normal ranges. Serum copper showed positive correlation with blast cells in 61% of all paired data. These data were divided into two periods, one consisting of the first 30 days after initial treatment was started and the second, the total period after initial therapy for which adequate paired values were available. In the initial 30-day period, there is complete correlation (100%) between serum copper and bone marrow blast percentages. With more extended intervals up to 266 days, the correlation drops to 57.1%. A 77% correlation was found for SCL and marrow blast percentage in leukemia patients in remission. Among conditions associated with noncorrelation of SCL and marrow blast percentage were neoplastic extramedullary proliferation; viral infections, lymphoma development, and respiratory, ear and other "miscellaneous" infections. It was concluded that abnormal SCL reflected abnormal cellular proliferations.

- 5433 *IN VITRO* TRANSFORMATION OF A NEW CELL LINE FROM CHINESE HAMSTER EMBRYOS: EVOLUTION OF TRANSPLANTABILITY, KARYOTYPE AND CELL SURFACE. (Fr.) Berebbi, M. (Res. Service C.R.A.C.M., Marseille, France), Ph. De Micco and G. Meyer. *C R Acad Sci [D] (Paris)* 274(5):772-775, 1972.

A new line of cells from embryos of Chinese hamsters (*Cricetulus griseus*) was successfully and progressively transformed *in vitro*, as evidenced by changes in morphologic and karyologic features and changes in cell surface properties. The cells were cultured in Eagle medium with 10% bovine fetal serum and 0.25% trypsin. After the 15th passage, the culture seemed to be deteriorating, but at the end of one month the first colonies appeared. The culture was redispersed and thereafter developed normally. Cell agglutinability was tested with Concanavalin A and the results expressed as an agglutinability coefficient (AC) indicating time of latent stage, stage of maximal agglutination and the time required to reach this stage. The AC increased from 1 during the 27th passage to 10 during the 43rd passage in a nonlinear manner. Transplantability of cells from the 20th, 35th, and 45th passages was tested by inoculating 2×10^6 cells into the cheek pouch of cortisone-treated Syrian hamsters. The cells induced tumors in 50% of the cases. Karyologic analysis during the 12th, 32nd, and 42nd passages disclosed evolution of the cell strain toward hyperploidy from 22 to 24 chromosomes. In the 42nd passage, populations with 23, 24 and 25 chromosomes were trisomic for the sixth chromosome.

- 5434 KINETIC STUDIES ON PHOSPHOFRUCTOKINASE FROM EHRlich ASCITES TUMOR CELLS. (E.) Sumi, T. (Fac. Pharm. Sci., Hokkaido U., Sapporo, Japan) and M. Ui. *Biochim Biophys Acta* 276(1):19-30, 1972.

Phosphofructokinase (Fru-6-P) was isolated from Ehrlich ascites tumor cells and observed using a coupled assay system employing various substrates and effectors. Fru-6-P at different concentrations was inhibited by high concentrations of ATP; ATP inhibition decreased as Fru-6-P concentration increased. The binding of ATP to the inhibitor site of Fru-6-P may have been abolished by Fru-6-P at saturating concentrations. The cooperative interactions displayed by this enzyme are completely lost in the presence of a saturating concentration of any of the positive effectors (Pi, AMP, ADP, SO_4^{-2}). The resultant hyperbolic saturation curve for Fru-6-P or ATP shows the same pattern regardless of the kind of effectors used, except for the case of ADP which, besides functioning as a positive effector, is inhibitory competitively with ATP. Cooperative interactions of Fru-6-P were completely lost in the presence of a saturating concentration of any of the effectors. All effectors except ADP failed to interact with Fru-6-P catalytic sites, acting instead to abolish allosteric properties of Fru-6-P.

- 5435 INHIBITION OF GLYCOLYSIS IN ASCITES TUMOR CELLS PREINCUBATED WITH 2-DEOXY-2-FLUORO-D-GLUCOSE. (E.) Coe, E. L. (Northwestern U. Med. Sch., Chicago, Ill.). *Biochim Biophys Acta* 264(2):319-327, 1972.

The effect of 2-deoxy-2-fluoro-D-glucose (2-deoxy-2-F-Glc) on glycolysis of a hyperdiploid strain of Ehrlich ascites carcinoma cells was studied *in vitro*. Cell suspensions were preincubated at room temp. ten to 15 min in buffer with or without 2-deoxy-2-F-Glc. The reaction was initiated by addition of 10 mM glucose. Reactions were terminated five to 30 sec later by acidification with perchloric acid. The neutralized acid extract was analyzed for glycolytic intermediate content by enzymatic and spectrophotometric assay. 2-Deoxy-2-F-Glc metabolism was determined in the same manner except that the preincubation step was omitted. In controls, glucose-6-P and fructose-6-P had already reached their maxima (1.8 and 0.5 $\mu\text{moles/ml}$ cells, resp.) at five sec, and levels declined through the remainder of the incubation period. In cells preincubated with 0.5 mM 2-deoxy-2-F-Glc, both hexose monophosphates reached a maximum more slowly (about ten sec) and declined more slowly. Preincubation with 2-deoxy-2-F-Glc depressed fructose-1,6-diP to about one-third the value of controls (11 $\mu\text{moles/ml}$ cells). Triose phosphate was relatively constant and was not appreciably affected by 2-deoxy-2-F-Glc. The phosphoglyceric acids plus phosphoenol pyruvate level tended to rise gradually in analogue-treated cells, whereas it tended to remain constant (2.5 $\mu\text{moles/ml}$ cells) or decline slightly in controls. Pyruvate levels showed a transient rise in controls and a transient decline in treated cells. The

rates of accumulation of lactate were about the same in control and in treated cells. Calculation of the velocities of glycolytic enzymes from intermediate accumulation rates between five and 15 sec after glucose addition revealed a 20-40% inhibition of hexokinase, phosphoglucose isomerase and fructose-6-P kinase, and a slight stimulation of the remainder of glycolysis, thus indicating a block by 2-deoxy-2-F-Glc at or prior to fructose-6-P-kinase. The effect of 2-deoxy-2-F-Glc on the hexokinase reaction of intact cells was determined by using 2-deoxyglucose as a substrate, since 2-deoxy-glucose is phosphorylated by hexokinase but is not further metabolized. The results showed that 2-deoxy-2-F-Glc caused a 30% inhibition of 2-deoxyglucose consumption at both low and high substrate concentrations, indicating that the hexokinase inhibition by 2-deoxy-2-F-Glc was noncompetitive. The actual inhibitory compound could not be identified.

- 5436 SMALL MOLECULAR WEIGHT RNA COMPONENTS IN EHRlich ASCITES TUMOR CELLS. (E.) Høllung-Larsen, P. (Fac. Med., U. Copenhagen, Denmark) and S. Frederiksen. *Biochim Biophys Acta* 262(3):290-307, 1972.

Nuclear and cytoplasmic preparations from Ehrlich ascites tumor cells were extracted by four methods (hot phenol, cold phenol, triisopropyl-naphthalene sulphonate, or sodium dodecyl sulphate in reticulocyte standard buffer and phenol-chloroform), and the RNA was separated by polyacrylamide gel electrophoresis. The four different extraction procedures yielded patterns of small nuclear RNA (nRNA) components which were essentially identical. Ehrlich ascites cells contained five small nRNA components (L, A, C, D and F) which migrated more slowly than 5S RNA and three components (H_1 , H_2 and H_3) which migrated between 5S RNA and tRNA. Isolation and electrophoretic analysis of small nRNA from purified nucleoli and nucleoplasm, although complicated by the presence of large quantities of heterodisperse RNA, indicated that components C and D were localized in the nucleoplasm and component A in the nucleolus. Comparison of electrophoretic mobilities of ^{32}P -labeled nRNA and rRNA indicated that small nRNA was not of ribosomal origin nor was it formed by degradation of rRNA. Each of the small nRNA components comprised about 0.2 to 0.7% of total cellular RNA. Metabolism of small nRNA components L, A, C, D, H_3 and H_{1+2} was compared with that of 5S RNA, tRNA and rRNA by electrophoretic analysis of mixtures of *in vivo* ^{32}P -labeled RNA and *in vitro* ^3H -labeled RNA. $^3\text{H}/^{32}\text{P}$ ratios of the various components indicated that labeling kinetics of L, A, C, H_3 , tRNA and 5S RNA were not significantly different. H_{1+2} was labeled two to three times faster than small nRNA which in turn was labeled two to three faster than rRNA. Similar dual label experiments indicated that H_{1+2} , H_3 , L, A, C and D were either stable or were not transported from the nucleus to the cytoplasm. *In vivo* labeling with ^3H -methyl methionine showed that A, C, D, H_{1+2} and H_3 were methylated. Ascites cells were preincubated with either 3'-deoxyadenosine (15-30 $\mu\text{g/ml}$, 35 min, 37°C) or actinomycin D (44 $\mu\text{g/ml}$, 10 min, 37°C) followed

by a three hr incubation with ^3H -uridine. These were mixed with cells labeled with ^{32}P for 72 hr *in vivo* to study inhibition of small mRNA synthesis. Actinomycin D inhibited tRNA, H_{1+2} and H_3 less than A, C and D, which were in turn less inhibited than 5S RNA. $3'$ -Deoxyadenosine inhibited tRNA, H_{1+2} , H_3 and 5S RNA to about the same extent, which was greater than the inhibition of A, C and D. Electrophoretic analysis of small mRNA from Ehrlich ascites cells, Yoshida ascites cells and L 5178 Y lymphoblasts showed identical mobilities for all components. L, C, D, 5S and tRNA from HeLa and Ehrlich cell nuclei showed identical migration patterns on polyacrylamide gels. Component A migrated differently and component K, present in HeLa cells, was absent in ascites cells.

- 5437 THE EFFECT OF CANCER ON CELL TURNOVER IN MOUSE ORGANS. (Ger.) Lockner, D. (Inst. Theoret. Alcohol Res., Karolinska Inst., Stockholm, Sweden), U. Ericson and A. Pettersson. *Z Krebsforsch* 77:1-8, 1972.

The cachexia which accompanies the cancer syndrome was studied with respect to cell turnover by determining the incorporation of ^{14}C thymidine into DNA in various mouse organs after inoculation of mice with ELD tumor. At a tumor size of 13% of body wt, total body wt remained unchanged, indicating the occurrence of a relative cachexia. The only significant reduction occurred in the intestinal fat content. The liver and spleen increased in wt, a change that was accompanied by increased DNA synthesis. The DNA turnover of all other organs remained unchanged. Tumor inoculation stimulated a transitory increase of DNA synthesis in kidneys and muscles. The results indicate that cachexia cannot be attributed to reduced cell synthesis or increased cell destruction in the organs examined. An early decrease of label in the spleen and a concomitant increase in the liver, kidney, and muscle may indicate cell migration.

- 5438 MIXED TUMORS OF SALIVARY GLANDS: LONG-TERM FOLLOW-UP. (E.) Krolls, S. O. (Armed Forces Inst. Path., Washington, D.C.) and R. C. Boyers. *Cancer* 30(1):276-281, 1972.

A long-term follow-up study of the behavior of mixed human tumors of salivary gland origin was undertaken to determine the recurrence rate and the histologic pattern associated with recurrence. Complete follow-up information was obtained in 89 of the first 100 cases of mixed salivary gland tumors diagnosed at the Armed Forces Pathological Institute after January 1, 1945. The median age at the time of surgery in this group was 29.5 yr, somewhat younger than the general experience. Seventy-eight of the patients were male and 11 were female. Both the above findings were biased, however, due to the military source of the cases. Seventy-five of the patients were Caucasians, nine were Negroes and one was Oriental (in four cases, race was not stated). There was no difference between white and nonwhite patients concerning the relative incidence of cases with respect to their respective

population sizes. Of the 89 tumors, 74 were located in the parotid gland, 11 in the submandibular gland, and four in minor salivary glands. There were none in the sublingual gland. Thirty-nine of the 89 patients experienced one to five recurrences each, corresponding to a recurrence rate of 43.8%. Most (53.9%) of the patients had only one recurrence. The highest recurrence rate was in the parotid gland, where 50% of the tumors recurred. The high recurrence rate in the series was most probably due to inadequate surgical removal of the primary lesion. Most recurrences occurred within ten yr. Most of the recurrent nodules were composed of a purely myxoid stroma, while a few were highly cellular.

- 5439 CONTENT OF NUCLEIC ACIDS IN SUBCELLULAR STRUCTURES IN NORMAL AND EXPERIMENTAL LEUKEMIA IN MICE. (Rus.) Bala, Yu. M. (Voronezh Med. Inst. USSR) and V. M. Lifshits. *Probl Gematol Pereliv Krovi* 16(12):41-44, 1971.

Quantitative changes in RNA and DNA levels were studied in the subcellular structures of the liver, spleen, tumor tissue, and pure culture of hemocytoblasts of mice with experimental (i.p. inoculated) leukemia. The levels of RNA and DNA were determined spectrophotometrically. The levels of nucleic acids in cell nuclei of the liver and spleen increased in acute reticulosis-hemoblastosis. The DNA levels in cell nuclei of the liver, spleen, tumor tissue increased in proportion to the levels of blast elements in the cells. In other words, the high DNA level in hemoblastic cells is due to the increase in the ploidy of these cells. A cytophotometric study showed that 16.5% of the hemocytoblasts studied were tetraploidy or higher. RNA/DNA ratio in the mitochondria decreased in the liver and spleen of animals with leukemia. The RNA levels in the microsomes of hemocytoblasts and tumor tissue cells were higher than those in the microsomes of the liver and spleen.

- 5440 PROTEIN CONTENT AND BIOLOGICAL ACTIVITY OF RIBOSOMAL PARTICLES OF CELLS FROM KREBS II ASCITES CARCINOMA. (Rus.) Fais, D. A. (Acad. Sci. USSR, Moscow), R. S. Shakulov and E. V. Klyachko. *Biokhimiia* 36(5):1033-1041, 1971.

Chemical composition and biological activity of ribosomes and polyribosomes from Krebs II ascites carcinoma cells, as affected by the detergent used for their isolation, were studied. Treatment of the mitochondrial supernate with a 1% sodium desoxycholate solution or with a mixture consisting of 0.5% sodium desoxycholate and 1% tween 40 produced ribosomes and polyribosomes with 1.57 g/cm³ and 1.50-1.54 g/cm³ buoyant densities in CsCl, resp. The ribosome and polyribosome density variations reflected their protein content. Regardless of their density or protein level, the ribosomes could be dissociated into non-deproteinized 60S and 40S subunits with 1.61 and 1.52 g/cm³ densities, resp. Thus the observed ribosome and polyribosome density variations depended on the presence of proteins that were not constituents of

the isolated 60S and 40S subunits. Recombination of the subunits resulted in ribosomes with a 1.57-1.58 g/cm³ density. Ribosomes and polyribosomes with buoyant densities in CsCl of 1.50-1.54 g/cm³ showed endogenous protein-synthesizing activity and were capable of synthesizing polyphenylalanine in the presence of polyuridines. On the other hand, ribosomes and polyribosomes with 1.57-1.58 g/cm³ density and the subunits were biologically inactive. In these denser ribosomes, protein-synthesizing factors are absent. Sodium desoxycholate-treated ribosomes and recombined subunits accomplish synthesis of polyphenylalanine in presence of polyuridines only by addition of protein fractions obtained by the dissociation of initial sodium desoxycholate-tween-treated ribosomes.

- 5441 ADENYL CYCLASE AND PHOSPHODIESTERASES IN SOMATIC HYBRIDS OF GLIAL CELLS. (Fr.) Benda, P. (Lab. Mol. Biol., Coll. of France, Paris), J. Premont and S. Jard. *C R Acad Sci [D] (Paris)* 275(12):1303-1306, 1972.

The development of the adenylyl cyclase and phosphodiesterase activities of rat glial cells, 3 T 3 fibroblasts and of their hybrids, is described. The results confirm the existence in C 6 glial cells of an adenylyl cyclase sensitive to isoproterenol, and of two phosphodiesterases (PDE I and II). The marked increase in PDE I observed on the seventh day after culture initiation suggests the existence of an induction of this enzymatic activity, similar to the induction observed in fibroblasts under the influence of exogenous 3'-5'-AMP or repeated stimulation with prostaglandins. The hybrid glial cell C 6 x 3 T 3-4 fibroblast behaves in the same way as the parent 3 T 3. Although, on day 3, the hybrid responds with the same intensity as the glial cell to activation by isoproterenol, on days 5 and 7, it behaves as the parent fibroblast.

- 5442 NEONATAL ONCOLOGY. (Fr.) Gubern-Salisachs, L. (Corachan Inst., Barcelona, Spain) and L. Gubern-Pi. *Ann Chir Infant* 12(4):269-284, 1971.

Although at least 60% of the malignant tumors operated on in the first year of life are histologically congenital malformations, such tumors are rarely diagnosed in the neonate. This because the tumors are frequently too small to be apparent and because the association of tumors with neonates is rarely considered. Examples are given of congenital tumors that were diagnosed and treated during the neonatal period and of undiagnosed tumors that led to complications requiring emergency surgery. In some cases, the congenital origin of a tumor was evident only histologically; other undiagnosed tumors might have been suspected from clinical symptoms. Some practical measures are offered: the mother could be X-rayed during pregnancy to determine the possible existence of a tumor; a detailed examination of the placenta could reveal the invasion of a tumor; the neonate should be examined carefully with palpation

of the lumbar fossa, bearing in mind the frequency with which Wilms tumors and adrenal tumors occur in the very young infant. Abdominal and pulmonary tumors may also occur in the neonate. Benign tumors should certainly be extirpated since they do not disappear spontaneously and, if neglected, may cause life-endangering complications. Malignant tumors must also be extirpated; they are not always incurable.

- 5443 ANEMIC STRESS AS A TRIGGER OF MYELOGENOUS LEUKEMIA IN THE UNIRRADIATED RF MOUSE. (E.) Gong, J. K. (Sch. Dent., State U. New York, Buffalo), P. G. Braunschweiger and C. A. Glomski. *Science* 177(4045):274-276, 1972.

Thirty female RF mice, nine wk old, were bled of 50% of total blood volume from the posterior orbital sinus. Hematocrit values, white blood cell counts and percentages of different cell types were monitored for the lifetime of the mice. Mean survival time of the bled mice was 39 wk after bleeding. Ninety-six percent of bled mice developed fatal myelogenous leukemia (ML) by 15 months after venesection. All mice appeared to be naturally prone to ML development, but only 3 of 9 nonbled control animals had died by 65 wk. The anemia resulting from the bleeding was thought to have triggered the overt appearance of ML. The results support the concept of a two-step *de novo* induction of ML.

- 5444 THE MECHANISM OF ACTION OF THE EPIDERMAL GROWTH FACTOR. III. STIMULATION OF THE UPTAKE OF LABELED PRECURSORS INTO RNA, DNA AND PROTEINS BY EGF IN ISOLATED TUMOR CELLS. (E.) Covelli, I. (Inst. Gen. Path., U. Perugia, Italy), R. Mozzi, R. Rossi and L. Frati. *Hormones* 3(3):183-191, 1972.

Epidermal growth factor (EGF) was purified from the submaxillary glands of male mice and used to treat cultures of HeLa and KB (human rhinopharyngeal tumor) cells; ³H-thymidine, ³H-uridine and ¹⁴C-amino acids were also added to mixtures. In HeLa cells, uptake of ³H-thymidine, ³H-uridine and ¹⁴C-amino acids was greater in EGF-treated than in untreated cells, with the increase in ³H-uridine uptake being evident earlier than the increases in the other labeled precursors. Uptake of radioactive precursors in KB cells was also enhanced by EGF. Uptake of ³H-uridine and ¹⁴C-amino acid was lower in EGF-treated KB cells than in EGF-treated HeLa cells.

- 5445 DNA-DEPENDENT DNA POLYMERASES I AND II FROM NORMAL HUMAN-BLOOD LYMPHOCYTES. (E.) Smith, R. G. (Nat'l. Cancer Inst., Bethesda, Md.) and R. C. Gallo. *Proc Nat Acad Sci USA* 69(10):2879-2884, 1972.

Two DNA-dependent DNA polymerases were purified from blood lymphocytes from normal humans and designated DNA polymerases I and II. Both I and II were physicochemically and enzymatically distinct proteins. DNA polymerase I sedimented as two peaks, corresponding to molecular wts of 300,000 and 150,000, while DNA

polymerase II had a molecular wt of about 30,000. II was evidently more basic than I. Unlike leukemic lymphoblast DNA polymerases, neither I nor II transcribed the heteropolymeric regions of 70S avian myeloblastosis virus RNA.

- 5446 DNA-SYNTHESIS TIME OF BONE MARROW CELLS IN HEALTHY AND ASCITES TUMOR-BEARING MICE. (E.) Lala, P. K. (Dept. Anat., McGill U., Montreal, Canada). *Cell Tissue Kinet* 5:79-85, 1972.

DNA-synthesis (S) times of myelocytes and nucleated erythroid cells in the bone marrow of 20 healthy female CF₁ mice and 24 female CF₁ mice bearing advanced Ehrlich ascites tumors were measured with a combined *in vivo-in vitro* double isotope labeling technique. Bone marrow from both femora of animals sacrificed shortly after i.v. injection of ³H-thymidine was placed in homologous plasma at 37 C and immediately incubated with ¹⁴C-thymidine for 15 min. Smears of double-labeled cells and of cells prior to incubation with ¹⁴C-thymidine were autoradiographed. Cells with 3H alone were those that moved out of S *in vivo* during a specified interval, while cells with ¹⁴C(±3H) were those in S at time of sampling. The number of 3H-labeled cells plotted as a fraction against the number of ¹⁴C(±3H) yielded a slope representing the rate of progress of cells out of S. The inverse of this rate was a measure of the S-period. Neither the S-period nor the proliferation rate of myeloiderythroid precursor cells was influenced by the presence of advanced ascites tumor in the hosts. The rate of movement of cells out of S was the same in myelocytes and erythroid cells of both normal and tumor-bearing animals. In contrast, the tumor cells themselves exhibited a marked retardation of the cell cycle, including S-periods, as well as a decline in the fraction of cells actually in the growth cycle. These findings in the aging tumor were probably due to changes in the local ascites environment such as increasing metabolic deficiency or accumulation of toxic products.

- 5447 THE ULTRASTRUCTURE OF HUMAN AND MURINE ASTROCYTES AND OF HUMAN FIBROBLASTS IN CULTURE. (E.) Macintyre, E. H. (Dept. Biol. Sci., U. Denver, Colo.), J. Pontén and A. E. Vatter. *Acta Pathol Microbiol Scand [A]* 80:267-283, 1972.

Morphological studies by electron microscopy and cytochemical studies were undertaken to determine fine structural differences between normal and malignant astrocytes and normal fibroblasts in cell culture. A series of human adult normal astrocytes and malignant astrocytes (including RSV-transformed cells) whose cultural characteristics had previously been reported formed the basis of the study. Also included were matched normal human fetal fibroblasts and astrocytes (from the same fetus) and methylcholanthrene-induced murine malignant astrocytes. Pellets of cells scraped from their culture vessel and sectioned as well as *in situ* preparations were examined. The fibroblasts were the only cells whose external microfibrils were collagenase-sensitive and considered

to be tropocollagen. Both the benign and the malignant astrocytes had intracytoplasmic microfibril bands (gliofibrils) and some had external collagenase-resistant microfibrils. Malignant astrocytes had a much more developed membrane system (used in its widest sense) than normal astrocytes, had many free ribosomes and some had morphologically abnormal mitochondria. Virus was seen only in the murine malignant astrocytes, where it was abundant and of the murine leukemia virus group. Areas interpreted as representing fusion in progress were seen at the surface of some RSV-transformed giant tumor astrocytes. The fine structure of one cell type from an IgG-producing culture from human glioblastoma corresponded with that reported for immunocytes.

- 5448 CYTOGENETIC STUDIES IN CHRONIC LYMPHOCYTIC LEUKAEMIA: I. A STUDY OF 40 PATIENTS. (E.) Woodliff, H. J. (Roy. Perth Hosp., Australia) and G. Cohen. *Med J Aust* 1(19):970-974, 1972.

Cytogenetic studies were performed on blood and bone marrow cells from 40 patients, aged 43-95 yr, with chronic lymphocytic leukemia. Cultures from ten patients showed a normal karyotype with no morphological abnormalities and an aneuploidy of 5% or less. The 30 remaining cases showed increased aneuploidy, though no aneuploid cell lines were seen. Pseudodiploidy was not found in untreated patients, and in no case was any G-group deletion detected. Chromatid breaks and gaps, acentric fragments, rings, dicentric and an atypical chromosome were observed in cells of six treated patients, and two untreated patients showed chromatid breaks. No persistent marker chromosomes were seen.

- 5449 ABDOMINAL TUMORS IN CHILDREN. (Ger.) Rehbein, F. (German Assoc. Pediat. Surg., Bremen, West Germany), L. Nahnsen and H. Kolb. *Langenbecks Arch Chir* 329:118-123, 1971.

Of the abdominal tumors occurring in childhood, neuroblastomas and Wilms tumors are by far the most common. Eighteen cases of neuroblastoma and 32 cases of Wilms tumor treated between 1964-1971 are presented. Some of the tumors were localized; others had infiltrated local areas or metastases to the bones and liver. Treatment of children with neuroblastomas included primary surgery, radio-cobalt therapy and chemotherapy with cyclophosphamide and Vincristin, but these measures were mostly ineffective. The prognosis for abdominal neuroblastomas is very poor with a survival rate between 8-32%. The Wilms tumor results were much better. Of the 32 children treated with surgery, Actinomycin D (plus Vincristin-Endoxan in cases with metastases) and radio-cobalt, 25 survived the five-year period. Surgical methods applied to pulmonary metastases with some measure of success are described. With improvement in treatment, the survival rate has risen from 40 to 60% in these cases.

50 INHIBITORS OF PROTEOLYTIC ENZYMES IN NEOPLASIA. (Pol.) Worowski, K. (Med. Acad., Bialystok, Poland) and R. Farbiszewski. *Wotwory* 21(4):253-259, 1971.

Antienzymes such as antiplasmin, antitrypsin, and total protein levels were determined in: 1) serum of 24 patients (40-60 years old) with different cancers (lungs, stomach, cervix, liver, breast, ovary, uterus, esophagus and sarcoma), 2) pleural and peritoneal exudates of six cancer patients, 3) serum of eight patients 1-2 months after surgical removal of tumor, 4) serum of ten newborn infants, 5) serum of 20 healthy controls. In addition, enzyme activity was determined in serum of Wistar rats after induction of Guerin tumors, in rats with liver necrosis induced by acute or chronic CCl_4 poisoning, in rats with kidney necrosis induced by acute or chronic HgCl_2 poisoning and in healthy rats. Results revealed a statistically significant increase of serum antiplasmin (30% increase in inhibition) in 85% of cancer patients and increase of serum antitrypsin (20%) in 68% of these patients. Serum of rats with Guerin tumor showed a 12% increase in antiplasmin activity. Pleural and peritoneal exudates also showed high enzyme inhibition activity (especially antitrypsin) in spite of twofold lower levels of total protein. Cancer patients enzyme activities returned to normal levels after surgical removal of malignant tumors. Infant activity was only slightly higher than in adults. Serum of rats with liver necrosis showed increased activity of both antienzymes; in rats with kidney necrosis only antiplasmin activity was significantly increased (after chronic poisoning). It is suggested that the elevated levels of these inhibitors are due to increased permeability of tumor cell membranes caused by necrosis, inflammatory foci and circulatory disturbances.

51 DIFFERENCES IN SYNTHESIS AND DEGRADATION OF SERUM PROTEINS IN NORMAL AND HEPATOMA-BEARING ANIMALS. (E.) Ove, P. (U. Pittsburgh Sch. Med., Pa.), M. L. Coetzee, J. Chen and H. P. Norris. *Cancer Res* 32(11):2510-2518, 1972.

The amounts, synthesis, and degradation of several serum proteins were studied in rats bearing Morris hepatoma 7800 and Morris hepatoma 7777. Serum protein compositions in the tumor-bearing animals differed from those in normal rats. There was a slight decrease of albumin and an increase in α -globulin proteins in the circulating blood of the tumor-bearing animals. The increase in α -globulin was larger than could be expected if globulin just compensates for the slight decrease in albumin, resulting in increased protein levels in the hepatoma-bearing animals. Synthesis of serum proteins released into the circulating blood was similar in host and normal rats. α -Globulin proteins in tumor-bearing rats had a decreased rate of breakdown, accounting for the absolute increase of these proteins. The capacity of liver tissue and hepatoma tissue to synthesize albumin differed 11-fold, with the hepatomas showing the lower rate of synthesis. *In vitro* determinations

showed a six- to seven-fold difference. Host liver had the same synthetic capacity as normal liver. Both total protein synthesis and albumin synthesis were inhibited by cycloheximide and puromycin. The albumin synthesized by the hepatomas is apparently not released into the circulating blood to any great extent.

5452 ATYPICAL MITOSES IN HUMAN BRAIN TUMORS (MEDULLOBLASTOMA, GLIOBLASTOMA). (Ger.) Schröder, R. (Path. Inst. U. Cologne, West Germany) and H. Kaess. *Acta Neuropathol (Berl)* 20(2):171-173, 1972.

Atypical mitoses are classified in 40 medulloblastomas, together with their incidence, and compared with previous data on 10 glioblastomas. In the medulloblastomas, irregularly structured mitoses are found more often than in glioblastomas. The distribution of the different types of mitosis is about the same in the two kinds of tumors. Most frequently, chromosome "laggards" occur in the metaphase orientation; others are: "hollow spindles", "colchicine mitoses", multipolar mitoses and chromosome "stickiness". These abnormalities, as with those in other human and experimental tumors, are attributed to necrobiotic processes. The mitotic course in these tumors, as well as in astrocytoma, is quite different from that in mesenchymal tumors.

5453 RELATIVE FREQUENCY OF OVARIAN NEOPLASMS IN CHILDREN AND ADOLESCENTS. (E.) Norris, H. J. (Armed Forces Inst. Path., Washington, D.C.) and R. D. Jensen. *Cancer* 30(3):713-719, 1972.

A series of 353 primary ovarian tumors which occurred in patients less than 20 yr old was studied. Fifty-five percent of the tumors were malignant, 45% benign. Germ cell tumors, the most common category, made up 58% of all ovarian tumors. The proportion of malignant germ cell tumors decreased with increasing age of patients, while the proportion of benign cystic teratomas increased. Embryonal carcinoma and dysgerminoma were more frequent in older patients. Although epithelial tumors represented 19% of ovarian tumors in the under 20 group, none was seen in patients under nine yr old. Neoplasms derived from gonadal stroma accounted for 18% of all ovarian tumors. Adenocarcinomas were very rare (three cases). Only 18 ovarian tumors (5% of total) were present in patients under five yrs.

5454 LEUKOCYTE CHROMOSOME ABNORMALITIES IN ADVANCED NONHEMATOPOIETIC CANCER. (E.) Bridge, M. F. (Mem. Hosp. Cancer Allied Dis., New York, N.Y.) and M. R. Melamed. *Cancer Res* 32(10):2212-2220, 1972.

Karyotypes were done on leukocyte cultures from 25 patients with advanced nonhematopoietic neoplasms. The patients were grouped according to type and amount of drug and/or radiotherapy received, and

chromosome abnormalities were compared in these groups. No chromosome abnormalities were observed in cells of three untreated patients or in cells of six patients given single-drug therapy. Chromosomes were also normal in four patients receiving two or three drugs, but one of three patients receiving six or more drugs had a large number of structural aberrations. Numerical and structural chromosomal changes were most marked in patients treated by radiotherapy, particularly in patients treated by high-voltage irradiation (betatron, cobalt or ^{125}I radiation). The results indicate that chromosomal abnormalities in patients with advanced cancer of nonhematopoietic tissues are due to therapy and not the effects of the neoplasm *per se*.

5455 EFFECTS OF PROTEASE INHIBITORS ON GROWTH OF HAMSTER TUMOR CELLS IN CULTURE. (E.)

Goetz, I. E. (City Hope Med. Ctr., Duarte, Calif.), C. Weinstein and E. Roberts. *Cancer Res* 32(11): 2469-2474, 1972.

Various protease inhibitors were tested for their effects on the growth of transformed hamster fibroblasts in culture. Beef pancreas trypsin inhibitor (BPTI) promoted parallel alignment of hamster tumor cells in culture and increased the adhesiveness of rounded cells. It had a slightly depressing effect on cell proliferation. Soybean inhibitor depressed cell proliferation but had no effect on cell alignment. Egg white inhibitor had no effect on proliferation or cell alignment. The synthetic protease inhibitor *N*- α -tosyl-L-lysine chloromethyl ketone HCl had no effect on cell alignment but depressed cell proliferation. It was toxic in concentrations in excess of 20 μM . BPTI had no effect on cell proliferation or cell interaction of non-tumorigenic hamster embryo cells in culture. The results suggest that some aspects of the morphology and social behavior of the tumor cells studied may be associated with protease activity that can be inhibited by BPTI.

5456 BIOCHEMICAL AND CYTOGENETIC CHARACTERIZATION OF RAT HEPATOMA CELL LINES *IN VITRO*.

(E.) DeLuca, C. (Sch. Dent., St. U. New York, Buffalo), E. J. Massaro and M. M. Cohen. *Cancer Res* 32(11):2435-2440, 1972.

Comparative studies of H4-II-E-C3 cells, from a rat hepatoma and two lines derived from them are described. On the basis of morphology, kinetics of growth, tumorigenicity, and karyotype, the three lines segregated into two distinct groups. All three cell lines were, however, related as evidenced by the presence of certain marker chromosomes. Isozyme measurements could be used to separate these cells into three distinct groups. Quantitative biochemical differences were also discerned among all three lines. These were based on the inducibility of tyrosine aminotransferase with steroid and the activity profile of pyridine-adenine dinucleotide transhydrogenase during the growth cycle. These studies illustrate

the necessity for the use of multiple parameters to characterize evolving cell lines *in vitro*. Furthermore, they suggest the feasibility of using a combination of cytogenetic and biochemical measurements, in conjunction with model systems, for the study of mammalian cell genetics and the question of tumorigenesis.

5457 KARYOMETRICAL AND CYTOCHEMICAL STUDIES OF HARDING-PASSEY MELANOMA AND HORNING-MITCHELY KIDNEY TUMOUR. II. CYTOCHEMISTRY OF NUCLEIC ACIDS AND PROTEINS. (E.) El-Fiky, S. M. (Med. Res. Inst., Alexandria, U.A.R.), T. Y. Fahmy and S. E. Abdo. *Acta Histochem* 42:106-114, 1972.

5458 KARYOMETRICAL AND CYTOCHEMICAL STUDIES OF HARDING-PASSEY MELANOMA AND HORNING-MITCHELY KIDNEY TUMOUR. III. CYTOCHEMISTRY OF SOME HYDROLYTIC ENZYMES. (E.) El-Fiky, S. M. (Med. Res. Inst., Alexandria, U.A.R.), T. Y. Fahmy and S. E. Abdo. *Acta Histochem* 42:115-120, 1972.

5459 KARYOMETRICAL AND CYTOCHEMICAL STUDIES OF HARDING-PASSEY MELANOMA AND HORNING-MITCHELY KIDNEY TUMOUR. I. KARYOMETRICAL STUDIES. (E.) El-Fiky, S. M. (Med. Res. Inst., Alexandria, U.A.R.) and S. E. Abdo. *Acta Histochem* 42:98-105, 1972.

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5462 THE CHROMOSOMES OF FIFTY PRIMARY ROUS RAT SARCOMAS. (E.) Mitelman, F. (Inst. Path., U. Lund, Sweden). *Hereditas* 69(2):155-186, 1971.

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5464 MATERNAL EFFECT ON DEVELOPMENT OF MELANOMA IN HYBRID FISH OF THE GENUS *XIPHOPHORUS*. (E.) Siciliano, M. J. (Dept. Biol., U. Texas M.D. Anderson Hosp. Tumor Inst., Houston) and A. Perlmutter. *J Nat Cancer Inst* 49(2):415-421, 1972.

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Cancer 30(4):989-996, 1972.

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AGLIOTTON, C.M.
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AGOSTINI, C.
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AGRELL, I.P.S.
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ALBERT, R.E.
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ALBINO, A.P.
5256
ALEKSANYAN, YU.T.
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ALFXANDER, P.
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AMOS, B.
5307
AMPOFO, D.A.
5690*
ANCHEVA, M.
5322
ANDERSEN, H.K.
5268
ANDERSEN, S.R.
5643*
ANDERSON, C.W.
5263
ANDERSON, D.P.
5578*
ANDERSON, R.E.
5013
ANDERSSON, G.K.A.
5644*
ANDREWS, E.J.
5353
ANDRIANOV, L.A.
5186*
ANDZHAPARIDZE, D.G.
5208
ANGHILFRI, L.J.
5536*

ANGUERA, A.
5392*
APOSHIAN, H.V.
5261
ARATA, T.
5517*
ARCOS, J.C.
5105
ARGUS, M.F.
5105
ARIAKF, S.
5545*
ARMSTRONG, G.
5345
ARNOLD, C.
5563*
ARNSTEIN, H.R.V.
5651*
ARZAMASTSEV, V.P.
5161
ASAFU-ADJAYE, J.H.
5689*
ASAKAWA, H.
5318
ASHERSON, G.L.
5375*
ASTALDI, A., JR.
5396*
ASTALDI, G.
5396*
ATTARDI, D.
5347
AURIOL, J.C.
5028
AVRAMFAS, S.
5365
AXELSON, C.
5060*
BACHMANN, K.D.
5431
BAIANU, I.
5476*
BAKER, J.A.
5479*
BAKULINA, S.P.
5177
BALA, YU.M.
5439
BALAGUERO LLADO, L.
5595*
BALAZS, M.
5355
BALDA, B.R.
5224
BALDWIN, R.W.
5332
BALF, G.F.
5572*
BALFOUR, I.C.
5395*
BALHORN, R.
5504*, 5506*

BALL, J.J.
5480*
BALTIMORE, D.
5219, 5233
BALUDA, M.A.
5215
BANDINI, A.
5647*
BARINSKII, I.F.
5289*
BARKER, E.A.
5150
BARLOW, J.J.
5484*
BARNA, S.
5391*
BARTOLONI ST. OMER
5189*
BASERGA, R.
5535*
BASMADZHYAN, M.E.
5693*
BASOMBRIQ, M.A.
5293, 5353
BASSIN, R.H.
5683*
BASSO, M.
5112
BATES, J.
5541*
BATKA, H.
5118, 5178
BAUER, G.E.
5171
BAUER, H.
5035*, 5046*, 5280*
BAUER, L.
5116
BAULDAUF, K.
5419
BAUMSLAG, N.
5184*
BAWAB, M.S.
5542*
BAYER, R.
5364
BAZILIER, M.
5281*
BEABOUT, J.W.
5520*
BECK-PECCOZ, P.
5614*
BECKER, Y.
5262
BEGGS, J.
5469*
BELCHER, R.W.
5685*
BELIKOVA, S.G.
5425
BELITSKII, C.A.
5177

BELLONE, C.
 5561*
 BELOSHAPKO, A.A.
 5059*, 5187*
 BELYAFVA, N.N.
 5400
 BENDA, P.
 5441
 BENDINELLI, M.
 5375*
 BENJAMIN, S.A.
 5350
 BENNETT, P.
 5200
 BERGEA, I.
 5639*
 BERCEANU, S.
 5394*
 BEREBBI, M.
 5299, 5433
 BERG, P.
 5278*
 BERGEL'SON, L.D.
 5671*
 BERGHOFFER, B.
 5157
 BERGOEND, H.
 5564*
 BERGSJO, P.
 5039*
 BERKE, G.
 5307
 BERMAN, L.D.
 5329
 BERNADOU, A.
 5062*
 BERTALANFFY, F.D.
 5632*
 BETSKII, B.A.
 5425
 BEVAN, M.J.
 5374*
 BHATTACHARAYA, M.
 5361
 BHIDE, S.V.
 5114
 BIAS, W.B.
 5304
 BIFLSCHOWSKY, M.
 5498*
 BIERWOLF, D.
 5342
 BIFZUNSKI, N.
 5359
 BIGNER, D.D.
 5277
 BIKOFF, F.
 5608*
 BILSKI-PASQUIER, G.
 5062*
 BIRKMAYER, G.D.
 5224
 BLACK, L.M.
 5249
 BLINOVA, L.I.
 5289*
 BLOOM, R.R.
 5351
 BLUMENSON, L.E.
 5584*
 BLUNCK, J.M.
 5100
 BOCHAROV, A.F.
 5289*
 BODELET, B.
 5408*
 BODFY, G.P., SR.
 5360
 BOEHMER, E.
 5364
 BOIRON, M.
 5281*
 BOLDEN, A.
 5220
 BOLOGNESI, D.P.
 5035*, 5280*
 BONILLA-MUSOLES, F.
 5681*
 BONNET, H.
 5397*
 BONT, W.S.
 5166
 BOOHER, J.
 5696*
 BOORMAN, G.A.
 5686*
 BORAM, L.H.
 5463*
 BOREK, C.
 5599*
 BORNSTEIN, R.S.
 5473*
 BORUM, K.
 5324
 BOSCH, D.A.
 5078
 BOSCO, I.
 5037*
 BOTTEX, C.
 5179
 BOUSSER, J.
 5062*
 BOYD, V.A.L.
 5206
 BOYERS, R.C.
 5438
 BOYSE, E.A.
 5336
 BRADY, C.L.
 5566*
 BRAND, I.
 5404
 BRAND, K.G.
 5404
 BRANDER, W.
 5129
 BRANDESKY, G.
 5428*
 BRATIANU, A.
 5391*
 BRAUN-FALCO, O.
 5224
 BRAUNSCHWEIGER, P.G.
 5443
 BRECCIA, P.
 5626*
 BREGULA, U.
 5695*
 BREMNER, T.
 5258
 BRIDGE, M.F.
 5454
 BRIEF, D.K.
 5616*
 BRIERE, N.
 5131
 BRIGGS, P.M.
 5273
 BRIGGS, W.A.
 5337
 BRINCKER, H.
 5379*
 BROCKWELL, P.J.
 5601*
 BROOKS, W.F., JR.
 5513*
 BROOKS, W.H.
 5422
 BROWN, C.H.
 5384*
 BROWN, D.Q.
 5081
 BROWN, R.R.
 5124
 BROWNE, R.M.
 5566*
 BROWNSTEIN, W.E.
 5692*
 BROYN, T.
 5487*
 BRUNNER, K.T.
 5310
 BUCHELER, J.
 5146
 BUCKLEY, P.M.
 5264
 BUOEN, L.C.
 5404
 BUONOCORE, F.
 5662*
 BURBANK, F.
 5413, 5415
 BURCHARTH, F.
 5060*
 BURDEA, M.
 5391*

BURG, C.
5317
BURGIO, G.R.
5396*
BURKE, P.J.
5304
BURMESTER, B.R.
5282*
BURNS, F.J.
5200
BUSBE, D.L.
5121
BUSCH, H.
5529*
RUSSOLATI, G.
5618*
BUTEL, J.S.
5206
BUTENKO, Z.A.
5210
BUTTNER, H.
5151
BUTZLER, W.
5032
BUZHURINA, I.M.
5177
BYKOVSKIY, A.F.
5270
BYRNE, M.J.
5568*
CABRINI, R.L.
5649*
CALABRESE, L.
5496*
CAMPION, E.C.
5386*
CANAAANI, E.
5207
CANTRELL, E.T.
5121
CAPDEVILA-TORRA, J.
5624*, 5680*
CAPPS, M.J.
5122
CAPRON, A.
5301
CAPRON, M.
5301
CARRUTHERS, C.
5361
CARSWELL, E.A.
5239
CARTER, I.P.
5469*
CARTER, R.L.
5097
CARVALHO, A.R.L.
5043*
CASPARY, E.A.
5383*
CASSINGENA, R.
5205

CASTRO, E.R.
5642*
CATOVSKY, D.
5486*, 5652*
CAULET, T.
5101
CAVIA, E.
5620*
CECILIONI, V.A.
5414
CEROTTINI, J.C.
5310
CESTARI, R.
5626*
CHABANAS, A.
5672*
CHALKLEY, R.
5504*, 5506*
CHAMEAUD, J.
5197
CHANDLER, F.W., JR.
5519*
CHAPEL, J.F.
5137
CHARDON, V.
5564*
CHAVAN, B.G.
5114
CHELIBONOVA-LORER, H.
5499*, 5500*
CHEN, H.W.
5316
CHEN, J.
5451
CHERNOV, V.A.
5096
CHERVENICK, P.A.
5507*
CHEVREL, B.
5001
CHEVREL, J.P.
5001
CHIFAN, M.
5594*
CHRETIEN, J.
5006, 5197
CHRISTIAN, E.C.
5690*
CHRISTINE, B.W.
5429*
CHRISTOFFERSEN, T.
5125
CHRISTOV, K.
5087, 5170
CHU, E.W.
5683*
CIESLUK, S.
5290, 5326
CINTORINO, M.
5460*
CIRIOTTI, G.
5477*

CIZKOVA, J.
5679*
CLAPP, N.K.
5418
CLINE, M.J.
5667*
CLOT, J.
5397*
COCCIA, P.F.
5402
COE, E.L.
5435
COE, J.E.
5260
COETZEE, M.L.
5451
COHAN, M.
5557*
COHEN, G.
5448
COHEN, M.M.
5456
COLLINS, C.J.
5269
COLLINS, M.J.
5283*
COMI, P.
5583*
CONGDON, C.C.
5202
CONNEY, A.H.
5133
CONRAD, E.
5156
CONZELMAN, G.M., JR.
5092
COOKSON, P.J.
5548*
COPPOC, G.L.
5516*
CORNELIUS, E.A.
5228, 5246
CORNELL, G.N.
5573*
CORTESE, A.F.
5573*
COVELLI, I.
5444, 5669*
COWAN, D.H.
5582*
COWAN, N.J.
5550*
COX, J.D.
5574*
CRAIG, A.W.
5122
CREAGAN, E.T.
5421
CREMISI, CH.
5205
CRISS, W.E.
5538*

CROOK, R.B. 5688*	DE SANCTIS, C. 5477*	DONNER, M. 5317
CULLEN, T.H. 5553*	DE VAUX ST. CYR, C. 5349	DOROGOKUPLYA, A.G. 5095
CUPRAK, I.J. 5655*	DEHARVEN, E. 5256	DOSIK, H. 5668*
CURRIE, A.R. 5020	DEHNER, L.P. 5571*, 5650*	DOUGHERTY, R.M. 5357
CUTTNER, J. 5580*	DEINHARDT, F. 5282*	DRAKE, W.P. 5306
CUZIN, F. 5026	DELIBETOVA, G.A. 5289*	DREWS, J. 5503*
CYMBALISTA, S. 5359	DELIUS, H. 5279*	DRIZE, O. B. 5398
CZARNOMSKA, A. 5593*	DELL'ACQUA, A. 5496*	DROHAN, W.N. 5215
D'ATH, E.F. 5498*	DELUCA, C. 5456	DRUCKREY, H. 5103
DA SILVA RODRIGUES, J. 5043*	DEODHAR, S.D. 5384*	DU PASQUIER, P. 5028
DABROUS, M.K. 5600*, 5604*	DES ROCHES, G. 5308	DUBERT, J.M. 5637*
DABICH, L. 5402	DESCHAUX, P. 5179	DUBY, M.M. 5628*
DAEHNFELDT, J.L. 5664*	DESSELBERGER, U. 5266	DUCHINI, L. 5189*
DAHLIN, D.C. 5520*	DEV, V.G. 5599*	DUCKLER, L. 5586*, 5613*
DALEZIOS, J.I. 5153	DHARAMADHACH, A. 5401	DUESBERG, P. 5207
DALLENBACH-HELLWEG, G. 5399	DI LUZIO, N.R. 5298	OULBECCO, R. 5235
DANKO, I.M. 5393*	DIAMANDOPOULOS, G.T. 5321	DUNGWORTH, D.L. 5264
DANNENBERG, H. 5076	DICKSON, A. 5653*	DUNN, E.L. 5567*
DAPKUS, D.C. 5238	DILLARD, P.H. 5484*	DUPUY, J.M. 5352
DAVID, D. 5275	DILLARD, R.D. 5077	DYATLOVITSKAYA, E.V. 5671*
DAVIE, J. 5576*	DILLER, I.C. 5479*	DZAGNIDZE, L.I. 5159
DAVIS, R.L. 5479*	DIPERT, M.H. 5601*	EBELS, E.J. 5078
DAWKINS, R.L. 5568*	DISTEFANO, H.S. 5357	EBERLE, B.J. 5240
DAY, F.D. 5330	DIXON, F.J. 5308	ECKMANN, L. 5067*
DE ALMEIDA SNARES, H. 5043*	DMOCHOWSKI, L. 5212	EDDY, A.A. 5544*
DE ANTONI, E. 5662*	DOBRESCU, G. 5594*	EDLOW, D.W. 5542*
DE LIGNIERES, B. 5034*	DOBRJANSKY, A. 5631*	EDWARDS, G.S. 5174
DE MICCO, M. 5496*	DOCIMO, R. 5660*	EDYNAK, E.M. 5323
DE MICCO, PH. 5433	DOLAPCHIEV, L. 5499*	EGAN, M.L. 5327
DE NECHAUD, B. 5300	DOMAGALA, W. 5592*	EGGE, H. 5552*
DE SAILLE, I. 5605*	DOMBEROWSKY, P. 5410	EGGLESTON, J.C. 5406*

FI-FIKY, S.M.
 5457*, 5458*, 5459*
 FIGLIO, K.
 5125
 FILIS, H.
 5636*
 FILLIS, V.L.
 5238
 FIMBERGER, J.M.
 5397*
 FIMEL'YANOV, B.A.
 5289*
 FIMMELT, P.
 5166
 FIMDO, M.
 5677*
 FIMROTH, C.-M.
 5581*
 FIMZINGER, F.M.
 5571*
 FIMHARD, P.
 5285*
 FIMSON, U.
 5437
 FIMLANDSON, R.A.
 5463*
 FIMSCHWEGE, M.F.
 5408*
 FIMANS, C.A.
 5395*
 FIMARRIS, C.
 5477*
 FIMAGLIA, G.
 5614*
 FIMAGRAFUS, A.
 5069*
 FIMAHMY, M.J.
 5164
 FIMAHMY, D.G.
 5164
 FIMAHMY, T.Y.
 5457*, 5458*
 FIMAIRLEY, G.H.
 5319
 FIMAIS, D.A.
 5440
 FIMARBER, J.L.
 5535*
 FIMARRISZEWSKI, R.
 5450
 FIMAREED, G.C.
 5231
 FIMARROW, G.M.
 5579*
 FIMAUSTRON, N.
 5630*
 FIMEDOROVSKA, M.I.
 5348
 FIMERNANDE7 CABALEIRO, J.L.
 5659*
 FIMERNANDE7-CRUZ, L.
 5680*

FERRARI, C.
 5614*
 FERRER, R.
 5681*
 FERTAKIS, A.
 5390*
 FIELD, E.J.
 5383*
 FINKLE, H.I.
 5587*
 FISCHER, W.
 5657*
 FISHER, E.R.
 5407*
 FIUMARA, A.
 5682*
 FLAKS, B.
 5169
 FLANDERS, L.E.
 5092
 FLANNERY, J.T.
 5429*
 FLAX, H.
 5129
 FLETCHER, D.J., JR.
 5519*
 FLORIDI, A.
 5047*
 FOA, P.P.
 5640*
 FONT, R.L.
 5643*
 FONTANGES, R.
 5179
 FOOTE, F.W., JR.
 5646*
 FORGUE, A.P.
 5595*
 FORSBERG, J.G.
 5039*
 FOWLER, A.K.
 5250
 FRANCFSCHINI, P.
 5477*
 FRANCKE, U.
 5308
 FRANK, H.
 5280*
 FRANZEN, S.
 5478*
 FRAPPA, J.
 5179
 FRATI, L.
 5444, 5669*
 FRAUMENI, J.F., JR.
 5413, 5421
 FRAUMENI, J., JR.
 5412
 FRAYSSINET, C.
 5130
 FREDERIKSEN, S.
 5436

FREEDMAN, L.B.
 5310
 FREEDMAN, S.I.
 5570*
 FREIREICH, E.J.
 5360
 FRIEDEL, G.H.
 5124
 FRIEDMANN, T.
 5275
 FRIEDRICHS, K.H.
 5135
 FRITZ, W.
 5148
 FRONT, R.L.
 5571*
 FRY, R.J.M.
 5084, 5115, 5601*
 FUKUI, H.
 5286*
 FUKUNISHI, R.
 5119
 FUNAKOSHI, I.
 5534*
 GALLAGHER, R.E.
 5629*
 GALLO, R.C.
 5445, 5629*
 GANTT, R.R.
 5265
 GARBIT, F.
 5637*
 GARCIA, H.
 5080, 5142
 GARCIA TORRE, J.
 5659*
 GARON, C.F.
 5231
 GAUDIN, D.
 5139
 GAZDAR, A.F.
 5223
 GAZZOLO, L.
 5241
 GEDIGK, P.
 5401
 GELDERBLOM, H.
 5035*, 5280*
 GEORGII, A.
 5266
 GERARD-MARCHANT, R.
 5598*
 GERBER, P.
 5387*
 GERICKE, D.
 5031*
 GERRITS, P.O.
 5078
 GERWIN, B.I.
 5683*
 GESTELAND, R.Y.
 5263

GEVORKYAN, S.K.	GORDON, H.W.	GUBAREVA, A.V.
5693*	5663*	5201
GHERMAN, GR.	GORKIN, V.Z.	GUBERNPI, L.
5589*	5700*	5442
GHILEYAN, N.	GORODETSKII, S.I.	GUHA, A.
5589*	5398	5549*
GHOBRIAL, H.K.G.	GOTH, R.	GULLINO, P.M.
5404	5172	5157, 5158
GHOSH, A.K.	GOTO, M.	GULYAKIN, M.F.
5672*	5489*	5602*
GIBB, L.F.	GOTOHDA, E.	GUMINSKA, M.
5544*	5136	5255
GIBFL, W.	GOTTLIEB, C.F.	GUTTERMAN, J.U.
5420	5338	5360
GIBSON, M.H.L.	GRAF, TH.	HAAPALA, D.K.
5632*	5035*	5683*
GIBSON, W.R.	GRAHAM, S.	HAAS, M.
5077	5424	5235
GILLMAN, T.	GRANGE, J.	HADARAG, E.
5163	5241	5639*
GIRARD-MARCHANT, R.	GRANNER, D.	HADFIELD, M.G.
5574*	5504*, 5506*	5471*
GITLITS, A.	GRANTHAM, F.H.	HADLOW, W.J.
5377*	5157	5612*
GLAVES, P.	GRASMUK, H.	HAENZEL, W.
5332	5503*	5416
GLONSKI, C.A.	GRASSO, G.	HAGA, J.J.
5443	5682*, 5691*	5137
GLUZMAN, D.F.	GREEN, M.	HAGAN, M.
5210	5347	5689*
GOODARD, P.	GFEN, S.	HAGID, K.G.
5182	5631*	5088
GOETZ, I.F.	GREENE, H.J.	HAJDU, S.
5455	5482*	5521*
GOGL, A.	GREENGARD, D.	HAJDU, S.I.
5355	5515*	5463*
GOLDBLUM, N.	GREGG, R.S.	HALL, T.C.
5359	5139	5513*
GOLDMAN, P.M.	GRICE, H.C.	HALLCHES, R.C.
5259	5531*	5163
GOLDMAN, R.L.	GRIMAUD, R.	HALMI, N.S.
5587*	5408*	5694*
GOLDSTEIN, A.L.	GRIMONT, P.	HAMADA, T.
5549*	5028	5699*
GOLDSTEIN, H.S.	GROB, H.U.	HAMACKA, T.
5654*	5134	5368*
GOMMI, R.	GROB, P.J.	HAMEED, K.
5133	5354	5611*
GONG, J.K.	GROHSMAN, J.	HANAFUSA, H.
5443	5303	5220, 5233, 5533*
GONZALEZ GONZALEZ, D.	GROMEK, A.	HANAFUSA, T.
5033*	5664*	5220
GONN, R.A.	GROSS, H.J.	HANAICHI, T.
5340	5076	5204
GOODALL, C.M.	GROSS, M.D.	HANAOKA, M.
5498*	5640*	5302
GOPALAKRISHNAN, A.	GROSSMANN, H.	HANCOCK, R.L.
5616*	5211, 5305	5126
GORKOVA, N.P.	GROVER, S.	HANDLEMAN, S.L.
5671*	5409	5265
GORDON, D.F.	GRUSHINA, A.A.	HANNA, M.G.
5237	5096	5388*

HARAN-GHFRA, N.	HENKEL, H.	HOLLINSHEAD, A.
5272	5428*	5372*
HARDAS, U.D.	HENLE, G.	HOLLMANN, K.H.
5409	5041*	5015
HARDY, M.A.	HENLE, W.	HOLLMANN, K.-H.
5549*	5041*	5040*
HARF, A.	HERBERMAN, R.B.	HOLLMANN, M.K.H.
5006	5325	5025
HARIBHAKTI, P.B.	HEROLD, H.J.	HOLT, P.J.L.
5497*	5420	5486*
HARLOZINSKA, A.	HERRERA, M.I.	HOLTON, C.P.
5378*	5596*	5493*
HARRIS, P.N.	HERSH, E.M.	HONOHAN, T.
5077	5360	5072
HARTLEY, J.W.	HERZFFLD, A.	HOPPER, R.
5258, 5265, 5331	5515*, 5641*	5481*
HARTMANN, N.R.	HIASA, Y.	HOOVER, E.A.
5410	5183	5292
HARTWICH, G.	HICKS, J.J.	HOPFNER, C.
5032*	5537*	5101
HARWELL, L.	HIGA, E.	HORAI, T.
5320	5575*, 5576*	5403
HASEGAWA, Y.	HIGASHINO, K.	HCFIE, A.
5518*	5505*	5180, 5555*
HASHIMOTO, K.	HILF, R.	HORVAT, B.
5517*, 5572*, 5600*, 5604*	5513*	5407*
HASHINOTSUME, M.	HILFRICH, J.	HOSOKAWA, M.
5505*	5155	5136
HASPEL, O.	HILL, G.S.	HOSSE, H.E.
5262	5406*	5236
HATTORI, S.	HILL, M.J.	HOURL, M.
5403	5182	5334
HAUGH-GRANTH, R.	HILL, R.S.	HOWARD, C.H.
5272	5652*	5511*
HAUT, M.I.	HINO, S.	HOZUMI, N.
5582*	5244	5623*
HAYASHI, F.	HIRONO, I.	HRGOVCIC, M.
5555*	5091	5432
HAYASHI, Y.	HIRSCH, A.	HSU, S.M.
5385*	5006	5195*
HAYNIF, T.P.	HJERTMAN, L.	HUEBNER, R.J.
5609*	5581*	5254, 5316, 5331
HAYWARD, A.F.	HOBBS, J.R.	HUFF, S.D.
5491*	5129	5264
HAZRA, T.A.	HOFFMAN, G.C.	HULL, J.D.
5542*	5557*	5548*
HECKER, D.	HOFFMANN, W.D.	HULTIN, T.
5673*	5065*	5171
HEGEDUS, S.I.	HOHMANN, P.	HUMPHREY, R.L.
5665*	5504*	5304
HEGGLIN, J.	HOKAMA, Y.	HUSEBY, R.A.
5676*	5532*	5633*
HEIDELBERGER, C.	HOLBOROW, E.J.	HUTTON, J.J.
5173	5319	5336
HEINIGER, H.J.	HOLLAND, E.	HUVOS, A.G.
5316	5666*	5654*
HELLMAN, A.	HOLLANDER, C.F.	ICHIHARA, A.
5250	5686*	5474*
HELLUNG-LARSEN, P.	HOLLEY, R.W.	II, Y.
5436	5016	5013
HELMER, F.	HOLLINS, B.	IKAWA, Y.
5428*	5511*	5223

IKONOPISOV, R.L. 5376*	JAHNS, M.F. 5609*	KAPP, L.N. 5697*, 5698*
IMAMURA, A. 5094	JAKIMOV, M. 5499*, 5500*	KARAMCUCHEVA, L. 5499*
IMAMURA, K. 5539*	JALOWAYSKI, I. 5561*	KARRER, K. 5428*
INCHLEY, M.P. 5315	JAMES, A.C. 5198	KARTENBECK, J. 5512*
INFANTE SANCHEZ, J.C. 5061*	JANDOVA, A. 5679*	KASHULINA, A.P. 5090
INOMATA, M. 5141	JANICKI, K. 5417	KATAOKA, Y. 5489*
INOI, Y. 5094	JANISCH, W. 5178	KATZ, C. 5072
IRIKURA, T. 5518*	JANTSCH, B. 5073	KAUFMAN, D.G. 5176
IRLIN, I.S. 5175, 5209	JARD, S. 5441	KAWAJI, K. 5119
ISHIBASHI, S. 5495*	JFAN, R. 5397*	KAWAKAMI, T.G. 5264
ISHIDA, K. 5013	JENSEN, F. 5308	KAY, S. 5475*
ISHIKAKA, S. 5523*	JENSEN, R.D. 5453, 5687*	KAZANTZIS, G. 5009
ISHIKAWA, E. 5524*	JEPPESEN, TH. 5268	KEEFER, L. 5156
ISHIKAWA, S. 5526*	JHINGRAN, S.G. 5609*	KEIR, H.M. 5541*
ISHIKAWA, Y. 5677*	JOHNSON, K.H. 5404	KELLER, S.J. 5608*
ISHIMOTO, A. 5344	JOHNSON, W. 5666*	KELLEY, R.O. 5240
ITAKURA, K. 5336	JONSSON, N. 5324	KELLY, W.A. 5196*
ITO, M. 5089	KACIAN, D.L. 5229	KENNEDY, B.J. 5473*
ITO, N. 5183	KACZMARSKI, M. 5427*	KENNEL, S.J. 5308
ITO, Y. 5344	KAFSS, H. 5452	KERN, G. 5065*
ITOH, M. 5674*	KAGA, A.R. 5570*	KERR, J.F.R. 5020
IVANKOVIC, S. 5108, 5144, 5162	KAHN, L.B. 5577*	KHUZHAMBERDIYEV, M. 5700*
IVINS, J.C. 5520*, 5565*	KAKU, R. 5539*	KHYMENKO, O.I. 5210
IWATA, Y. 5555*	KALEDIN, V.I. 5082	KIM, Y.M. 5616*
JACKSON, J.L. 5265	KALUS, M. 5470*	KIMURA, I. 5249
JACKSON, T.A. 5612*	KAMAMOTO, Y. 5183	KISCH, A.L. 5240
JACOBS, B.R. 5633*	KAMESWARI, V.R. 5193*	KISELEVA, N.S. 5502*
JACOBS, D. 5334	KAMINSKA, L.P. 5348	KISH, V.M. 5102
JACQUEMONT, B. 5241	KANO-TANAKA, K. 5204	KISIELSKI, W.E. 5115, 5127
JAGARLAMONDY, S.M. 5049*	KANTROWITZ, P.A. 5370*	KITAGAWA, M. 5312
JAGELMAN, D.G. 5636*	KAPLAN, M.R. 5247	KITAGAWA, M. 5368*

KITAGAWA, T.
5098
KITTLICK, P.-D.
5151
KLEIN, G.
5695*
KLEINMAN, M.S.
5320, 5371*
KLFMM, W.
5151
KIYACHKO, F.V.
5440
KNORRF, D.
5132
KNOX, W.F.
5641*
KOBAYASHI, H.
5136
KOBAYASHI, S.
5287*
KODAMA, M.
5141
KONESTNER, A.
5363
KOHCHI, S.
5180
KOIDE, T.
5526*
KOLB, H.
5449
KONIKOWSKI, T.
5609*
KORBS, D.H.
5008
KORN, C.S.
5696*
KORNEEVA, L.A.
5425
KOROBKO, YU.A.
5199
KOROSTELEVA, T.A.
5291
KOSOW, D.P.
5547*
KOSS, L.G.
5521*
KOTLER, M.
5262
KOURI, R.F.
5081
KOVAC, W.
5428*
KOVACS, Z.
5355
KRAJ, M.
5290, 5326
KRAMER, F.R.
5229
KRASIK, YA.D.
5675*
KRASKOVSKIY, G.V.
5377*

KRASNIYANSKAYA, P.N.
5159
KRASOWSKA, I.
5427*
KRAVCHENKO, L.V.
5075
KREIDER, J.W.
5259, 5350
KROFS, R.M.
5335
KROLLS, S.O.
5438
KRUEGER, F.W.
5160
KRUGER, F.W.
5007
KRUGER, G.F.
5341
KUHN, C.
5468*
KULKA, R.G.
5688*
KURATA, N.
5510*
KURATSUNE, M.
5180
KURIHARA, M.
5416
KUROCKIN, IU.F.
5501*
KURPIOS, J.
5427*
KURSCHNER, E.
5619*
KURTH, R.
5035*
KUWATA, T.
5086
KUZF, M.
5674*
KUZMINA, S.N.
5700*
KUZMINSKA, A.
5590*
KUZNIK, B.I.
5675*
LAFUMA, J.
5197
LAGEMAN, A.
5118
LAGERLOF, B.
5478*
LALA, P.K.
5446
LANDI, E.
5626*
LANDON, J.
5334
LANG, C.M.
5259
LANGE, A.
5103

LANZEROTTI, R.H.
5158
LARDIS, M.P.
5323
LARSEN, C.J.
5281*
LAU, M.
5120
LAUGIER, A.J.
5574*
LAUROVA, L.
5679*
LAVIALLE, CH.
5205
LAWKOWICZ, W.
5290
LAWLEY, P.D.
5122
LAZAR, C.
5594*
LEAVENS, M.E.
5609*
LEBEDEVA, YU.L.
5425
LEBEDOV, V.N.
5425
LEBEL, J.S.
5384*
LEE, K.P.
5237
LEE, O.B.
5372*
LEE, R.C.K.
5416
LEFEBVRE, M.N.
5301
LEGRAND, E.
5276
LEKLEM, J.E.
5124
LEON, J.
5624*
LEONE, F.
5660*
LEPAGE, G.A.
5603*
LEPPLA, S.H.
5217
LERNER, R.A.
5308
LESCH, R.
5512*
LEUCHTENBERGER, C.
5154
LEUCHTENBERGER, R.
5154
LEVAN, A.
5695*
LEVAN, N.E.
5696*
LEVER, W.F.
5655*

I EVINE, P.H.
 5325, 5402
 I EVSHIN, V.F.
 5022
 I EVY, N.L.
 5330
 I EWANDOWSKI, I.J.
 5213, 5217
 I FWIS, D.A.
 5615*
 I FWIS, J.S.
 5642*
 I FWIS, M.G.
 5328
 I FWIS, S.M.
 5486*, 5652*
 I I, H.C.
 5610*
 I IFERMAN, P.H.
 5646*
 I IFCHTY, R.D.
 5461*
 I IEN, W.M.
 5554*
 I IFSHITS, V.M.
 5439
 I TJINSKY, W.
 5080, 5113, 5142, 5156
 I IN, J.-K.
 5195*
 I INCOLN, D.W.
 5196*
 I INDELL, A.
 5638*
 I INDENBERG, K.
 5676*
 I INNIK, A.B.
 5106
 I IOZNER, A.L.
 5208, 5270
 I ISS, A.YU.
 5377*
 I ITOVCHENKO, T.A.
 5270
 I ITWIN, S.
 5353
 I IVINGSTON, D.M.
 5358
 I OMUGLIO, A.F.
 5507*
 I OCKNER, D.
 5437
 I OGAN, J.W.
 5411
 I OGAN, N.E.
 5411
 I OMBARD, L.S.
 5152
 I OMBARDI, R.
 5661*
 I OSKANT, G.
 5295

LOSONCZY, I.
 5157
 LOUIS, C.J.
 5100
 LOWRY, W.B.
 5466*
 LUBET, R.A.
 5081
 LUCAS, J.
 5169
 LUCAS, S.
 5387*
 LUDBROOK, J.
 5386*
 LUDLUM, D.B.
 5138
 LUGER, A.
 5019
 LUZI, P.
 5460*
 MAASS, H.
 5038*
 MACASAET, F.
 5227
 MACGREGOR, A.J.
 5615*
 MACINOT, C.
 5408*
 MACINTYRE, E.H.
 5447
 MACK, T.
 5493*
 MACKLES, A.M.
 5482*
 MADISON, R.M.
 5254
 MAGAMADOV, YU.CH.
 5502*
 MAGEE, P.N.
 5138
 MAHALEY, M.S., JR.
 5330
 MAKEEVA, O.O.
 5096
 MAKINODAN, T.
 5338
 MAKIURA, S.
 5183
 MALCOLM, D.
 5014
 MALFK, R.S.
 5579*
 MALERE, B.D.
 5671*
 MANGALIK, A.
 5373*
 MANKODI, R.C.
 5497*
 MANTYJARVI, R.A.
 5251
 MANUKYAN, L.A.
 5693*

MARCHALONIS, J.J.
 5314
 MARDINEY, M.R., JR.
 5306
 MARGALITH, E.
 5333
 MARGALITH, M.
 5333
 MARIANI, T.
 5340
 MARK, L.P.
 5313
 MARQUARDT, H.
 5173
 MARSHALL, V.M.
 5541*
 MARSHALL, V.R.
 5386*
 MARTINO, P.
 5424
 MARUCCI, A.A.
 5357
 MARUGAMI, M.
 5183
 MARUYAMA, Y.
 5340
 MARZA, V.
 5588*
 MASAKI, H.
 5368*
 MASON, T.J.
 5412
 MASSARO, E.J.
 5456
 MASSE, R.
 5197
 MATHEWS, M.B.
 5651*
 MATSUDA, M.
 5403
 MATSUOKA, Y.
 5312, 5524*
 MATSUSHIMA, T.
 5510*, 5525*
 MATTERN, C.F.
 5683*
 MAUCHAUFFE, M.
 5281*
 MAUVAIS-JARVIS, P.
 5034*
 MAVLIGIT, G.
 5568*
 MAYER, J.
 5590*
 MAYHEW, E.
 5584*, 5588*
 MCARTHUR, W.P.
 5239
 MCCLURE, P.D.
 5325
 MCCORMICK, W.F.
 5694*

MCCREDIF. K.B.
 5360
 MCFARIANF. E.S.
 5288*
 MCGINNIS. J.P.
 5634*
 MCGOWAN. J.
 5128
 MCKAY. F.W., JR.
 5412
 MCKEE. F.E.
 5466*
 MCKFLWAY. W.
 5372*
 MCKHANN. C.F.
 5049*
 MCKINNELL. R.G.
 5238
 MCLANE. M.F.
 5321
 MCLEOD. G.M.
 5386*
 MCMAHON. N.J.
 5663*
 MCNAMEE. R.
 5298
 MEDNYK. M.R.
 5274
 MEDRAS. K.
 5085
 MEIER. F.CH.
 5354
 MEIER. H.
 5316
 MEKLER. I.B.
 5398
 MELAMFD. M.R.
 5454
 MELNICK. J.L.
 5372*
 MENFZFS. J.
 5242
 MENNEL. H.D.
 5107, 5108, 5110, 5162
 MENZIFS. D.N.
 5621*
 MEROLD. V.A.
 5149
 MERRETT. T.G.
 5334
 METCALF. D.
 5667*
 METZGAR. R.S.
 5381*
 MEUTH. N.L.
 5219
 MEYER. G.
 5299, 5433
 MEYER. R.R.
 5608*
 MICHEAU. C.
 5598*

MICHEEL. B.
 5342, 5343
 MICU. D.
 5396*
 MIDDLETON. V.L.
 5395*
 MIELNIK. J.
 5590*
 MIHAILOVICH. N.
 5152
 MILDNER. G.
 5419
 MILEA. N.
 5588*
 MILES. P.A.
 5569*
 MILLER. D.A.
 5599*
 MILLER. D.S.
 5381*
 MILLER. E.
 5298
 MILLER. F.
 5224
 MILLER. J.M.
 5236
 MILLER. L.D.
 5236
 MILLER. O.J.
 5599*
 MILLS. D.R.
 5229
 MILNE. R.J.
 5411
 MILO. G.E. JR.
 5267
 MILSTEIN. C.
 5550*
 MINCER. H.H.
 5634*
 MINCIONE. G.
 5189*
 MINFGISHI. K.
 5165
 MIRON. M.
 5488*
 MIRSKY. H.S.
 5580*
 MISHIMA. Y.
 5699*
 MISTRY. P.B.
 5276
 MITELMAN. F.
 5221
 MIYAHARA. M.
 5539*
 MIYAKAWA. M.
 5674*
 MIZUNO. D.I.
 5518*
 MKHEIDZE. D.M.
 5270

MOBERGER. G.
 5581*
 MOHANAKUMAR. T.
 5381*
 MOHR. U.
 5155
 MOISEENKO. M.I.
 5425
 MOLLING. K.
 5035*
 MONAKHOV. N.K.
 5670*
 MONOV. N.
 5423
 MONTALDO. G.
 5042*
 MONTEZANO. R.
 5176
 MOORE. T.L.
 5370*
 MOPERT. S.
 5419
 MORAGAS. J.M.DE
 5392*
 MORAIS. R.
 5488*
 MORI. W.
 5318
 MORISHIMA. T.
 5677*
 MORLAND. J.
 5125
 MORRIS. H.P.
 5339, 5451, 5538*
 MORROW. C.P.
 5483*
 MORROW. J.F.
 5278*
 MORTARA. G.
 5583*
 MOTOI. M.
 5286*
 MOURIGUAND. C.
 5672*
 MOVSESYAN. K.S.
 5693*
 MOZZI. R.
 5444, 5669*
 MUKAI. N.
 5287*
 MUKHERJEE. T.
 5386*
 MULDER. C.
 5279*
 MULLER. E.
 5116, 5657*
 MULLER. M.
 5211, 5305, 5562*
 MULLER. R.
 5220
 MULLINS. G.M.
 5304

MUMFORD, D.M.	NEWBURGH, R.W.	OLIVER, D.
5432	5558*	5504*, 5506*
MIJNAKATA, N.	NEYFAKH, S.A.	GLOFSSON, J.
5605*	5670*	5522*
MURAD, T.M.	NEYMAN, I.N.	OLSON, C.
5083	5045*	5236, 5237
MURAKAMI, K.	NINICHENKO, A.N.	OLSSON, O.
5495*	5095	5462*
MURAO, T.	NISHIHARA, H.	OLSZEWSKI, W.
5252	5403	5592*
MURAVIOVA, N.I.	NISHIOKA, K.	ONO, T.
5501*	5297	5607*
MYASNIKOV, A.I.	NISHIYAMA, H.	ORDEANU, A.
5095	5013	5588*
NADHOKNA, N.Y.	NISHIYAMA, R.H.	ORENSTEIN, M.M.
5274	5567*	5578*
NAGAO, M.	NISHIZUKA, Y.	ORLANDO, R.A.
5143	5168	5513*
NAGATA, C.	NISHIZUMI, M.	ORR, T.
5034, 5141	5180	5345
NAGAYO, T.	NOGUCHI, A.	OSBORN, M.
5089	5509*	5651*
NAGFI, G.A.	NOMURA, T.	OSECHINSKII, I.V.
5063*	5286*	5398
NAHNSFN, L.	NORRIS, H.J.	OSNES, J.B.
5449	5453, 5569*, 5687*	5125
NAKADATE, M.	NOTAKE, Y.	OSTERTAG, H.
5094	5645*	5266
NAKAGAWA, Y.	NOWINSKI, R.C.	OSTRYANINA, A.
5556*	5214, 5234	5185*
NAKAI, Y.	NOWOTNY, A.	OTERUELO, J.H.
5603*	5303	5061*
NAKAJUMA, Y.	NUCIFORO, G.	OTH, D.
5517*	5682*, 5691*	5317
NAMBA, Y.	O'CONNOR, P.J.	CUTZEN, H.C.
5302	5122	5353
NAII, F.	OROSHI, S.	OVE, P.
5637*	5526*	5451
NAVARRO, M.	ODA, T.	OWOR, R.
5397*	5243, 5253	5546*
NAYAK, D.P.	OETTGEN, H.F.	PAGLIARDI, G.L.
5382*	5351	5048*
NAZFRIAN, K.	OGAWA, I.	PAL, S.G.
5284*	5517*	5486*
NEHRIY, H.7.	OGAWA, K.	PANEDA CUESTA, F.
5210	5286*, 5474*	5659*
NEIMAN, P.F.	OKA, S.	PANOV, M.A.
5226	5540*	5177
NEIMAN, R.S.	OKADA, N.	PAPADOPULU, G.
5610*	5104	5079
NEISON, V.R.	OKADA, S.	PARKER, J.C.
5480*	5697*, 5698*	5283*
NEFI, V.	OKAJIMA, E.	PARKHOMENKO, I.I.
5614*	5183	5175
NESBIT, M.	OKULOV, V.B.	PARKS, W.P.
5473*	5296	5257, 5358
NETTESHEIM, P.	OKUNEWICK, J.P.	PARRY, E.W.
5113	5285*	5635*
NEUMANN, H.	OLD, L.J.	PARSHAD, R.
5272	5323, 5336	5430
NEWHERRNF, P.M.	OLIVARES, T.A.	PASKIN, D.L.
5335	5320	5548*

PASTERNAK, G.
5342, 5343, 5356
PATAKFAI, A.
5355
PATEL, D.
5621*
PATEL, R.
5337
PAULI, R.M.
5605*
PAVIA, U.
5460*
PFARSE, A.G.F.
5618*
PEARSON, G.
5345
PEDERSEN, R.N.
5664*
PEGG, A.F.
5093, 5123
PELLEGRINO, C.
5682*
PENCEA, V.
5594*
PERA, C.
5624*
PERAINO, C.
5084, 5127
PERGUM, G.D.
5395*
PERKINS, F.H.
5338
PERLMUTTER, A.
5464*
PERNOT, M.
5408*
PERRAUD, R.
5197
PERRYMAN, L.F.
5292
PERSHIN, G.N.
5096
PERSSON, B.H.
5638*
PERZIK, S.L.
5570*
PERZIN, K.H.
5508*
PETERS, R.L.
5254, 5331
PETTERSSON, A.
5437
PEIFFER, S.F.
5167, 5363
PHILLIPS, F.L.
5285*
PHILLIPS, P.A.
5273
PHILLIPS, T.M.
5328
PIENTA, R.J.
5325

PIERSCINSKA, E.
5551*
PILFRI, A.
5048*
PILGRIM, H.I.
5017
PISANO, J.C.
5298
PITOT, H.C.
5514*
PITTMAN, G.
5557*
PLATA, E.J.
5683*
PLUOT, M.
5101
POKROVSKIY, A.A.
5075
POLAC, N.
5391*
POLAK, J.M.
5618*
PONG, R.S.
5174
PONTEN, J.
5447
PONZONE, A.
5477*
POPESCU, M.
5359
POPHAM, R.R.
5553*
POPP, F.A.
5099, 5140
PORWIT-BOBR, Z.
5255
POTT, E.
5135
POVLSEN, C.O.
5617*
POYNTER, R.W.
5128
PRAGNELL, I.B.
5651*
PREHN, R.T.
5293, 5353
PREMONT, J.
5441
PREUD'HOMME, J.L.
5311
PREUSSMANN, R.
5108, 5162
PRICE, H.M.
5467*
PROBST, G.S.
5608*
PYLEV, L.N.
5117
RABES, H.M.
5073
RABIN, H.
5345

RABINOWITZ, Z.
5222
RABSTEIN, L.S.
5149, 5254, 5331
RACE, R.E.
5612*
RADOM, S.
5591*
RAHIMI, A.
5520*
RAICHEV, R.
5170
RAJEWSKY, M.F.
5172
RAJKA, G.
5585*
RAJU, M.V.S.
5191*, 5193*
RAMULU, C.
5191*
RANCHOD, M.
5472*
RAO, K.V.N.
5152
RAO, P.R.
5663*
RAPP, F.
5052*
RAPP, W.
5068*
RAPPAPORT, H.
5498*
RAUHS, R.
5428*
RAUTU, I.
5391*
RAVICCVITCH, R.E.
5281*
RAWLS, W.E.
5372*
REDDY, C.R.R.M.
5191*, 5193*
REDDY, J.
5543*
REDDY, M.M.
5527*
REDDY, P.G.
5191*
REDDY, S.S.
5193*
REED, C.D.
5250
REGE, V.
5337
REHBEIN, F.
5449
REINER, E.
5537*
REJMANOWSKI, T.
5625*
REY, J.M.
5397*

REYMOND, R.D.
5542*
RIBACCHI, R.
5389*
RICHARD, M.H.
5241
RICHTER, C.B.
5113, 5245
RIFU, D.
5397*
RILL, A.
5380*
RINDLER, R.
5190*
ROBERTS, F.
5455
ROBERTS, J.D.B.
5097
ROBIN, J.
5281*
ROBINSON, W.A.
5373*, 5493*
ROBI, M.G.
5237
RODRIGUEZ, V.
5360
ROE, F.J.C.
5021
ROESSMANN, U.
5560*
ROGERS, J.
5663*
ROGG, H.
5146
ROHRBACH, R.
5120
ROLAND, A.
5325, 5402
ROSAI, J.
5575*, 5576*
ROSE, I.A.
5547*
ROSENBERG, F.B.
5325
ROSENBERG, R.N.
5558*
ROSNER, F.
5668*
ROSSI, R.
5444, 5669*
ROUNDS, D.F.
5696*
ROVERA, G.
5535*
ROWF, W.P.
5758
ROY-BURMAN, P.
5247
RUDDMAN, D.
5511*
RUDDATFELSKA, M.
5427*

RUSSELL, H.R.
5137
RUTLEDGE, F.N.
5483*
RYBAKOVA, L.I.
5090
RYGAARD, J.
5617*
RZEHA, K.
5551*
SACHS, H.
5038*
SACHS, L.
5222, 5627*
SAEGESSER, F.
5563*
SAFAIE-SHIRAZI, S.
5461*
SAFFIOTTI, U.
5176
SAITO, M.
5545*
SAKURANE, H.
5678*
SALERNO, R.A.
5149
SALIH, H.
5129
SALINAS, F.A.
5388*
SALISACHS, L.
5442
SALWA, J.
5378*
SALZMAN, N.P.
5231
SANCHEZ GARRIDO, F.
5596*
SANDER, J.
5188*
SANDERS, F.K.
5256
SANDRITTER, W.
5120
SANFORD, K.K.
5265, 5430
SANI, B.
5102
SANTANDER, S.
5659*
SANTIAGO, H.
5628*
SANTORO, A.
5496*
SANTOS, G.W.
5304
SAPP, J.P.
5405*
SASTRY, G.A.
5527*
SATO, H.
5336, 5489*

SATO, K.
5339, 5490*
SATO, S.
5545*, 5556*
SATOH, S.
5366*
SAUER, G.
5269
SAUER, H.
5428*
SAUNDERS, F.C.
5150
SAVLOV, E.D.
5513*
SAWITSKY, A.
5668*
SCHACHTSCHABEL, D.
5552*
SCHACHTSCHABEL, D.O.
5619*
SCHAFER, W.
5004
SCHAJOWICZ, F.
5649*
SCHALLER, J.P.
5267
SCHAUENSTEIN, E.
5190*
SCHECHTER, J.
5528*
SCHEINBERG, M.A.
5568*
SCHERF, H.R.
5294
SCHIFFER, M.A.
5482*
SCHINDLER, R.
5190*
SCHLIENGER,
5408*
SCHMIDT-RUPPIN, K.H.
5079
SCHMITZ-MOORMANN, P.
5401
SCHNEIDER, J.
5111, 5118
SCHNEIDERBAUR, A.
5070*
SCHOCHET, S.S., JR.
5694*
SCHOLTZE, P.
5118, 5178
SCHOLZE, P.
5073
SCHORR, W.F.
5665*
SCHOTTENFELD, D.
5646*
SCHOTZ, W.
5424
SCHRAMM, T.
5005

CHREIBER, D.
5111, 5118, 5178
CHREIBER, G.
5512*
CHREIBER, H.
5113
CHRODER, R.
5452
CHROFDER, M.
5072
CHROFDER, T.M.
5023
CHULTE-HOLTHAUSEN, H.
5225
CHWEISGUTH, O.
5598*
COLNICK, E.M.
5232, 5257, 5358
FALY, R.
5577*
FFBER, S.
5529*
FGAL, A.
5072
FGI, M.
5416
FIBERT, F.B.
5479*
FIDEL, H.J.
5203
FIDO, T.
5526*
FKIYA, S.
5086
FLIGMANN, M.
5311
ELL, S.
5561*
ELLAKUMAR, A.R.
5176
FLYF, H.
5194*
FLZER, G.
5577*
ENFLAR, R.
5397*
ENOH, H.
5312
ERGEVNIN, V.V.
5602*
ERRE, A.
5397*
STANFV, A.K.
5106
HAH, J.P.
5654*
HAH, S.A.
5122
HAKUI OV, R.S.
5440
HANI, M.
5222

SHANMUGAM, G.
5347
SHARMA, J.M.
5282*
SHAROUKHOVA, K.S.
5501*
SHATTON, J.B.
5538*
SHAW, C.R.
5121
SHCHERBYNS'KA, A.M.
5274
SHIGEMATSU, T.
5212
SHIMOSATO, Y.
5526*
SHISA, H.
5168
SHKRABA, L.D.
5274
SHLYAKEVICH, M.A.
5398
SHLYAKHOVENKO, V.O.
5210
SHOOTER, K.V.
5181
SHOU-SIN SUNG, M.
5147
SHRAMEK, G.
5282*
SHURLADZE, A.K.
5289*
SHVARTSMAN, A.L.
5670*
SICILIANO, M.J.
5464*
SILVERRER, S.G.
5471*, 5475*
SILVERMAN, N.A.
5554*
SIMAN-TOV, R.
5627*
SIMES, R.J.
5649*
SIMON, K.
5355
SIMONE, J.V.
5666*
SINGER, Z.
5378*
SIU, G.
5027
SISKEN, J.E.
5606*
SKACHKOV, A.P.
5291
SKODA, V.
5679*
SLAVIN, M.
5492*
SMIRNOVA, I.A.
5210

SMITH, B.H.
5650*
SMITH, J.A.
5388*
SMITH, R.G.
5445
SMOLER, D.
5233
SMUCKLER, E.A.
5150, 5171
SNYDER, R.N.
5508*
SNYDER, S.P.
5264
SCKOL, F.
5230
SOKOLOV, A.V.
5398
SOKOLOV, P.P.
5270
SOLCIA, E.
5618*
SLOMON, J.J.
5284*
SLOV'EV, V.D.
5289*
SCNENSHEIN, G.E.
5205
SONTAG, J.M.
5335
SCPER, R.T.
5461*
SGROF, S.
5102
SCULE, E.H.
5565*
SPAHN, G.J.
5254, 5331
SPIEGELMAN, S.
5214, 5229, 5233, 5234
SPIRA, G.
5333, 5359
SPIRO, R.H.
5521*
SPJUT, H.J.
5074
SPORN, M.B.
5174
SREBR, Z.
5551*
STAFFELDT, E.
5084, 5115
STAMBROOK, P.J.
5606*
STANEEZEK, W.
5420
STANULLA, H.
5656*
STAVRCU, D.
5088
STEGNER, H.-E.
5036*

STEIN, J.J.
 5578*
 STEPANOVA, L.G.
 5208
 STEPHENSON, J.R.
 5232
 STERNBERG, S.S.
 5128
 STEVEN, I.M.
 5238
 STEVENS, D.A.
 5402
 STEWART, A.
 5559*
 STEWART, B.W.
 5123
 STERNWARD, J.
 5069*
 STOCCHI, G.
 5647*
 STOCKERT, F.
 5336
 STOKER, T.A.M.
 5636*
 STRAUSS, B.S.
 5605*
 STUART, D.W.
 5494*
 STUTMAN, D.
 5352
 SUAREZ, H.G.
 5205
 SUDA, M.
 5524*, 5539*
 SUFMASU, K.
 5523*
 SUGANO, H.
 5098
 SUGIHARA, S.
 5183
 SUGIMURA, T.
 5143, 5510*, 5545*, 5556*
 SULLIVAN, K.A.
 5307
 SULLIVAN, P.D.
 5429*
 SUMEGI, I.
 5585*
 SUMI, T.
 5434
 SUNG, M.
 5587*
 SUTER, L.
 5351
 SUZUKI, I.
 5369*
 SVET-MOLDAVSKIY, G.YA.
 5270
 SVOBODA, D.
 5543*
 SWENBERG, J.A.
 5363

SZABO, S.
 5194*
 TABBARA, W.S.
 5684*
 TAGASHIRA, Y.
 5141
 TAHMISIAN, T.N.
 5601*
 TAKAHASHI, Y.
 5509*
 TAKAKI, R.
 5104
 TAKAMIZAWA, H.
 5086
 TAKANF, T.
 5086
 TAKASUGI, M.
 5346
 TAKATSU, K.
 5368*
 TAKEMOTO, K.K.
 5260
 TAKII, M.
 5104
 TAMAMOTO, T.
 5244
 TAN, K.B.
 5230
 TANAKA, K.
 5555*
 TANAKA, T.
 5204, 5539*
 TANAKA, Y.
 5517*
 TANIUCHI, K.
 5539*
 TATEISHI, R.
 5403, 5509*
 TAUFFER, M.
 5190*
 TCHERNIA, G.
 5598*
 TEGMEYER, P.
 5216, 5227
 TENNANT, J.R.
 5309
 TENNANT, R.W.
 5245
 TERASAKI, P.I.
 5346
 TERASHI, S.
 5119
 TERENIUS, L.
 5638*
 TESSMER, C.F.
 5432
 THIERLEMONT, M.
 5006
 THOMAS, C.
 5120, 5146
 THOMAS, F.R.
 5432

THOMPSON, N.W.
 5567*
 THOMSON, A.E.R.
 5491*
 THORBECKE, G.J.
 5239
 THUST, R.
 5005, 5109
 TILZ, G.P.
 5349
 TIMKO, J.
 5512*
 TIMOFEYEVA, N.G.
 5671*
 TING, R.C.Y.
 5325
 TOBON, H.
 5467*
 TODARO, G.J.
 5250
 TODD, C.W.
 5327
 TCMKINS, G.M.
 5688*
 TOPOREK, M.
 5530*
 TOSI, P.
 5460*
 TRAYNOR, B.L.
 5213
 TREADWELL, P.E.
 5511*
 TREMBLAY, M.
 5485*
 TRONICK, S.R.
 5257
 TROUILLAS, P.
 5362
 TSAREV, B.M.
 5602*
 TSUGAWA, S.
 5526*
 TSUIKI, S.
 5490*
 TSUJI, T.
 5678*
 TSYSINA, E.N.
 5209
 TULUSAN, A.H.
 5116
 TURNER, H.C.
 5331
 TURNER, M.D.
 5320, 5371*
 TURUSOV, V.S.
 5186*
 TUTEL'YAN, V.A.
 5075
 TWEDELL, K.S.
 5218
 TYURINA, V.P.
 5398

ENOYAMA, K.
5607*
FYAMA, H.
5674*
GRYUMOV, F.P.
5289*
HLENBRUCK, G.
5029
I. M.
5434
MANSKY, YU.O.
5348
NGARD, P.C.
5306
RBAN, J.
5512*
RIEL, J.
5300
T7, D.C.
5579*
AHERI, A.
5533*
ALENTINI, F.
5614*
AN DE BOGART, R.
5156
AN DE VFLDE, R.L.
5570*
AN DUUREN, B.L.
5072
AN NOORD, M.J.
5686*
AN NOSTRAND, A.W.P.
5522*
AN PELT, A.
5202
ASIL'EV, YU.M.
5400
ASIL'FVA, N.N.
5106
ASSALLO, G.
5618*
ATTER, A.F.
5447
CCHIO, G.
5347
ELKOV, G.
5423
ENDRELY, C.
5057*
NITT, S.
5181
NKATESAN, N.
5105
RKHATS'KY, P.P.
5210
RKHATSKYY, P.P.
5348
RLFY, J.M.
5015
RMA, I.M.
5219

VERNIE, L.N.
5166
VFSELINOVITCH, S.D.
5152
VEYS, C.A.
5012
VIEU, F.
5598*
VIGIER, P.
5003
VILA, J.
5624*, 5680*
VINAS, J.
5392*
VISFELDT, J.
5617*
VISHNYAKOVA, V.V.
5501*
VOGLER, W.R.
5511*
VOGT, M.
5235
VOIGT, W.-H.
5203
VOLOBOYEVA, A.O.
5210
VON GRAWERT, H.
5431
VON HAAM, E.
5083
VOSE, B.M.
5332
VOSS, H.J.
5553*
VOUTSADAKIS, A.
5390*
VOZNESENSKII, A.N.
5465*
VRANA, M.
5323
VYETKOVA, O.P.
5348
WADSWORTH, E.M.
5351
WAGGENER, J.D.
5469*
WAGNER, H.
5211
WAHREN, B.
5066*, 5069*
WALBURG, H.E., JR.
5113
WALLER, R.E.
5018
WALTER, C.A.
5629*
WANG, F.
5086
WANGEL, A.G.
5386*
WARNER, N.L.
5314

WARZOK, R.
5111, 5118
WATANABE, K.
5119, 5523*
WATANABE, M.
5165, 5540*
WATANABE, S.
5312
WATERHOUSE, J.A.H.
5426
WATSON, K.F.
5214, 5233, 5234
WATTRE, P.
5301
WEBB, T.E.
5620*
WEBER, C.
5601*
WEBER, G.
5516*
WEBER, M.J.
5248
WECHSLER, W.
5167, 5277, 5363
WEIL, R.
5051*, 5503*
WEINBERG, E.
5262
WEINHOUSE, S.
5011, 5339, 5538*
WEINSTEIN, C.
5455
WEISBURGER, J.H.
5335
WEISS, M.H.
5560*
WEISSBACH, A.
5220
WEISSBERG, M.
5145
WELCH, R.M.
5133
WEPSIC, H.T.
5561*
WESTPHAL, H.
5030*
WETZER, K.
5658*
WEYLAND, P.
5076
WEZYK, J.
5593*
WHITE, A.
5549*
WHITEHOUSE, J.M.A.
5319
WHITMIRE, C.E.
5149, 5331
WHITTY, A.J.
5640*
WILBUR, J.
5432

WIFONG, R.F.
 5277
 WILLIAMS-ASHMAN, H.G.
 5516*
 WILLIAMS, W.C.
 5212
 WILLIAMSON, J.G.
 5621*
 WILSON, J.B.
 5690*
 WITSCHI, H.
 5192*
 WITTER, R.L.
 5282*, 5284*
 WITTLIFF, J.L.
 5513*
 WOGAN, G.N.
 5152, 5153, 5174, 5335
 WOHLENBERG, H.
 5108, 5162
 WOLF, M.
 5420
 WOLFF, I.G.
 5282*
 WOLFF, G.L.
 5514*
 WOLFF, M.
 5628*
 WOODLIFF, H.J.
 5448
 WOODRIFF, M.F.A.
 5315
 WOODWARD, A.H.
 5565*
 WOROWSKI, K.
 5450
 WRYKE, S.
 5592*
 WU, Y.H.
 5195*
 WUNDERLICH, V.
 5024
 WURNIG, P.
 5428*
 WYLLIE, A.H.
 5020
 WYNDER, F.L.
 5010
 YAM, C.
 5480*
 YAMADA, S.
 5089
 YAMAGUCHI, N.
 5253
 YAMAMOTO, S.
 5243
 YAMAMOTO, T.
 5253, 5678*
 YAMAMURA, Y.
 5505*
 YAMANISHI, Y.
 5600*, 5604*

YAMASHINA, I.
 5534*
 YANAGI, S.
 5539*
 YANAGIHARA, E.
 5532*
 YANIV, A.
 5214, 5233, 5234
 YANYSHEVA, N.YA.
 5002
 YAU, T.H.
 5248
 YAVUZ, H.
 5648*
 YELTON, D.B.
 5261
 YEOMANS, F.
 5479*
 YIELDING, K.L.
 5139
 YOHAN, D.S.
 5267, 5292
 YOKOCHI, T.
 5098
 YOSHIDA, T.O.
 5204
 YOSIDA, T.H.
 5525*
 YUDIN, I.YU.
 5602*
 YUHAS, J.M.
 5418
 YUNICHEVA, R.KH.
 5425
 YUTOKU, M.
 5312
 ZAGURY, D.
 5365
 ZAMCHECK, N.
 5370*
 ZATZ, M.M.
 5549*
 ZAWIDZKA, Z.Z.
 5531*
 ZAWIRSKA, B.
 5085
 ZBARSKYY, I.B.
 5700*
 ZBRANCA-TOPORAS, E.
 5594*
 ZEDECK, M.S.
 5128
 ZEITOUN, P.
 5365
 ZELFCHOWSKA, J.A.
 5591*
 ZELLER, W.J.
 5144
 ZHFLEZNOV, B.I.
 5058*
 ZHIRNOVA, N.E.
 5095

ZHIVKOV, V.
 5499*, 5500*
 ZHUKHINA, G.YE.
 5044*
 ZILLIKEN, F.
 5552*
 ZIMBER, P.
 5512*
 ZIMMERMAN, L.E.
 5643*
 ZITTOUN, R.
 5062*
 ZLOTNICK, A.
 5492*
 ZOBL, H.
 5266
 ZOTTER, S.
 5211
 ZUCKERMANN, C.
 5597*
 ZULCH, K.J.
 5107, 5110
 ZUR HAUSEN, H.
 5225

ACETAMIDONAPHTHALENE
 METABOLISM, DOG (5092)
 ACETYLAMINOFLUORENE
 LIVER, ADENYL CYCLASE, ADRENALIN
 RESPONSE, RAT (5125)
 PHENOBARBITAL, LIVER TUMOR, RAT (5084)
 ACETYLAMINOFLUORENE
 PANCREAS, ACINAR CELL, RAT (5169)
 TINOMYCIN D
 ACID PHOSPHATASE INDUCTION, LEUKEMIA,
 CELLS, MOUSE (5698)*
 7,12-DIMETHYLBENZ(A)ANTHRACENE, SKIN,
 TUMOR INHIBITION, PERSISTENCE, MOUSE
 (5072)
 ENINE
 PROTEIN SYNTHESIS, NORMAL CELLS,
 TUMOR CELLS, RAT (5583)*
 ENOCARCINOMA
 ENDOMETRIAL, DNA METABOLISM, KARYOTYPE
 ULTRASTRUCTURE, HUMAN (5681)*
 HERPESVIRUS, REPLICATION, KIDNEY, FROG
 (5238)
 ENOMA
 ACIDOPHIL, INTRACITOPLASMIC
 FILAMENTOUS AGGREGATES, ULTRA-
 STRUCTURE, HUMAN (5694)*
 ENOMATOSIS
 MULTIPLE ENDOCRINE, MEDIASTINAL
 ENDOCRINE NEOPLASM, CASE REPORTS
 (5576)*
 RENAL GLAND
 PROTEIN SYNTHESIS, DIMETHYLNITROSAMINE
 RAT (5171)
 RENALIN
 RESPONSE, ADENYL CYCLASE, LIVER,
 2-ACETYLAMINOFLUORENE, RAT (5125)
 LATOXIN
 B1
 HEPATOCARCINOGENICITY, MOUSE
 (5152)
 HEPATOCELLULAR CARCINOMA, ALPHA-
 FETOPROTEIN, RAT (5335)
 METABOLISM, MONKEY (5153)
 NUCLEOLAR MODIFICATION, FISH LIVER
 SNAIL (5116)
 RNA POLYMERASE, SELECTIVE INHIBI-
 TION, LIVER, RAT (5150)
 CARCINOGENICITY, TOXICITY, LIVER,
 ANIMALS, REVIEW (5059)*
 MITOMYCIN C, LYSOSOMAL ENZYMES, LIVER,
 RAT (5075)
 RNA POLYMERASE INHIBITION, CELLULAR
 RNA CONTENT CHANGES, DNA BINDING,
 HEPATOCYTES, RAT (5174)
 TUMORIGENICITY, AZOXYMETHANE, NERVOUS
 SYSTEM, RAT (5103)
 AGING
 TISSUE, JUVENILE CANCERS (5559)*
 AIR POLLUTION
 ATMOSPHERIC CARCINOGENS, STANDARDIZA-
 TION, REVIEW (5002)
 LUNG CANCER, OCCUPATIONAL HAZARD,
 SMOKING, REVIEW (5018)
 ALBUMIN
 CONTENT, HEPATOMAS, LIVER, RAT (5512)*
 PROTEIN SYNTHESIS, NORMAL CELLS,
 TUMOR CELLS, RAT (5583)*
 SERUM PROTEIN PRODUCTION, LIVER, RAT
 (5530)*
 SYNTHESIS, FREE POLYRIBOSOMES,
 HEPATOMA, RAT (5607)*
 ALCOHOLIC BEVERAGE
 CARCINOGEN, TUMOR PROMOTION (5180)
 ALKYLATION
 TUMORS, MORPHOLOGY, NERVOUS SYSTEM,
 ANIMALS (5107)
 ALPHA FETOPROTEIN
 CHEMICAL CARCINOGENESIS, HEPATIC
 CARCINOMA, RAT (5098)
 HEPATOCELLULAR CARCINOMA, AFLATOXIN B1
 RAT (5335)
 ISOLATION, CHARACTERIZATION, RAT
 (5561)*
 SYNTHESIS, INHIBITION, LIVER, RAT
 (5300)
 AMELOBLASTOMA
 HISTOLOGIC VARIANTS, ULTRASTRUCTURE,
 CASE REPORTS (5634)*
 AMINO ACID
 INCORPORATION, LIVER POLYRIBOSOME,
 DIMETHYLNITROSAMINE, RAT (5166)
 LEUCINE INCORPORATION, PROTEIN,
 INHIBITION, TUMOR-BEARING BLOOD, RAT
 (5524)*
 L-ORNITHINE METABOLISM, HEPATOMAS, RAT
 (5516)*
 AMINOAZO DYE
 METHEMOGLOBIN FORMATION, RAT (5195)*
 ANDROBLASTOMA
 OVARIES, RADIATION-INDUCED, MOUSE
 (5201)
 ANEMIA
 HEMOLYTIC, TUMOR CELL EMBOLI, INTRA-
 VASCULAR COAGULATION, CASE REPORT
 (5557)*
 MYELOGENOUS LEUKEMIA, MOUSE (5443)
 TRANSPLANTABLE LYMPHOID TUMOR, CHICKEN
 (5519)*
 ANGIOKERATOMA

CIRCUMSCRIPTUM NAEVIFORME, CASE REPORT (5678)*

ANTHANTHRENE
POLYNUCLEAR HYDROCARBON, SKIN CARCINOGENESIS, MOUSE (5142)

ANTIBODY
CELL MEMBRANE, CYTOPLASM, MALIGNANT MELANOMA, HUMAN (5328)
CYTOTOXIC, ACUTE LYMPHOCYTIC LEUKEMIA, HUMAN (5304)
FORMALINIZATION, TUMOR CELL, IMMUNE RESPONSE, MOUSE (5306)
MOUSE FETAL ANTIGEN, RAUSCHER LEUKEMIA CELLS, SERA (5344)
SERUM, POLYOMA VIRUS, HAMSTER (5260)
SMOOTH MUSCLE, CANCER PATIENT, SERUM (5319)

ANTIGEN
AUSTRALIA, HEPATOMA, ASIA (5297)
AVIAN LEUKOSIS VIRUS, TYPE SPECIFICITY CHICKEN CELL (5357)
C-TYPE RNA TUMOR VIRUS, PROLACTIN-INDUCED, TUMORIGENESIS, MOUSE (5316)
CARCINOEMBRYONIC
COLON ADENOCARCINOMA, HUMAN (5327)
COLONIC CARCINOMA, RADIOIMMUNO-ASSAY, SERUM, HUMAN (5371)*
DIGESTIVE SYSTEM, RADIOIMMUNOASSAY HUMAN (5384)*
INFLAMMATORY BOWEL DISEASE, CASE REPORTS (5370)*
LYMPHOCYTE SENSITIZATION, MULTIPLE SCLEROSIS, HUMAN (5383)*
STRUCTURE, DETERMINANTS, COLONIC CARCINOMA, HUMAN (5320)
TUMOR CELLS, HUMAN, REVIEW (5069)*
CROSS-REACTIVITY, TUMOR AND FETAL CELL MOUSE (5388)*
EMBRYONIC, HEPATOMA, SARCOMA, RAT (5332)
EPIDERMIS, CARCINOMA, 3-METHYL-CHOLANTHRENE, MOUSE (5361)
EPSTEIN-BARR VIRUS, INFECTIOUS MONONUCLEOSIS, ACUTE LYMPHOCYTIC LEUKEMIA, HUMAN (5402)
EPSTEIN-BARR VIRUS-ASSOCIATED, 5-BROMODEOXYURIDINE ACTIVATED, HUMAN CELLS (5387)*
EPSTEIN-BARR VIRUS-RELATED, IMMUNO-ELECTRON MICROSCOPIC ANALYSIS, BURKITT LYMPHOMA CELLS, HUMAN (5369)*
FELINE LEUKEMIA VIRUS, MURINE LEUKEMIA VIRUS, PROTEIN ASSAY (5358)
GAMMA FETOPROTEIN, MALIGNANT TISSUE, HUMAN (5323)
GIX EXPRESSION, GENE, MURINE LEUKEMIA VIRUS, MOUSE (5336)
GRAFFI VIRUS-INDUCED LEUKEMIA, RAT, MOUSE (5343)
GROUP-SPECIFIC
C-TYPE VIRUS, LIFE SPAN, MOUSE (5331)
MEMBRANE-BOUND, GRAFFI AND GROSS LEUKEMIAS, MOUSE, RAT (5342)
GROUP-SPECIFIC C PARTICLE, ASCITES TUMOR, MOUSE (5389)*
HEPATITIS-ASSOCIATED, PRIMARY HEPATOMA CASE REPORT (5386)*
HERPESVIRUS, ACTIVATION, LEUKEMIC LYMPHOBLASTS, GUINEA PIG (5382)*
HETERO-ORGANIC, ASCITES HEPATOMA, RAT (5366)*
HISTOCOMPATIBILITY, LYMPHOMA, HUMAN (5337)
HL-A, CELL-SURFACE, CYTOTOXIC PLATING INHIBITION TEST, CULTURED TUMOR CELL HUMAN (5346)
IMMUNE RESPONSE, TUMOR CELLS, HUMAN REVIEW (5066)*
INTRACELLULAR AND CELL MEMBRANE, HERPESVIRUS SAIMIRI, IMMUNO-FLUORESCENCE, MONKEY (5345)
MAMMARY TUMOR VIRUS, MURINE LEUKEMIA VIRUS, MOUSE (5212)
NEOANTIGENS, SV40, TRANSFORMED-FIBROSARCOMA CELLS, HAMSTER (5349)
ONCOGENIC VIRUS RNA, CARCINOEMBRYONIC ANTIGENS, GLIAL TUMORS, HUMAN (5362)
S, SV40, HAMSTER (5329)
SARCOMA, FRACTIONATION, MACROPHAGE MIGRATION INHIBITION TEST, GUINEA PIG (5351)
SOLUBLE MEMBRANE, CERVICAL CANCER, HERPESVIRUS TYPE 2 ANTISERUM, IMMUNOLOGY (5372)*
SV40, TRANSFORMED CELL, MONKEY (5333)
T, SYNTHESIS, GLYCOLYTIC ENZYMES, POLYOMA VIRUS INFECTION, HAMSTER MOUSE (5255)
TUMOR
SV40, TUMOR, IMPRINT TEST, HAMSTER (5321)
SV40-INDUCED, TRANSFORMED KIDNEY CELLS, HAMSTER (5359)
TUMOR SPECIFIC
HUMAN LYMPHOCYTIC AND MYELOID LEUKEMIA CELLS, DETECTION (5381)*
INDUCTION, CARCINOGEN-TREATED

CELLS, MOUSE (5353)
 TUMOR-SPECIFIC TRANSPLANTATION,
 RHABDOMYOSARCOMA, DIBENZANTHRACENE,
 IMMUNE REACTION, MOUSE (5317)
 UMBILICO-PLACENTAL, MALIGNANT TUMOR,
 HUMAN (5318)
 VIRAL AND LEUKEMIA-ASSOCIATED, ACUTE
 LEUKEMIA, IDENTICAL TWINS (5325)
 ANTILYMPHOCYTE SERUM
 THYMECTOMY, TRANSPLANTATION, LEUKEMIA,
 HAMSTER, HUMAN (5313)
 APOPTOSIS
 CELL DELETION, NEUPLASIA, REVIEW
 (5020)
 AROMATIC AMINES
 OCCUPATIONAL HAZARD, REVIEW (5012)
 RHENOBLASTOMA
 MALE HORMONE PRODUCING TUMOR, YOUNG
 WOMAN, CASE REPORT (5690)*
 ASBESTOS
 BENZO(A)PYRENE, LUNG, MORPHOLOGICAL
 CHANGES, RAT (5117)
 SCITES
 EHRLICH CARCINOMA, GROWTH KINETICS,
 ALTERED IMMUNOLOGICAL CONDITIONS
 (5377)*
 HEPATOMA
 GLYCOGEN STORAGE, MECHANISM, RAT
 (5490)*
 GLYCOPOLYMER, ISOLATION, ANALYSIS
 MICROSOBES, RAT (5534)*
 HETERO-ORGANIC ANTIGEN, RAT
 (5366)*
 HEPATOMA 109A, SERUM GLYCOPROTEIN
 LEVELS, RAT (5385)*
 SCITES TUMOR
 EHRLICH
 NOVIKOFF, PANCREATIC-LIKE
 RIBONUCLEASE ACTIVITY, MOUSE
 (5488)*
 PHOSPHOFRUCTOKINASE, KINETICS
 (5434)
 GROUP-SPECIFIC C PARTICLE ANTIGENS,
 MOUSE (5389)*
 GLYCOLYSIS INHIBITION, 2-DEOXY-2-
 FLUORO-D-GLUCOSE, CELLS (5435)
 STROCYTE
 FIBROBLASTS, ULTRASTRUCTURE, HUMAN,
 MURINE (5447)
 PROTEIN SYNTHESIS, NORMAL CELLS,
 TUMOR CELLS, RAT (5503)*
 AUSTRALIAN ANTIGEN
 HEPATOMA, ASIA (5297)
 OXYMETHANE
 TUMORIGENICITY, AGE DEPENDENCE,
 NERVOUS SYSTEM, RAT (5103)
 BACILLUS CALMETTE-GUERIN
 IMMUNITY, BLOCKING ACTIVITY, MELANOMA,
 HUMAN (5330)
 BACTERIA
 INTESTINE, ESTRADIOL PRODUCTION (5182)
 TUMORS, HUMAN, GUINEA PIG, MOUSE
 (5479)*
 BACTERIOPHAGE
 RNA, SYNTHESIS (5229)
 BASAL CELL
 CARCINOMA, AMYLOID-LIKE SUBSTANCE,
 HUMAN (5585)*
 EPITHELIOMA, COLLAGENOLYTIC ENZYMES,
 SKIN, HUMAN (5600)*
 EPITHELIOMA, COLLAGENOLYTIC ENZYMES,
 ULTRASTRUCTURE, SKIN, HUMAN (5604)*
 BASIC LEAD ACETATE
 KIDNEY TUMOR, RAT (5193)
 BENZO(A)PYRENE
 ASBESTOS, MORPHOLOGICAL CHANGES, LUNG,
 RAT (5117)
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 COMBINED ACTION, SKIN, MOUSE (5186)*
 5-HYDROXY DERIVATIVE, SKIN, FIBRO-
 SARCOMA, MOUSE (5141)
 INDUCED VIRUS PRODUCTION, TRANSFORMED
 CELL LINE, HAMSTER (5271)
 METABOLITE FORMATION, FIBROBLASTOID
 CELLS, HAMSTER (5177)
 OVERHEATED COOKING OILS, CARCINO-
 GENICITY, RAT (5159)
 RESPIRATORY TRACT CARCINOGENESIS,
 HAMSTER (5176)
 SMOKED FOOD PRODUCTS, PENETRATION
 THROUGH BODY, RAT, DOG, HUMAN (5095)
 1,2-BENZOPYRENE
 CARCINOGENIC ACTION, ELECTRONIC STRUC-
 TURE, MOLECULAR ORBIT (5140)
 ELECTRONIC STRUCTURE, CARCINOGENIC
 ACTIVITY, RESONANCE ANALYSIS (5099)
 3,4-BENZOPYRENE
 CARCINOGENIC ACTION, ELECTRONIC STRUC-
 TURE, MOLECULAR ORBIT (5140)
 ELECTRONIC STRUCTURE, CARCINOGENIC
 ACTIVITY, RESONANCE ANALYSIS (5099)
 BITUMENS
 CARCINOGENESIS, OCCUPATIONAL HAZARD,
 HUMAN, REVIEW (5027)
 BLADDER
 CANCER
 AROMATIC AMINE, TRYPTOPHAN META-
 BOLISM, HUMAN (5124)
 IMMUNOLOGICAL CHARACTERISTICS,

- HUMAN, REVIEW (5055)*
 BLASTOMOGENESIS
 LYMPHOCYTE, LEUKEMIA CELLS, IMMUNO-
 COMPETENCE, SERUM, HUMAN (5360)
 THYROID, 6-METHYLTHIOURACIL, RAT
 (5296)
- BLOOD
 ANEMIA, MYELOGENOUS LEUKEMIA, MOUSE
 (5443)
 MONOCYTES, GRANULOCYTE STIMULATORS,
 MONONUCLEAR COLONY FORMATION,
 HUMAN (5507)*
 PERIPHERAL CELLS, COLONY GROWTH,
 LEUKEMIA PATIENTS (5493)*
- BONE
 ADAMANTINOMA, ULTRASTRUCTURE, CASE
 REPORTS (5649)*
 OSTEOGENIC SARCOMA, OSSIFICATION,
 HUMAN, REVIEW (5043)*
 PLUTONIUM RADIATION, RAT (5198)
- BONE MARROW
 BLAST, LEUKEMIA, SERUM COPPER, HUMAN
 (5432)
 MULTIPLE MYELOMA, CYTOLOGY, IMMUNOLOGY
 HUMAN (5390)*
 NEUROBLASTOMA, HISTOLOGIC STUDY,
 CHILDREN (5598)*
- BONE
 INFLAMMATORY DISEASE, CARCINOEMBRYONIC
 ANTIGEN, CASE REPORTS (5370)*
- BRAIN
 BOVINE PAPILLOMA VIRUS, HAMSTER (5237)
 CRANIAL TUMOR, ADENOVIRUS 12,
 N,N'-DIMETHYLNITROSOUREA, MOUSE
 (5252)
 METASTATIC CARCINOMA, SCINTIGRAMS,
 HUMAN (5609)*
 TUMORS
 ATYPICAL MITOSIS, HUMAN (5452)
 GEOGRAPHIC DISTRIBUTION, KENTUCKY
 (5422)
 GLUTAMATE DEHYDROGENASE, ASPARTATE
 AMINOTRANSFERASE ACTIVITY, HUMAN
 (5657)*
 ROUS SARCOMA VIRUS, RAT (5277)
- BREAST
 CANCER
 ESTROGEN EXCRETION, ANDROGEN-
 TREATED PATIENTS (5501)*
 HUMAN, MOUSE, REVIEW (5025)
 MAMMARY TUMOR VIRUS, MOUSE (5211)
 MULTICENTRIC ORIGIN, CASE REPORT
 (5616)*
 CARCINOMA
 EPIDEMIOLOGICAL STUDY, GERMANY
 (5419)
 EPIDEMIOLOGY, HUMAN, REVIEW
 (5039)*
 EPITHELIOID CELL LINE ISOLATION,
 HUMAN (5683)*
 ESTROGEN-BINDING CAPACITY, CYTO-
 PLASMIC RECEPTOR, TISSUE, HUMAN
 (5513)*
 PRECANCEROUS CONDITIONS, DETECTION,
 HUMAN, REVIEW (5067)*
 VIRUSES, HUMAN, REVIEW (5040)*
 LOBULAR CARCINOMA
 CLINICAL STUDY (5624)*
 ULTRASTRUCTURE, CASE REPORTS
 (5467)*
- BRENNER TUMOR
 OVARY, LEYDIG CELL HYPERPLASIA, CASE
 REPORT (5611)*
 PROLIFERATIVE
 CASE REPORT (5587)*
 MALIGNANT, OVARY, CLINICAL STUDY
 (5569)*
- 5-BROMODEOXYURIDINE
 EPSTEIN-BARR VIRUS-ASSOCIATED ANTIGENS
 HUMAN CELLS (5387)*
- BROMOMETHYLBENZ(A)ANTHRACENE
 DNA CROSS-LINKING, T7 BACTERIOPHAGE
 (5181)
- BURKITT'S LYMPHOMA
 CELL AGGREGATION, STATIONARY CULTURE,
 EXPERIMENTAL ANALYSIS, THEORETICAL
 ANALYSIS (5584)*
 EPSTEIN-BARR VIRUS, HUMAN, REVIEW
 (5041)*
- BURSECTOMY
 ROUS SARCOMA VIRUS, TUMOR GROWTH,
 HYPOGAMMAGLOBULINEMIA, CHICKEN
 (5239)
- N-BUTYL-N-(4-HYDROXYBUTYL)NITROSAMINE
 KIDNEY TUMOR, RAT (5183)
- N-BUTYL-NITROSOUREA
 NEUROGENIC TUMORS, RAT (5144)
- CACHEXIA
 CANCER SYNDROME, CELL TURNOVER, MOUSE
 (5437)
- CADMIUM
 CARCINOGENESIS, HUMAN, RAT (5014)
- CADMIUM CHLORIDE
 INTERSTITIAL CELL TUMORS, TESTES, RAT
 (5132)
- CALCIUM
 PHOSPHOLIPID-CALCIUM COMPLEXES,
 EXPERIMENTAL TUMORS (5536)*
 PROTEIN SYNTHESIS, NORMAL CELLS,
 TUMOR CELLS, RAT (5503)*

ALCER

ENZYMES, MOLECULAR FORMS (5538)
INCIDENCE, 1969, CONNECTICUT (5429)*
JUVENILE, TISSUE AGING (5559)*
LUNG, GI TRACT, MINERAL OIL, INCIDENCE
HUMAN (5426)
MORTALITY, 1950-1967, AMERICAN INDIANS
(5421)
VIRUS, HUMAN, REVIEW (5071)*

ALBA-ATE

1-(4-CHLOROPHENYL)-1-PHENYL-2-PROPYL,
TUMORIGENICITY, RAT (5077)

ARCINOEMBRYONIC ANTIGEN

COLON ADENOCARCINOMA, HUMAN (5327)
DETERMINANTS, COLONIC CARCINOMA, HUMAN
(5320)

ARCINOGENESIS

CADMIUM, HUMAN, RAT (5014)
GENETICS, HUMAN, REVIEW (5023)
NICKEL, CHROMIUM, HUMAN, REVIEW (5009)

ARCINOGENICITY

OVERHEATED COOKING OILS, BENZO(A)-
PYRENE, RAT (5159)

ARCINOMA

OVARY, EPIDEMIOLOGY, BULGARIA (5423)

ARCINOSARCOMA

GASTRIC, CASE REPORT (5496)*

CELL

BLOOD MONOCYTES, GRANULOCYTE STIMULA-
TORS, MONONUCLEAR COLONY FORMATION,
HUMAN (5507)*

CHEMICAL CARCINOGEN TREATMENT,
INCREASE IN LIFE SPAN, HAMSTER
EMBRYO (5175)

HEPATOMA, BIOCHEMISTRY, CYTOGENETICS,
RAT (5456)

NEOPLASTIC, METABOLISM, REVIEW (5047)*

PANCREATIC EXOCRINE, LIPID CONTENT,
WALKER TUMOR, RAT (5635)*

PYROLYSIS-GAS-LIQUID CHROMATOGRAPHY,
NORMAL CELLS, LEUKEMIC CELLS,
MAMMALS (5537)*

SPINDLE CELL CARCINOMA, BURN SCAR,
UPPER LIMB, CASE REPORT (5564)*

CELL CYCLE

GROWTH, TUMORS, HUMAN, REVIEW (5048)*
KINETICS, LEUKEMIA, MOUSE (5410)
MOVEMENT AND DIFFERENTIATION OF CELLS,
BASAL LAYER, CORNEAL EPITHELIUM
(5601)*

RNA SYNTHESIS, 3H URIDINE AND 3H
ADENINE INCORPORATION, HAMSTER CELLS
(5606)*

SYNCHRONIZATION, CYTOSINE ARABINOSIDE,
MELANOMA, MOUSE (5632)*

CELL DELETION

APOPTOSIS, NEOPLASIA, REVIEW (5020)

CELL MEMBRANE

GROWTH NUTRIENT, MALIGNANT GROWTH,
REVIEW (5016)

CELLOPHANE

INDUCED-TUMORS, SEMINAL GLAND, RAT
(5199)

CENTRAL NERVOUS SYSTEM

GIANT CELL TUMORS, METHYLNITROSOUREA,
DOG, RAT (5109)
TUMOR, NERVOUS TISSUE-SPECIFIC PROTEIN
RAT (5363)

CERVICAL ESOPHAGUS

CANCER, TREATMENT, CASE REPORTS
(5494)*

CERVIX

CANCER, SOLUBLE MEMBRANE ANTIGEN,
HERPESVIRUS TYPE 2 ANTISERUM,
IMMUNOLOGY (5372)*
CARCINOMA, SERUM PROTEIN-BOUND FUCOSE
LEVELS, PATIENTS (5484)*

CHEMICAL CARCINOGEN

DOSE LIMITS DETERMINATION, REVIEW
(5045)*

NEOPLASTIC ALTERATIONS, TOXICITY,
CELLS, REVIEW (5005)

OCCUPATIONAL HAZARD, ANIMAL STUDIES,
REVIEW (5021)

CHEMICAL CARINOGENESIS

3,4-BENZPYRENE, 1,2-BENZPYRENE,
ELECTRONIC STRUCTURE, MOLECULAR
ORBIT (5140)
MECHANISMS, REVIEW (5024)
POLYCYCLIC HYDROCARBONS, MOLECULAR
MECHANISMS, K AND L REGIONS (5147)

CHEMODECTOMA

LARYNX, CASE REPORTS (5481)*

CHEMOTHERAPY

LEUKOCYTE, CHROMOSOME, ABNORMALITY,
HUMAN (5454)

CHROMIUM

CARCINOGENESIS, OCCUPATIONAL HAZARD,
HUMAN, REVIEW (5009)

CHROMOSOME

ABERRATIONS, MALIGNANT TUMORS, VIRAL
ETIOLOGY, HUMAN, REVIEW (5042)*
ABNORMALITY, LEUKOCYTE, THERAPEUTIC
DRUG, RADIATION, HUMAN (5454)
ALTERATIONS, CARCINOGENESIS, HUMAN,
REVIEW (5023)
ANALYSIS, HUMAN TUMORS, HETEROTRANS-
PLANTATION TO MOUSE (5617)*
ANALYSIS, KARYOTYPE, QUINACRINE
FLUORESCENT AND GIEMSA BANDING,

TRANSFORMED AND MALIGNANT CELL LINES
 LIVER, RAT (5599)*
 ANOMALIES, AMYLOSE, AGED MICE (5672)*
 CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN
 (5448)
 KARYOLOGY, RHABDOMYOSARCOMA, 3-METHYL-
 CHOLANTHRENE-INDUCED, RAT (5112)
 MARKER, YOSHIDA SARCOMA, RAT (5525)*
 PHILADELPHIA, CHRONIC MYELOGENOUS
 LEUKEMIA, BLASTIC CRISIS, CASE
 REPORT (5473)*
 PRIMARY ROUS SARCOMA, RAT (5462)*
 SEQUENTIAL CHANGE, SARCOMA, ROUS
 SARCOMA VIRUS, RAT (5221)
 STEMLINE KARYOTYPE, CENTRIC FUSION,
 MOUSE SARCOMA (5695)*
 CHROMATOGRAPHY
 PYROLYSIS-GAS-LIQUID, NORMAL CELLS,
 LEUKEMIC CELLS, MAMMALS (5537)*
 CIRCULATION
 BLOOD SUPPLY, ACUTE LIGATION, HEPATIC
 ARTERY, PORTAL VEIN, LIVER
 METASTASES, RAT (5554)*
 CIRRHOSIS
 INHIBITION, LATHYROGENIC COMPOUND,
 LIVER, RAT (5189)*
 COCARCINOGEN
 DNA REPAIR SYNTHESIS, INHIBITION,
 LYMPHOCYTE, HUMAN (5139)
 COLON
 ADENOCARCINOMA, CARCINOEMBRYONIC
 ANTIGEN, HUMAN (5327)
 CARCINOMA
 ADENOMATOUS POLYPS, BIOPSY, ORGAN
 TISSUE CULTURE, HUMAN (5470)*
 CARCINOEMBRYONIC ANTIGEN
 RADIOIMMUNOASSAY, SERUM, HUMAN
 (5371)*
 STRUCTURE, DETERMINANTS, HUMAN
 (5320)
 COLONIC MUCOSA, CARCINOSARCOMA
 IMPLANTATION, RAT (5487)*
 PRIMARY MULTIPLE CANCERS, CLINICAL
 STUDY (5602)*
 TUMOR, tRNA METHYLATION, 1,2-DIMETHYL-
 HYDRAZINE, MOUSE (5093)
 CONCAVALIN A
 RECEPTOR SITES, LYMPHOCYTES, LYMPHO-
 BLASTS, HUMAN (5605)*
 COPPER
 SERUM LEVEL, BONE MARROW BLAST,
 LEUKEMIA, HUMAN (5432)
 CYCASIN
 LIVER TUMORIGENESIS, RAT (5119)
 TUMOR INDUCTION, RAT, MOUSE, HAMSTER,
 RABBIT, GUINEA PIG (5091)
 CYCLIC NITROSAMINES
 TUMORIGENICITY, RAT (5080)
 CYSTOSARCOMA PHYLLODES
 CASE REPORTS (5680)*
 CYTOLOGY
 LARYNX, PRECANCEROUS LESIONS, HUMAN,
 REVIEW (5061)*
 LEUKEMIA-LIKE VIRUS, HUMAN (5289)*
 CYTOSINE ARABINOSIDE
 CELL CYCLE SYNCHRONIZATION, MELANOMA,
 MOUSE (5632)*
 CYTOSTATIC DRUGS
 CARCINOGENICITY, REVIEW (5032)*
 CYTOTOXICITY
 ANTIBODY, ACUTE LYMPHOCYTIC LEUKEMIA,
 HUMAN (5304)
 ETHYLNITROSOUREA, METHYLNITROSOUREA,
 NERVE CELL, RAT (5078)
 2-DEOXY-2-FLUORO-D-GLUCOSE
 ASCITES TUMOR CELLS, GLYCOLYSIS
 INHIBITION (5435)
 2-DEOXYGLUCOSE
 ENERGY METABOLISM, GRANULOMA TISSUE,
 RAT (5495)*
 DEXTRAN SULFATE
 PULMONARY METASTASIS INHIBITION, RAT
 (5523)*
 DIBENZANTHRACENE
 RHABDOMYOSARCOMA, TUMOR-SPECIFIC
 TRANSPLANTATION ANTIGEN, IMMUNE
 REACTION, MOUSE (5317)
 DIET
 FOOD PREPARATION, CARCINOGENIC HYDRO-
 CARBON FORMATION, GASTRIC CANCER,
 HUMAN (5148)
 MODIFICATION, TUMOR GROWTH, MOUSE
 (5540)*
 SMOKED FOOD PRODUCTS, BENZO(A)PYRENE,
 PENETRATION THROUGH BODY, RAT, DOG,
 HUMAN (5095)
 DIETHYLNITROSAMINE
 HEPATOCELLULAR CARCINOMA, GROWTH
 KINETICS, LIVER CELL POPULATIONS,
 RAT (5073)
 HEPATOMA INDUCTION, 4-HYDROXYPENTENAL,
 OXYGEN UPTAKE, SH CONTENT, LIVER,
 RAT (5190)*
 INFLUENZA VIRUSES, LUNG CARCINOMA
 INDUCTION, MOUSE (5079)
 LIVER CARCINOMA
 HISTOLOGICAL CHANGES, HISTO-
 CHEMICAL CHANGES, RAT (5401)
 INHIBITION, THYMUS TISSUES, RAT
 (5145)

URINARY 7-METHYL GUANINE EXCRETION,
 RAT (5076)
 DIGESTIVE SYSTEM
 CARCINOEMBRYONIC ANTIGEN, RADIOIMMUNO-
 ASSAY, HUMAN (5384)*
 DIGESTIVE TRACT
 PRECANCEROUS STAGES, HUMAN, REVIEW
 (5001)
 PRIMARY MALIGNANT LYMPHOMA, CASE
 REPORTS (5684)*
 DIMETHYLAMINOAZOBENZENE
 CARCINOGENESIS, INHIBITION, LATHYRO-
 GENIC COMPOUND, LIVER, RAT (5189)*
 HEPATOCARCINOGENESIS, GLYCOLYSIS, RAT
 (5161)
 DIMETHYLAMINOAZOBENZENE
 HEPATOMA
 CYTOSKELETON ALTERATIONS, LIVER
 CELLS, RAT (5131)
 SARCOMA, EMBRYONIC ANTIGEN, RAT
 (5332)
 2'-DIMETHYL-4-AMINOBIPHENYL
 INTESTINAL NEOPLASM, RAT, HUMAN (5074)
 12-DIMETHYLBENZANTHRACENE
 METABOLITE FORMATION, FIBROBLASTOID
 CELLS, HAMSTER (5177)
 SARCOMA, SKIN TRANSPLANTS, MOUSE
 (5270)
 12-DIMETHYLBENZ(A)ANTHRACENE
 ACTINOMYCIN-D, SKIN, TUMOR INHIBITION,
 PERSISTENCE, MOUSE (5072)
 BENZO(A)PYRENE, COMBINED EFFECT, SKIN,
 MOUSE (5186)*
 LEUKEMIA, THYMUS, MOUSE (5168)
 MAMMARY CARCINOMA, ULTRASTRUCTURE, RAT
 (5083)
 MAMMARY GLAND TUMORS, HORMONE-INDUCED
 STIMULANT EFFECTS, MOUSE, REVIEW
 (5064)*
 TUMOR-SPECIFIC ANTIGEN INDUCTION,
 CELLS, MOUSE (5353)
 UTERUS, ADENOCARCINOMA, RAT (5086)
 10-DIMETHYL-1,2-BENZANTHRACENE
 URINARY 7-METHYL GUANINE EXCRETION,
 RAT (5076)
 2-DIMETHYLHYDRAZINE
 COLONIC TUMOR, tRNA METHYLATION, MOUSE
 (5093)
 DIMETHYLNITROSAMINE
 ADRENAL GLAND, PROTEIN SYNTHESIS, RAT
 (5171)
 LIVER POLYRIBOSOME, AMINO ACID
 INCORPORATION, RAT (5166)
 tRNA METHYLASE, KIDNEY, RAT (5123)
 URINARY 7-METHYL GUANIDE EXCRETION,

RAT (5076)
 NN-DIMETHYLNITROSAMINE
 RNA METHYLATION, LIVER, RAT (5122)
 N,N'-DIMETHYLNITROSOUREA
 ADENOVIRUS 12, CRANIAL TUMOR, MOUSE
 (5252)
 DNA
 ALKYLATION, HEPATOCARCINOGENIC
 DIALKYL-NITROSAMINES, FLOW DICHROISM
 SPECTRUM MODIFICATION, LIVER, RAT
 (5105)
 BINDING, AFLATOXINS, RNA POLYMERASE
 INHIBITION, NUCLEAR EFFECTS, RAT
 (5174)
 CIGARETTE-SMOKE CONDENSATE EFFECT,
 BENZO(A)PYRENE FIXATION, RAT (5130)
 COCARCINOGEN, REPAIR SYNTHESIS
 INHIBITION, LYMPHOCYTE, HUMAN (5139)
 CROSS-LINKING, BROMOMETHYLBENZ(A)-
 ANTHRACENE, T7 BACTERIOPHAGE (5181)
 EPSTEIN-BARR VIRUS, TUMOR CELLS, HUMAN
 (5225)
 ONCOGENIC VIRUSES, CELL TRANSFORMATION
 REVIEW (5030)*
 POLYMERASE
 AVIAN MYELOBLASTOSIS VIRUS
 RNA-DNA LINKAGE (5219)
 ISOLATION, TUMOR CELLS (5623)*
 LANDSCHUTZ ASCITES-TUMOR CELLS
 (5541)*
 LYMPHOCYTE, NORMAL HUMAN (5445)
 RAUSCHER LEUKEMIA VIRUS,
 REVERSIBLE INACTIVATION (5257)
 ROUS-ASSOCIATED VIRUS, INFECTED
 CELL, CHICKEN (5220)
 POLYMERASE DEFICIENCY, ROUS SARCOMA
 VIRUS, ALPHA (5233)
 POLYMERASE TEMPLATE, RNA SUBUNIT,
 ROUS SARCOMA VIRUS (5207)
 REPAIR SYNTHESIS, MECHANISMS,
 UV RADIATION, 4-NITROQUINOLINE
 1-OXIDE, 4-NITROPYRIDINE 1-OXIDE,
 E. COLI MUTANTS (5143)
 REPLICATING, SV40 (5243)
 SHOPE FIBROMA VIRUS, SIZE (5241)
 SV40
 CLEAVAGE
 BACTERIAL RESTRICTION ENZYME
 (5278)*
 ENDONUCLEASE R1, PARTIAL
 DENATURATION MAPPING (5279)*
 HYBRIDIZATION, RNA (5235)
 INFECTION, HOST INTEGRATION,
 NONPERMISSIVE CELLS (5269)
 REPLICATION, MOLECULAR ORIGIN

- (5231)
SYNTHESIS
BONE MARROW CELLS, MOUSE (5446)
NUCLEI, LIVER, RAT (5608)*
RNA, HUMAN CANCER RESEARCH REVIEW
(5057)*
SV40, TEMPERATURE SENSITIVE MUTANT
(5216)
SV40 VIRUS, GEL ELECTROPHORESIS
ANALYSIS (5227)
- DUODENUM
CARCINOMA, CLINICAL STUDY (5573)*
TUMORS, CASE REPORTS (5563)*
ULCERS, PROPIONITRIL, RAT (5194)*
- DUST
ASBESTOS-LIKE PARTICLES, TUMOR
FORMATION, RAT (5135)
- EHRlich ASCITES
CARCINOMA
BRAIN-PASSAGED SUBLINE ESTABLISH-
MENT, CHARACTERISTICS, MOUSE
(5518)*
GROWTH KINETICS, ALTERED IMMUNO-
LOGICAL CONDITIONS (5377)*
CARCINOMA CELLS, QUABAIN RESISTANT,
ION TRANSPORT (5588)*
TUMOR CELLS
FATTY ACID SYNTHESIS (5664)*
HEMATOGENOUS DISSEMINATION,
METASTASES FORMATION, MOUSE
(5502)*
OXYGEN CONSUMPTION, SERIAL
CULTIVATION IN HYPERTONIC MEDIA
(5619)*
PROLIFERATION, CYTOPLASMIC AND
NUCLEAR GROWTH, MOUSE (5644)*
RNA COMPONENTS (5436)
- ENDOCRINE
MEDIASTINAL NEOPLASM, CLINICAL STUDY
(5575)*
MULTIPLE ADENOMATOSIS, MEDIASTINAL
NEOPLASM, CASE REPORTS (5576)*
TUMORS, HORMONE DEPENDENCY, MOUSE
(5633)*
- ENDOMETRIUM
CARCINOMA
DEVELOPMENT, ESTROGEN EFFECT,
HUMAN (5399)
LACTIC DEHYDROGENASE ACTIVITY,
SERUM AND TISSUES, CLINICAL
STUDY (5679)*
NONMALIGNANT, NEW CELL LINE ESTABLISH-
MENT, HUMAN (5517)*
PRECANCEROUS CHANGES, HUMAN, REVIEW
(5058)*
- ENVIRONMENT
ATMOSPHERIC CARCINOGENS, STANDARDIZA-
TION, REVIEW (5002)
ENVIRONMENTAL HAZARD
LEUKEMIA, PESTICIDE, POLAND (5417)
STEEL MANUFACTURE, FLUORIDE, LUNG
CANCER, CANADA (5414)
URANIUM, LANDFILL, CANCER MORTALITY,
COLORADO (5412)
- ENZYME
ACID PHOSPHATASE ACTIVITY, LEUKEMIA
CELLS, MOUSE (5697)*
ACID PHOSPHATASE INDUCTION,
ACTINOMYCIN D, LEUKEMIA CELLS,
MOUSE (5698)*
ADENYL CYCLASE
ADRENALIN RESPONSE, 2-ACETYLAMINO-
FLUORENE, RAT (5125)
SOMATIC HYBRIDS, GLIAL CELLS,
RAT (5441)
ALDOLASE, POLYMORPHISM, LEUKOSIS, HENS
(5639)*
ALKALINE PHOSPHATASE, CARPAMYL
PHOSPHATE HYDROLYSIS, TUMOR TISSUES,
RAT (5641)*
ALKALINE PHOSPHATASE ACTIVITY,
LEUKEMIA, MOUSE (5272)
ALKALINE PHOSPHATASE VARIANT,
NEURAMINIC ACID REMOVAL, HEPATOMA
CELLS (5505)*
ALTERATION, RESPIRATION, MORKIS
HEPATOMA, REVIEW (5011)
ARYL HYDROCARBON HYDROXYLASE, PHYTO-
HEMAGGLUTININ, 3-METHYLCHOLANTHRENE,
LEUKOCYTE, HUMAN (5121)
ARYL HYDROCARBON HYDROXYLASE ACTIVITY,
QUANTITATION, INDIVIDUAL FETAL CELLS
HAMSTER (5081)
ASPARTATE AMINOTRANSFERASE ACTIVITY,
BRAIN TUMORS, HUMAN (5657)*
CATALASE SYNTHESIS, INHIBITION, LIVER,
MOUSE (5532)*
COLLAGENOLYTIC, BASAL CELL EPITHELIOMA
HUMAN (5600)*
ULTRASTRUCTURE, SKIN, HUMAN
(5604)*
DEDIFFERENTIATED PATTERN, LIVER,
TUMOR-BEARING RATS (5515)*
DEHYDROGENASE, MAMMARY CARCINOMA,
PROLACTIN DEPENDENCE, HUMAN (5129)
DNA POLYMERASE
AVIAN ONCORNAVIRUS, SEROLOGIC
ANALYSIS (5234)
ISOLATION, TUMOR CELLS (5623)*
LANDSCHUTZ ASCITES TUMOR CELLS

(5541)*
 MONOSPECIFIC ANTISERUM, AVIAN
 ONCORNAVIRUS (5214)
 DNASE R1, SV40 DNA, CLEAVAGE,
 PARTIAL DENATURATION MAPPING (5279)*
 CYCOGEN PHOSPHORYLASE, HEPATOMA,
 FETAL LIVER, MUSCLE, RAT (5339)
 CYCOLYTIC, T ANTIGEN SYNTHESIS,
 POLYOMA VIRUS INFECTION, HAMSTER,
 MOUSE (5255)
 GLUTAMATE DEHYDROGENASE ACTIVITY,
 BRAIN TUMORS, HUMAN (5657)*
 GLUTAMINE SYNTHETASE ACTIVITY, CLONAL
 DIFFERENCES, HEPATOMA CELLS (5688)*
 KINASE ISOENZYMES, MALIGNANT
 TUMOR TISSUES, HUMAN (5670)*
 KINASE ISOZYMES, GROWTH, HEPATOMA
 CELLS, RAT (5556)*
 CYCOLYTIC, HARDING-PASSEY MELANOMA,
 KIDNEY TUMOR, CYTOCHEMISTRY, MOUSE
 HAMSTER (5458)*
 INVASIVE TUMOR GROWTH, HISTOCHEMICAL
 STUDIES, RAT, HUMAN (5673)*
 ISOENZYMES, MOLECULAR FORMS, CANCER
 (5538)*
 ISOZYME PATTERNS, BRANCHED-CHAIN AMINO
 ACID TRANSAMINASE, HEPATOMAS, RAT
 (5474)*
 KINASE ACTIVITY, PHOSPHORYLATION,
 TUMORS, MOUSE, HUMAN (5603)*
 LACTIC DEHYDROGENASE ACTIVITY,
 CARCINOMA OF ENDOMETRIUM, SERUM AND
 TISSUES, CLINICAL STUDY (5679)*
 LYSOSOMAL, AFLATOXIN, MITOMYCIN C,
 LIVER, RAT (5075)
 LYSOSOMAL MIXED-FUNCTION OXIDASE,
 INDUCTION, POLYCYCLIC AROMATIC
 HYDROCARBON, TRANSFORMATION, MOUSE
 PROSTATE CELL (5173)
 MONOAMINE OXIDASE ACTIVITY, CELL
 NUCLEI, SARCOMA DEVELOPMENT, LIVER,
 MOUSE (5700)*
 NICOTINAMIDE ADENINE DINUCLEOTIDE
 GLYCOHYDROLASE, EHRlich ASCITES
 TUMOR CELL NUCLEI, MOUSE (5631)*
 PHOSPHODIESTERASES, SOMATIC HYBRIDS,
 GLIAL CELLS, RAT (5441)
 PHOSPHOFRUCTOKINASE
 KINETICS, EHRlich ASCITES TUMOR
 (5434)
 MULTIPLE FORMS, TUMOR TISSUES,
 RAT (5510)*
 PROTEINASE, INHIBITORS, GROWTH, CULTURE
 CELLS, HAMSTER (5455)
 PROTEOLYTIC, INHIBITORS, HUMAN (5450)

PYRUVATE KINASE ACTIVITY, EHRlich
 ASCITES TUMOR CELLS, LIVER, MOUSE
 (5539)*
 REGULATION, NEUROBLASTOMA CELLS, MOUSE
 (5627)*
 REVERSE TRANSCRIPTASE INDUCTION,
 ROUS SARCOMA VIRUS, ARGININE
 DEPRIVATION (5262)
 RNA POLYMERASE
 CHROMATIN TEMPLATE ACTIVITY,
 FIBROBLASTS, HUMAN (5535)*
 SELECTIVE INHIBITION, AFLATOXIN B1
 LIVER, RAT (5150)
 tRNA METHYLASE ACTIVITY, ADENOVIRUS-
 18-INDUCED TUMOR, CELL-FREE EXTRACTS
 HAMSTER (5288)*
 EPIDIDYMO
 SUBCUTANEOUS SACROCOCYGEAL,
 METASTASIS, ULTRASTRUCTURE, CASE
 REPORT (5628)*
 EPIDEMIOLOGY
 OVARIAN CARCINOMA, BULGARIA (5423)
 EPIDERMAL
 GROWTH FACTOR
 FREE NUCLEOTIDES, AMINO ACID
 TURNOVER, TUMOR CELLS, MOUSE
 (5669)*
 PRECURSOR UPTAKE, HELA CELL,
 KB CELL (5444)
 EPIDERMIS
 CARCINOMA, ANTIGENS, 3-METHYL-
 CHOLANTHRENE, MOUSE (5361)
 EPIDERMAL CARCINOMA
 CYSTIC TERATOMA, CASE REPORTS (5659)*
 EPITHELIOMA
 BASAL CELL, COLLAGENOLYTIC ENZYMES
 SKIN, HUMAN (5600)*
 ULTRASTRUCTURE, SKIN, HUMAN
 (5604)*
 CALCIFYING, MALHERBE, CHILD, CASE
 REPORT (5625)*
 LARYNX, MAST CELLS, HUMAN (5647)*
 MIDDLE EAR, PATHOGENESIS, CHILD,
 CASE REPORT (5408)*
 MALIGNANT MEDULLO EPIGLIAL EPITHELIAL
 CARCINOMA, CASE REPORT (5555)*
 ESOPHAGUS
 CERVICAL, CANCER, TREATMENT, CASE
 REPORTS (5494)*
 ESTRADIOL RECEPTORS
 GENITAL TRACT, HUMAN CANCER TISSUE,
 FEMALES (5638)*
 ETHIONINE
 PROTEIN SYNTHESIS, NORMAL CELLS,
 TUMOR CELLS, RAT (5583)*

TRIA METHYLASE, YEAST CELLS (5126)
 ETHYLNITROSOUREA
 CYTOTOXICITY, NERVE CELLS, RAT (5078)
 MALIGNANT NEURINOMA, CLONAL LINE,
 SCHANN CELL, RAT (5167)
 NEUROGENIC TUMORS, MALIGNANT
 NEURINOMAS, TRANSPLACENTAL INDUCTION
 MORPHOLOGY, HAMSTER (5110)
 N-ETHYL-N-NITROSOUREA
 ETHYLATION, NUCLEIC ACID, FETUS, ADULT
 PAT (5172)
 ETIOLOGY
 VIRAL, MALIGNANT TUMORS, CHROMOSOME
 ABERRATIONS, HUMAN, REVIEW (5042)*
 EYE
 CHOROID METASTASIS, CLINICAL STUDY
 (5578)*
 MEDULLOEPITHELIOMA, RHABDOMYOSARCOMA-
 TUS, DIFFERENTIATION, CASE REPORTS
 (5643)*
 FATTY ACIDS
 SYNTHESIS, EHRLICH ASCITES TUMOR CELLS
 (5664)*
 FERRIC OXIDE
 RESPIRATORY TRACT CARCINOGENESIS,
 HAMSTER (5176)
 FETOPROTEIN
 TUMOR CELLS, HUMAN, REVIEW (5069)*
 FETUS
 ADULT, ETHYLNITROSOUREA, ETHYLATION,
 NUCLEIC ACID, RAT (5172)
 FIBROBLAST
 MALIGNANT ASTROCYTES, ULTRASTRUCTURE,
 HUMAN, MURINE (5447)
 FIBROHEMANGIOSARCOMA
 HOST SEX, TUMOR MASS, HAMSTER (5655)*
 FIBROMA
 CHONDROMYXOID, CLINICOPATHOLOGIC STUDY
 (5520)*
 GASTRIC, CASE REPORT (5660)*
 FIBROSARCOMA
 BILATERAL, OVARY, HYSTERECTOMY, CASE
 REPORT (5622)*
 N-2-FLUORENYLACETAMIDE
 ALPHA-FETOPROTEIN, HEPATOCARCINOGENE-
 SIS, RAT (5098)
 N,N'-2,7-FLUORENYLENEBISACETAMIDE
 INTESTINAL ADENOMA, RAT (5089)
 FLUORIDE
 STEEL MANUFACTURE, LUNG CANCER, CANADA
 (5414)
 FUNGUS
 INFECTION, ACUTE LEUKEMIA, POSTMORTEM
 RECORD STUDY (5580)*
 GENE
 SIX ANTIGEN EXPRESSION, MURINE
 LEUKEMIA VIRUS, MOUSE (5336)
 HOMOZYGOUS ALEUTIAN, LYMPHOEPITELIAL
 PROLIFERATIVE DISEASE, MINK (5612)*
 HUMORAL IMMUNE RESPONSE, LEUKEMIA,
 MOUSE (5338)
 MURINE LEUKEMIA VIRUS, MOUSE (5258)
 GENETICS
 CARCINOGENESIS, HUMAN, REVIEW (5023)
 NEOPLASTIC TRANSFORMATION, CHROMOSOME
 STABILITY, SERUM EFFECTS,
 EMBRYONIC CELLS, MOUSE (5430)
 GENITAL TRACT
 ESTROGEN RECEPTORS, HUMAN CANCER
 TISSUE, FEMALES (5638)*
 GIANT CELL
 GRANULOMA, NITROSOQUINOLINE, MACRO-
 PHAGE, RAT (5097)
 GLIOBLASTOMA
 ATYPICAL MITOSES, HUMAN (5452)
 GIANT-CELL, ULTRASTRUCTURE, CASE
 REPORT (5471)*
 GIGANTO-CELLULAR, LUMBO-SACRAL SPINAL
 CORD, CASE REPORT (5560)*
 GLUCOSE
 INCORPORATION, OXYGEN CONSUMPTION,
 ATMOSPHERIC MICROCONSTITUENT
 INOCULATION, BUCCAL CELL CULTURES,
 CALF (5179)
 METABOLISM, NOREPINEPHRINE, GLIO-
 BLASTOMA CELLS, NEUROBLASTOMA CELLS,
 RAT (5558)*
 UTILIZATION, DELAYED FEEDBACK CONTROL,
 ASCITES TUMOR CELLS (5547)*
 GLYCOLYSIS
 INHIBITION, 2-DEOXY-2-FLUORO-D-GLUCOSE
 ASCITES TUMOR CELLS (5435)
 GLYCOPEPTIDE
 ISOLATION, ANALYSIS, MICROSOMES,
 ASCITES HEPATOMA, RAT (5534)*
 GLYCOPROTEIN
 SERUM LEVELS, ASCITES HEPATOMA 109A,
 RAT (5385)*
 GRANULOCYTE
 COLONY FORMATION, ACUTE GRANULOCYTIC
 LEUKEMIA, SERUM, HUMAN (5373)*
 GRANULOMA
 ENERGY METABOLISM, INSULIN,
 2-DEOXYGLUCOSE, RAT (5495)*
 JAW, PERIPHERAL GIANT CELL, CASE
 REPORTS (5405)*
 NITROSOQUINOLINE, MACROPHAGE, GIANT
 CELL, RAT (5097)
 GROWTH
 AUTOMATIC MONITORING, MYELOMA CELLS,

TISSUE CULTURE, MOUSE (5550)*
 CELL CYCLE, TUMORS, HUMAN, REVIEW
 (5048)*
 CYTOPLASMIC AND NUCLEAR, EHRlich
 ASCITES TUMOR CELLS, MOUSE (5644)*
 DECREASE OF SATURATION DENSITY,
 CULTURED TUMOR CELLS, DEXTRAN
 SULFATE, HAMSTER (5489)*
 HEPATOCELLULAR CARCINOMA, DIETHYL-
 NITROSAMINE-INDUCED, CELL POPULATION
 RAT (5073)
 HEPATOMA CELLS, HEXOKINASE ISOZYMES,
 RAT (5556)*
 HEPATOMAS, L-ORNITHINE METABOLISM, RAT
 (5516)*
 INVASIVE TUMOR, HISTOCHEMICAL ENZYME
 STUDIES, RAT, HUMAN (5673)*
 KINETICS, EHRlich ASCITES CARCINOMA,
 ALTERED IMMUNOLOGICAL CONDITIONS
 (5377)*
 MALIGNANT, NUTRIENT, CELL MEMBRANE,
 REVIEW (5016)
 MAMMARY TUMOR TRANSPLANT, C. PARVUM,
 ANTITUMOR GLOBULIN, MOUSE (5315)
 MYELOMA, PHAGOCYTTIC CELL FACTOR,
 IMMUNOCYTOLOGY, MOUSE (5302)
 PLASMACYTOMA, PARAPROTEIN IMMUNOASSAY,
 MOUSE (5312)
 PROTEASE INHIBITORS, CULTURE CELLS,
 HAMSTER (5455)
 TRANSPLANTABLE LEUKEMIA
 MORPHOLOGY, RAT (5531)*
 RABBIT IMMUNE SERA, MOUSE (5356)
 TUMOR
 BOVINE ADENOVIRUS TYPE-3, HAMSTER
 (5286)*
 DIETARY MODIFICATION, MOUSE
 (5540)*
 INHIBITION MECHANISM, POLYINOSINIC
 POLYCYTIDYLIC ACID, IMMUNITY,
 RAT (5350)
 TUMOR CELLS, PARASITIC LARVAE, HAMSTER
 RAT (5301)
 WOUND TUMOR VIRUS (5249)
 PTELE
 BETA-NAPHTHYLAMINE, CARCINOGENESIS,
 DOG (5291)
 ART
 CARDIAC TUMORS, 1-PYRIDYL-3,3-DIETHYL-
 TRIAZENE, RAT (5108), (5162)
 PRIMARY OSTEOSARCOMA, CASE REPORT
 (5466)*
 MANGIOMA
 PULMONARY SCLEROSING, ULTRASTRUCTURE,
 CASE REPORT (5406)*

HEMANGIOPERICYTOMA
 VULVA, METASTASIS TO BONE, CASE REPORT
 (5542)*
 HEPATOMA
 AFLATOXIN B1, MOUSE (5152)
 ALBUMIN CONTENT, LIVER, RAT (5512)*
 ALBUMIN SYNTHESIS, FREE POLYRIBOSOMES,
 RAT (5607)*
 ALKALINE PHOSPHATASE VARIANT,
 NEURAMINIC ACID REMOVAL (5505)*
 ASCITES
 GLYCOGEN STORAGE, MECHANISM, RAT
 (5490)*
 GLYCOPEPTIDES, ISOLATION, ANALYSIS
 MICROSOMES, RAT (5534)*
 HETERO-ORGANIC ANTIGEN, RAT
 (5366)*
 ASCITES 109A, SERUM GLYCOPROTEIN LEVEL
 RAT (5385)*
 AUSTRALIA ANTIGEN, ASIA (5297)
 BIOCHEMISTRY, CYTOGENETICS, CELL LINES
 RAT (5456)
 DIETHYLNITROSAMINE-INDUCED,
 4-HYDROXYPENTENAL, OXYGEN UPTAKE,
 SH CONTENT, LIVER, RAT (5190)*
 4-DIMETHYLAMINOAZOBENZENE, CYTO-
 SKELETON ALTERATIONS, LIVER CELLS,
 RAT (5131)
 DNA, HISTONES, HISTONE PHOSPHATE
 TURNOVER, TISSUE CULTURE CELLS
 (5504)*
 GLYCOGEN PHOSPHORYLASE, FETAL LIVER,
 RAT (5339)
 ISOZYME PATTERNS, BRANCHED-CHAIN
 AMINO ACID TRANSAMINASE, RAT (5474)*
 POLYAMINE CONTENT, RAT (5620)*
 PRIMARY
 HEPATITIS-ASSOCIATED ANTIGEN,
 CASE REPORT (5386)*
 HYPOGLYCEMIA, CASE REPORT (5689)*
 SPONTANEOUS, INCIDENCE, HEPATIC MALIC
 ENZYME CAPACITY, MOUSE (5514)*
 TRANSPLANTABLE CELL LINE, MOUSE
 (5693)*
 YOSHIDA ASCITES CELLS, IMMUNE RESPONSE
 RAT (5364)
 HETEROKARYONS
 ONCOGENIC POTENTIAL, MOUSE, HAMSTER
 (5398)
 HISTONE
 F1, MOLECULAR NATURE, PHOSPHORYLATION,
 CULTURED HEPATOMA CELLS (5506)*
 TURNOVER, HEPATOMA TISSUE, CULTURED
 CELLS (5504)*
 HODGKIN'S DISEASE

PATHOLOGY, CLINICAL STUDY (5577)*
 SERUM PROTEINS, IMMUNOELECTROPHORETIC
 INVESTIGATIONS, PATIENTS (5378)*
 TOTAL URINE HYDROXYPROLINE EXCRETION,
 PATIENTS (5591)*

HORMONE
 DEPENDENCY, ENDOCRINE TUMORS, MOUSE
 (5633)*
 EPIDERMAL GROWTH FACTOR, PRECURSOR
 UPTAKE, HELA CELL, KB CELL (5444)
 ESTRADIOL, PRODUCTION, INTESTINAL
 BACTERIA (5182)
 ESTROGEN, C-TYPE RNA VIRUS, ACTIVATION
 UTERUS, MOUSE (5250)
 ESTROGEN-BINDING CAPACITY, CYTOPLASMIC
 RECEPTOR, NORMAL, NEOPLASTIC BREAST
 TISSUES, HUMAN (5513)*
 ESTROGEN EXCRETION, BREAST CANCER,
 ANDROGEN-TREATED PATIENTS (5501)*
 FACTORS, UTERINE MYOMA, PATHOGENESIS,
 HUMAN (5646)*
 NEUROSECRETION, EHRlich ASCITES
 TUMOR CELLS, MOUSE (5551)*
 PROLACTIN, BREAST TUMOR, REVIEW
 (5034)*
 PROLACTIN DEPENDENCE, MAMMARY
 CARCINOMA, DEHYDROGENASE, HUMAN
 (5129)
 THYMOSIN, PURIFICATION, BIOLOGICAL
 ACTIVITY, THYMUS GLAND, MOUSE
 (5549)*
 THYROID GLAND, GASTRIC CANCER INDUC-
 TION, RAT (5187)*

HYBRIDIZATION
 INTRASPECIFIC SOMATIC, MALIGNANT
 CELLULAR TRANSFORMATION, KARYOLOGIC
 MODIFICATIONS, HAMSTER (5299)
 3-HYDROXYANTHRANILIC ACID
 METABOLISM, LIVER, GUINEA PIG, RAT,
 MOUSE, HUMAN (5165)
 5-HYDROXY-3,4-BENZOPYRENE
 SKIN FIBROSARCOMA, MOUSE (5141)
 4-HYDROXPENTENAL
 OXYGEN UPTAKE, SH CONTENT, HEPATOMA,
 LIVER, RAT (5190)*

HYPERCALCEMIA
 UNDIFFERENTIATED LEUKEMIA, CASE REPORT
 (5610)*

HYPERPLASIA
 LEAD ACETATE, PORPHYRIN CONTENT,
 KIDNEY, RAT (5065)
 LEYDIG CELL, BRENNER TUMOR OF OVARY,
 CASE REPORT (5611)*

HYPERTRICHOSIS LANUGINOSA
 ACQUIRED, MALIGNANCY, CASE REPORTS
 (5665)*

HYPOGAMMAGLOBULINEMIA
 BURSECTOMY, ROUS SARCOMA VIRUS, TUMOR
 GROWTH, CHICKEN (5239)
 HYPOGLYCEMIA
 PRIMARY HEPATOMA, CASE REPORT (5649)*

IMMUNE RESPONSE
 ANTIBODY, FORMALINIZATION, TUMOR CELL,
 MOUSE (5306)
 HUMORAL, GENETIC CONTROL, LEUKEMIA,
 MOUSE (5338)
 IMMUNOSUPPRESSION, ANTIGEN CHALLENGE
 LYMPHOSARCOMA, MOUSE (5341)

IMMUNITY
 ALLOGRAFT, TUMOR, T CELL, MOUSE (5310)
 CELL-MEDIATED
 BLOCKING ACTIVITY, BCG THERAPY,
 MELANOMA, HUMAN (5330)
 ROUS SARCOMA VIRUS, THYMECTOMY,
 RAT (5324)
 RECOGNITION, MAMMARY TUMOR, ENDOTOXIN,
 MOUSE (5303)
 TRANSPLANT RESISTANCE, LEUKEMIA, VIRUS
 INFECTION, MOUSE (5309)

IMMUNOCYTOLOGY
 MYELOMA, PHAGOCYTTIC CELL FACTOR,
 GROWTH REQUIREMENT, MOUSE (5302)

IMMUNODEPRESSION
 FRIEND AND RILEY VIRUSES, CONTACT
 SENSITIVITY, MOUSE (5375)*
 GRAFFI LEUKEMIA VIRUS, MOUSE (5322)

IMMUNOGLOBULIN
 G, ANTIBODY ACTIVITY, IGM, LEUKEMIA,
 HUMAN (5311)
 GAMMA FRACTION, BLOOD SERUM, LYMPHATIC
 LEUKEMIA, LYMPHOSARCOMA, HUMAN
 (5290)
 IGA, INTERCHAIN DISULFIDE BOND FORMA-
 TION, MYELOMAS, MOUSE (5374)*
 IGE, CANCER PATIENT, SERUM (5334)
 IGG DETECTION, LYMPHOCYTES, SPLEEN AND
 LYMPH NODES, MOUSE (5365)
 MALIGNANT LYMPHOGRANULOMATOSIS,
 THYMOMA, HUMAN (5326)

IMMUNOLOGY
 ACUTE LEUKEMIA, CHILDREN (5391)*
 BETA 1 A/C CONCENTRATION, MALIGNANT
 LYMPHOMA, MYELOMA, VALDENSTROM'S
 DISEASE, SERUM, HUMAN (5354)
 CANCER, IMMUNOTHERAPY, HUMAN, REVIEW
 (5063)*
 CROSS-REACTIVITY OF ANTIGENS, TUMOR
 AND FETAL CELLS, MOUSE (5388)*
 IMMUNE RESPONSE
 LEUKEMIA, CAT (5292)

NEOPLASMS, HUMAN, REVIEW (5049)*
 SPONTANEOUS AND CHEMICALLY INDUCED
 TUMORS, MOUSE (5293)
 TUMOR CELLS, HUMAN, REVIEW (5066)*
 YOSHIDA HEPATOMA ASCITES TRANS-
 PLANT, RAT (5364)
 MALIGNANT MELANOMA, IMUNOFLUORESCENCE
 (5392)*
 NEOPLASTIC DISEASES, BLASTIC TRANS-
 FORMATION, LYMPHOCYTES, HUMAN,
 REVIEW (5044)*
 TUMOR, CELL MEMBRANE CHANGES,
 PROTEOLYTIC ENZYMES, REVIEW (5029)
 TUMORIGENESIS, REVIEW (5068)*
 UTERINE CERVIX, CARCINOMA, PROTEIN
 STRUCTURE, HUMAN (5295)
 IMMUNOSUPPRESSION
 ANTIGEN CHALLENGE, LYMPHOSARCOMA,
 MOUSE (5341)
 CHROMATIN FRACTION, NUCLEI, EHRLICH
 ASCITES TUMOR CELLS, MOUSE (5368)*
 FRIEND LEUKEMIA VIRUS, RESISTANCE,
 MOUSE (5352)
 LEUKEMIA, CAT (5292)
 IMMUNOTHERAPY
 CANCER, IMMUNOLOGY, HUMAN, REVIEW
 (5063)*
 INDUCTION
 INTERSTITIAL CELL TUMORS, CADMIUM
 CHLORIDE, TESTES, RAT (5132)
 LUNG CANCER, N-NITROSCHEPTAMETHYLENE-
 IMINE, RAT (5113)
 LUNG CARCINOMA, DIETHYLNITROSAMINE,
 INFLUENZA VIRUSES, MOUSE (5079)
 NERVOUS SYSTEM TUMORS, PHENYL-
 DIMETHYL-TRIAZENE, RAT (5111)
 THYROID TUMOR, METHYLCHOLANTHRENE,
 C-CELLS, RAT (5090)
 INFECTION
 POLYOMA VIRUS, VIRUS PRODUCTION TIME
 COURSE, MOUSE (5261)
 SV40, PROTEIN SYNTHESIS, MONKEY (5263)
 INFECTIOUS MONONUCLEOSIS
 ACUTE LYMPHOCYTIC LEUKEMIA,
 EPSTEIN-BARR VIRUS ANTIGEN, HUMAN
 (5402)
 INSULIN
 ENERGY METABOLISM, GRANULOMA TISSUE,
 RAT (5495)*
 INTESTINE
 ADENOMA, N,N'-2,7-FLUORENYLENEBIS-
 ACETAMIDE, RAT (5089)
 BACTERIA, ESTRADIOL PRODUCTION (5182)
 PEYER'S PATCHES, MALIGNANT LYMPHOMA,
 PATHOLOGY, MOUSE (5498)*
 TUMOR, 3-2'DIMETHYLAMINOSIPHENYL, RAT,
 HUMAN (5074)
 IODINE
 METHYLTHIOURACIL, THYROID TUMOR,
 HAMSTER (5170)
 JAW
 GRANULOMA, PERIPHERAL GIANT CELL,
 CASE REPORTS (5405)*
 JENSON'S SARCOMA
 CARDOLIPINS, MITOCHONDRIA, MICROSOMES
 (5671)*
 KAPOSI'S SARCOMA
 TISSUE CULTURE (5696)*
 KARYOTYPE
 LYMPHOID CELL LINE, VIRUS, MOUSE
 (5308)
 QUINACRINE FLUORESCENT AND GIEMSA
 BANDING, CHROMOSOME ANALYSIS, TRANS-
 FORMED AND MALIGNANT CELL LINES,
 LIVER, RAT (5599)*
 KIDNEY
 ADENOCARCINOMA, HERPES TYPE VIRUS,
 FROG (5218)
 BASIC LEAD ACETATE, N-NITROSDIMETHYL-
 AMINE, N-BUTYL-N-(4-HYDROXYBUTYL)-
 NITROSOAMINE, 3-METHYLCHOLANTHRENE,
 4-NITROQUINOLINE 1-OXIDE, RAT (5183)
 NON-DIFFERENTIATED NEURAL TUMORS,
 CASE REPORTS (5691)*
 PORPHYRIN CONTENT, LEAD ACETATE,
 HYPERPLASIA, RAT (5085)
 PRIMARY CARCINOMA, RENAL PELVIS AND
 URETER, URINE CYTOLOGY, HUMAN
 (5553)*
 TRNA METHYLASE, DIMETHYLNITROSAMINE,
 RAT (5123)
 TUMOR
 HYDROLYTIC ENZYMES, CYTOCHEMISTRY,
 HAMSTER (5458)*
 KARYOMETRICAL STUDY, MITOTIC INDEX
 HAMSTER (5459)*
 NUCLEIC ACIDS, PROTEINS, CYTO-
 CHEMISTRY, HAMSTER (5457)*
 KUPFFER CELL
 LIVER, PHAGOCYTOSIS, HUMORAL
 RECOGNITION FACTOR, LEUKEMIA, RAT
 (5298)
 LARYNX
 CHEMOECTOMATA, CASE REPORTS (5481)*
 EPITHELIOMA, MAST CELLS, HUMAN (5647)*
 PRECANCEROUS LESIONS, CYTOLOGY, HUMAN
 REVIEW (5061)*
 VERRUCOUS CARCINOMA, CLINICAL STUDY,
 PATHOLOGICAL STUDY (5522)*
 LATHYROGENIC COMPOUND

INHIBITION, CARCINOGENESIS AND
 CIRRHOSIS, LIVER, RAT (5189)*
 LEAD ACETATE
 HYPERPLASIA, PORPHYRIN CONTENT,
 KIDNEY, RAT (5085)
 LEIOMYOBlastoma
 UTERUS, CASE REPORT (5595)*
 LEIOMYOMA
 GIZARKE, VULVA, CASE REPORT (5682)*
 LEIOMYOMATA
 UTERUS, ASCITES AND HYDROTHORAX-
 ASSOCIATED, CASE REPORT (5621)*
 LEUCINE
 INCORPORATION, PROTEIN, INHIBITION,
 TUMOR-BEARING BLOOD, RAT (5524)*
 LEUKEMIA
 ACUTE
 FUNGAL INFECTION, POSTMORTEM
 RECORD STUDY (5580)*
 IMMUNOLOGY, CHILDREN (5391)*
 PLATELET FUNCTION, CLINICAL STUDY
 (5582)*
 VIRAL AND LEUKEMIA-ASSOCIATED
 ANTIGENS, IDENTICAL TWINS (5325)
 ACUTE GRANULOCYTIC, GRANULOCYTE COLONY
 FORMATION, SERUM, HUMAN (5373)*
 ACUTE LYMPHOCYTIC
 CYTOTOXIC ANTIBODY, HUMAN (5304)
 INFECTIOUS MONONUCLEOSIS, EPSTEIN-
 BARR VIRUS ANTIGENS, HUMAN
 (5402)
 PERIPHERAL BLOOD CELLS, COLONY
 GROWTH, PATIENTS (5493)*
 ACUTE MYELOID, SERUM PROTEINS, IMMUNO-
 ELECTROPHORETIC INVESTIGATIONS,
 PATIENTS (5378)*
 ALKALINE PHOSPHATASE ACTIVITY, MOUSE
 (5272)
 BONE MARROW BLAST, SERUM COPPER, HUMAN
 (5432)
 CELL CYCLE KINETICS, MOUSE (5410)
 CHILDHOOD, REMISSION, FATALITIES,
 CLINICAL STUDY (5666)*
 CHRONIC GRANULOCYTIC
 ACQUIRED LIPIDOSIS, GAUCHER-LIKE
 AND BLUE CELLS, CLINICAL STUDY
 (5666)*
 POLYCYTHEMIA VERA, MEGAKARYOCYTES,
 ULTRASTRUCTURE HUMAN (5478)*
 CHRONIC LYMPHOCYTIC
 CHROMOSOME, HUMAN (5446)
 LYMPHOCYTES, ANTIGENIC PROPERTY,
 HUMAN (5396)*
 CHRONIC MYELOGENOUS, PHILADELPHIA
 CHROMOSOME, BLASTIC CRISIS, CASE
 REPORT (5473)*
 DEVELOPMENT, 3-METHYLCHOLANTHRENE,
 AGE FACTOR, MOUSE (5149)
 FIBRINOLYTIC ACTIVITY, BLOOD
 LEUKOCYTIC COUNT, CLINICAL STUDY
 (5675)*
 GRAFFI AND GROSS, GROUP-SPECIFIC,
 MEMBRANE-ROUND ANTIGEN, MOUSE, RAT
 (5342)
 GRAFFI VIRUS-INDUCED, IDENTICAL
 ANTIGENS, RAT, MOUSE (5343)
 GROSS, SKIN ALTERATION, TUMOR CELLS,
 MOUSE (5340)
 IMMUNOGLOBULIN, G, IgG, ANTIBODY
 ACTIVITY, HUMAN (5311)
 INCIDENCE, EPIDEMIOLOGY, USSR (5425)
 LEUKEMIA-LIKE VIRUS, CYTOLOGY, HUMAN
 (5289)*
 LEUKEMOCENESIS, FACTORS, HUMAN, REVIEW
 (5053)*
 LIVER, KUPFFER CELL, PHAGOCYTOSIS,
 HUMORAL RECOGNITION FACTOR, RAT
 (5298)
 LYMPHATIC
 LYMPHOCYTES, ULTRASTRUCTURE, HUMAN
 (5491)*
 LYMPHOSARCOMA, IMMUNOGLOBULINS,
 GAMMA FRACTION, HUMAN (5290)
 LYMPHOCYTE CYTOTOXICITY, PERITONEAL
 CAVITY, MOUSE (5307)
 LYMPHOCYTOTOXINS, CLINICAL STUDY
 (5653)*
 LYMPHOMA, PATHOGENESIS, ATOMIC BOMB,
 REVIEW (5013)
 MALIGNANT LYMPHOMA, MULTIPLE MYELOMA,
 MORTALITY, NEW ZEALAND (5411)
 MIXED LEUKOCYTE REACTION, TARGET CELL
 DEATH, HUMAN (5395)*
 MYELOGENOUS, ANEMIA, MOUSE (5443)
 MYELOID MONOCYTIC, IMMUNOLOGY,
 CYTOLOGY, ULTRASTRUCTURE, INFANTS
 (5397)*
 MYELOMONOCYTIC, CELLULAR DIFFERENTIA-
 TION, MOUSE (5667)*
 N-NITROSOBUTYLUREA, RAT (5136)
 NONLYMPHATIC TUMORS, GLOMERULO-
 SCLEROSIS, INCIDENCE, MICE (541A)
 NUCLEIC ACID CONTENT, LIVER, SPLEEN,
 CELL NUCLEI, MOUSE (5439)
 PERINATAL, BLAST CELL PROLIFERATION,
 CHROMOSOMAL TRANSLOCATION, CASE
 REPORT (5477)*
 PESTICIDE, ENVIRONMENTAL HAZARD,
 POLAND (5417)
 RADIATION, GUINEA PIG (5202)

RADIO-LEUKOSIS VIRUS, MOUSE (5276)
 RAUSCHER VIRUS, RNA, DNA FRACTIONS,
 SPLEEN, MOUSE (5210)
 SUB-ACUTE MYELO-MONOCYTIC, CASE REPORT
 REVIEW (5062)*
 THYMUS, 7,12-DIMETHYLBENZ(A)ANTHRACENE
 MOUSE (5168)
 TRANSPLANTABLE, GROWTH PATTERN,
 MORPHOLOGY, RAT (5531)*
 TRANSPLANTATION, THYMECTOMY, ANTI-
 LYMPHOCYTE SERUM, HAMSTER, MOUSE
 (5313)
 UNDIFFERENTIATED, HYPERCALCEMIA, CASE
 REPORT (5610)*
 VIRUS INFECTION, TRANSPLANT RESISTANCE
 MOUSE (5309)

LEUKOCYTE
 ARYL HYDROCARBON HYDROXYLASE,
 3-METHYLCHOLANTHRENE, PHYTOHEMAGGLU-
 TININ, HUMAN (5121)
 CHROMOSOME, ABNORMALITY, THERAPEUTIC
 DRUG, RADIATION, HUMAN (5454)

LEUKOSIS
 ALDOLASE POLYMORPHISM, HENS (5639)*
 AVIAN COMPLEX, ZINC CONTENT, TISSUES,
 FOWL (5527)*

LEYDIG CELL
 HYPERPLASIA, BRENNER TUMOR OF OVARY,
 CASE REPORT (5611)*
 TUMORS, MICROBODIES, TESTIS, RAT
 (5543)*

LIPID
 COMPOSITION, EHRlich ASCITES TUMOR
 CELLS, NACE CONTENT OF MEDIA (5552)*
 PANCREATIC EXOCRINE CELLS, WALKER
 TUMOR, RAT (5635)*

LIPIDOSIS
 ACQUIRED, CHRONIC GRANULOCYTIC
 LEUKEMIA, GAUCHER-LIKE AND BLUE
 CELLS, CLINICAL STUDY (5668)*

LIVER
 ADENYL CYCLASE, ADRENALIN RESPONSE,
 2-ACETYLAMINOFLUORENE, RAT (5125)
 CANCER, CIGARETTE SMOKE, TISSUE
 CULTURES, MOUSE (5154)
 CARCINOMA, DIETHYLNITROSAMINE, INHIBI-
 TION, THYMUS TISSUES, RAT (5145)
 CARCINOMA, DIETHYLNITROSAMINE-INDUCED,
 HISTOLOGICAL CHANGES, HISTOCHEMICAL
 CHANGES, RAT (5401)
 CIRRHOSIS, HEPATOCARCINOMA, ALCOHOL,
 HUMAN, REVIEW (5070)*
 DEDIFFERENTIATED PATTERN OF ENZYMES,
 TUMOR-BEARING RATS (5515)*
 DIMETHYLAMINOAZOBENZENE CARCINOGENESIS

GLYCOLYSIS, RAT (5161)
 GLYCOGEN PHOSPHORYLASE, FETAL LIVER,
 HEPATOMA, RAT (5339)
 HEPATOCELLULAR CARCINOMA
 AFLATOXIN B1, ALPHA-FETOPROTEIN,
 RAT (5335)
 DIETHYLNITROSAMINE-INDUCED, GROWTH
 KINETICS, CELL POPULATIONS, RAT
 (5073)
 VERTEBRAL METASTASES, RADICULAR
 COMPRESSION, CASE REPORTS
 (5568)*

HEPATOMA
 AFLATOXIN B1, MOUSE (5152)
 BIOCHEMISTRY, CYTOGENETICS, CELL
 LINER, RAT (5456)
 4-DIMETHYLAMINOAZOBENZENE,
 CYTOSKELETON ALTERATIONS, CELLS,
 RAT (5131)
 KUPFFER CELL, PHAGOCYTOSIS, HUMORAL
 RECOGNITION FACTOR, LEUKEMIA, RAT
 (5298)
 MORRIS HEPATOMA, ENZYME ALTERATION,
 RESPIRATION, REVIEW (5011)
 PHENOBARBITAL BINDING, RAT (5127)
 POLYRIBOSOME, AMINO ACID INCORPORATION
 DIMETHYLNITROSAMINE, RAT (5166)
 PROTEIN CONJUGATE, 3'-METHYL-4-
 DIMETHYLAMINOAZOBENZENE, RAT (5102)
 PROTEIN DISTRIBUTION, 3'-METHYL-4-
 DIMETHYLAMINOAZOBENZENE, RAT (5100)
 PROTEIN H, CARCINOGEN SUSCEPTIBILITY,
 IMMUNOLOGY, RAT, MOUSE, HAMSTER,
 GUINEA PIG, RABBIT (5082)
 REGENERATION, CARCINOGENESIS,
 MAGNESIUM ION CONCENTRATION,
 INORGANIC PYROPHOSPHATASE, RAT
 (5151)
 RNA AND PROTEIN SYNTHESIS, COMPARATIVE
 STUDY, RAT (5192)*
 RNA METHYLATION, METHYL METHANE-
 SULFONATE, NN-DIMETHYLNITROSAMINE,
 RAT (5122)
 RNA SYNTHESIS INHIBITION, METHYL AZOXY-
 METHANOL ACETATE, RAT (5128)
 TUMOR, 2-ACETYLAMINOFLUORENE,
 PHENOBARBITAL, RAT (5084)
 TUMORIGENESIS, CYCASIN, RAT (5119)
 SARCOMA, SPONTANEOUS RECOVERY, CASE
 REPORT (5380)*

LUNG
 BRONCHIAL CANCER, TOBACCO SMOKING,
 HUMAN, REVIEW (5006)
 BRONCHIAL CARCINOMA, TUBERCULOSIS,
 JOINT OCCURRENCE, CASE REPORT

- (5858)*
BRONCHIOLO-ALVEOLAR CELL CARCINOMA,
ULTRASTRUCTURE, HUMAN, (5468)*
BRONCHOPULMONARY CARCINOMA, RADON,
INHALATION, RAT (5197)
CANCER
CIGARETTE SMOKING, REVIEW (5010)
ENVIRONMENTAL HAZARD, STEEL
MANUFACTURE, FLUORIDE, CANADA
(5414)
N-NITROSEPTAMETHYLENEIMINE-
INDUCED, RAT (5113)
SMOKING, OCCUPATIONAL HAZARD, AIR
POLLUTION, REVIEW (5018)
CARCINOMA
HISTOGENESIS, HUMAN, REVIEW
(5060)*
INDUCTION, DIETHYLNITROSAMINE,
INFLUENZA VIRUSES, MOUSE (5079)
METASTASIS TO JAWS, VIA SPUTUM TO
TOOTH SOCKETS, CASE REPORT
(5615)*
CELL CULTURE, MALIGNANT TRANSFORMATION
N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
RAT (5104)
INDUCED LESIONS, N-NITROSO-N-METHYL-
URETHANE, ULTRASTRUCTURE, CRYSTALL-
INE CELLULAR INCLUSIONS, MOUSE
(5101)
OAT-CELL CARCINOMA, HISTOGENESIS,
MORPHOLOGY, CLINICAL STUDY (5403)
PULMONARY CARCINOMA, OAT CELL TYPE,
NEW FLOATING CELL LINE, HUMAN
(5526)*
PULMONARY METASTASES, RHINOPHARYNX
TUMORS, CASE REPORTS (5589)*
RNA AND PROTEIN SYNTHESIS, COMPARATIVE
STUDY, RAT (5192)*
LYMPHANGIOSARCOMA
CHRONIC LYMPHEDEMATOUS EXTREMITIES,
CLINICAL STUDY (5565)*
LYMPHOBLAST
LEUKEMIC, HERPESVIRUS ANTIGEN
ACTIVATION, GUINEA PIG (5382)*
LYMPHOCYTE
ANTIGENIC PROPERTIES, CHRONIC LYMPHO-
CYTIC LEUKEMIA, HUMAN (5396)*
BLASTIC TRANSFORMATION, NEOPLASTIC
DISEASES, IMMUNOLOGY, HUMAN, REVIEW
(5044)*
CELL LINE, KARYOTYPE, VIRUS, MOUSE
(5308)
CYTOTOXICITY, PERITONEAL CAVITY,
LEUKEMIA, MOUSE (5307)
DNA POLYMERASE, NORMAL HUMAN (5445)
IGG DETECTION, SPLEEN AND LYMPH NODES,
MOUSE (5365)
SURFACE STRUCTURE, EFFECT OF MITOGENS,
CELL CULTURES, HUMAN (5486)*
ULTRASTRUCTURE, LYMPHATIC LEUKEMIA,
HUMAN (5491)*
LYMPHOCYTOSARCOMA
RETICULUM CELL-SARCOMA, INCIDENCE,
GERMANY (5420)
LYMPHOGRANULOMATOSIS
IMMUNOLOGICAL DEFICIENCY, HUMAN (5355)
IMMUNOGLOBULIN LEVELS, HUMAN (5326)
LYMPHOMA
HISTOCOMPATIBILITY ANTIGEN, HUMAN
(5337)
LEUKEMIA, PATHOGENESIS, ATOMIC BOMB,
REVIEW (5013)
MALIGNANT, BETA 1 A/C CONCENTRATION,
SERUM, HUMAN (5354)
MALIGNANT, PEYER'S PATCHES, PATHOLOGY,
MOUSE (5498)*
PRIMARY MALIGNANT, DIGESTIVE TRACT,
CASE REPORTS (5684)*
LYMPHOPROLIFERATIVE DISEASE
IRRADIATION, CLINICAL STUDY, ADULTS
(5574)*
PAROXYSMAL NOCTURNAL HEMOGLOBINURIA-
LIKE RED CELL ABNORMALITY, CASE
REPORT (5652)*
LYMPHORETICULAR PROLIFERATIVE DISEASE
HOMOZYGOUS ALEUTIAN GENE, MINK (5612)*
LYMPHOSARCOMA
IMMUNOSUPPRESSION, ANTIGEN CHALLENGE,
IMMUNE RESPONSE, MOUSE (5341)
LYMPHATIC LEUKEMIA, IMMUNOGLOBULINS,
GAMMA FRACTION, HUMAN (5290)
LYPOSARCOMA
C-TYPE VIRUS
GIBBON (5264)
TRANSFER, COW, SHEEP, (5236)
MACROPHAGE
GRANULOMA, NITROSOQUINOLINE, GIANT
CELL, RAT (5097)
MAGNESIUM
LEUKEMIA, INCIDENCE, CHILDREN, POLAND
(5427)*
MALIGNANCY
ACQUIRED HYPERTRICHOSIS LANUGINOSA,
CASE REPORTS (5665)*
CHILDHOOD, INCIDENCE, INDIA (5409)
MALIGNANT DISEASE
PERITONEAL HEALING, RAT (5636)*
MALIGNANT LYMPHOMA
LEUKEMIA, MULTIPLE MYELOMA, MORTALITY,
NEW ZEALAND (5411)

ALIGNANT MELANOMA
 ANTIBODIES
 CELL MEMBRANE, CYTOPLASM, HUMAN (5328)
 IMMUNOLOGY, IMMUNOFLUORESCENCE (5392)*
 FALCK HILLARP'S FLUORESCENT TECHNIQUE, CASE REPORT (5677)*
 SKIN, IMMUNOSTIMULATION PROCEDURES, THERAPY, PATIENTS (5376)*
 TYROSINASE INHIBITOR, INTRACELLULAR DISTRIBUTION, HAMSTER (5699)*
 VIRUS-LIKE PARTICLE, HUMAN (5224)
 MAMMARY GLAND
 ACUTE CANCERS, CLINICAL STUDY (5597)*
 CANCER, AMYLOID-LIKE SUBSTANCE, HUMAN (5565)*
 CARCINOGENESIS, EPIDEMIOLOGY, HUMAN, REVIEW (5022)
 CARCINOMA
 MAMMARY TUMOR VIRUS, HUMAN (5305)
 PROLACTIN DEPENDENCE, DEHYDROGENASE, HUMAN (5129)
 IMMUNE RECOGNITION, ENDOTOXIN, MOUSE (5303)
 TUMOR
 7,12-DIMETHYLBENZ(A)ANTHRACENE HORMONE-INDUCED STIMULANT EFFECTS, MOUSE, REVIEW (5064)*
 ULTRASTRUCTURE, RAT (5083)
 HORMONE DEPENDENCE, REVIEW (5034)*
 N-NITROSUBUTYLUREA, RAT (5136)
 PRECANCEROUS CONDITION, MOUSE (5400)
 ULTRASTRUCTURE, HUMAN (5596)*
 VIRUSES, REVIEW (5015)
 TUMOR REGRESSION
 AUTOPHAGY, NEOPLASTIC CELLS, RAT (5158)
 HORMONE-DEPENDENT TISSUE, PHYSIO-PATHOLOGIC CHARACTERISTICS, RAT (5157)
 TUMOR TRANSPLANT GROWTH, C. PARVUM, ANTITUMOR GLOBULIN, MOUSE (5315)
 MANDIBLE
 OSTEOSTOMA, CASE REPORTS (5566)*
 PRIMARY MALIGNANT MIXED TUMOR, CASE REPORT (5570)*
 MASTOCYTOMA
 ALLOGRAFT IMMUNITY, T CELL, MOUSE (5310)
 MAXILLARY ANTRUM
 CANCER, TRACE ELEMENTS, SOIL, PLANTS, SNUFF USERS (5164)*
 MEDIASTINUM
 NEUROGENOUS TUMORS, CLINICAL STUDY (5656)*
 MEDULLOBLASTOMA
 ATYPICAL MITOSES, HUMAN (5452)
 MEDULLOEPITHELIOMA
 MALIGNANT INTRAOCULAR, RHABDYO-SARCOMATOUS DIFFERENTIATION, CASE REPORTS (5643)*
 MELANOMA
 AMELANOTIC, CLINICOPATHOLOGIC STUDY (5654)*
 DEVELOPMENT, MATERNAL EFFECT, HYBRID FISH (5464)*
 HARDING-PASSEY
 HYDROLYTIC ENZYMES, CYTOCHEMISTRY, MOUSE (5458)*
 KARYOMETRICAL STUDY, MITOTIC INDEX MOUSE (5459)*
 NUCLEIC ACIDS, PROTEINS, CYTO-CHEMISTRY, MOUSE (5457)*
 HARDING-PASSEY MELANOMA, KIDNEY TUMOR, CYTOCHEMISTRY, MOUSE, HAMSTER (5457)*
 MALIGNANT
 IMMUNOLOGY IMMUNOFLUORESCENCE (5392)*
 TYROSINASE INHIBITOR, INTRACELL-ULAR DISTRIBUTION, HAMSTER (5699)*
 METASTATIC, BALLOON CELL CHANGES, CASE REPORTS (5472)*
 MULTIPLE AGMINATED JUVENILE, CASE REPORT (5692)*
 VULVA, CLINICAL STUDY (5463)*
 MESOTHELIOMA
 MALIGNANT FIBROUS, PLEURA, ULTRA-STRUCTURE, CASE REPORT (5475)*
 METABOLISM
 2-ACETAMIDONAPHTHALENE, DOG (5092)
 AFLATOXIN B1, MONKEY (5153)
 CARBOHYDRATES, DIMETHYLAMINOAZOBENZENE HEPATO CARCINOGENESIS, RAT (5161)
 CRABTREE EFFECT, TUMOR CELL, REVIEW (5008)
 ENERGY, INSULIN, 2-DEOXYGLUCOSE, GRANULOMA TISSUE, RAT (5495)*
 ENZYME INDUCTION, POLYCYCLIC AROMATIC HYDROCARBONS, PREGNANT AND FETAL RATS (5133)
 GLUCOSE, NOREPINEPHRINE, GLIOBLASTOMA CELLS, NEUROBLASTOMA CELLS, RAT (5558)*
 NEOPLASTIC CELL, REVIEW (5047)*
 NITROSAMINE, RNA ACTIVITY, LIVER, RAT (5160)

NUCLEIC ACID
 POLYOMA, ROUS SARCOMA VIRUS,
 EMBRYO CELL CULTURES, MOUSE,
 CHICKEN (5274)
 RAUSCHER VIRUS-INDUCED LEUKEMIA,
 MOUSE (5210)
 L-ORNITHINE, HEPATOMAS, RAT (5516)*
 RNA, LIVER, RAT (5630)*
 METASTASIS
 CHOROID, CLINICAL STUDY (5578)*
 FORMATION, HEMATOGENOUS DISSEMINATION,
 EHRLICH ASCITES TUMOR CELLS, MOUSE
 (5502)*
 PENILE CANCER, CASE REPORT (5674)*
 PULMONARY, INHIBITION, DEXTRAN SULFATE
 RAT (5523)*
 PULMONARY, RHINOPHARYNX TUMORS,
 CASE REPORTS (5589)*
 SELECTIVE, RETICULAR SYSTEM TUMOR,
 REVIEW (5017)
 SUBCUTANEOUS SACROCOCYGEAL EPENDYMOMA
 ULTRASTRUCTURE, CASE REPORT (5628)*
 METHEMOGLOBIN
 AMINOAZO DYES-INDUCED, RAT (5195)*
 METHIONINE
 PROTEIN SYNTHESIS, NORMAL CELLS,
 TUMOR CELLS, RAT (5583)*
 N-METHYL-4-AMINOAZOBENZENE
 MUTAGENICITY, CARCINOGENICITY, FRUIT
 FLY (5164)
 METHYLATION
 TRANSFER RNA, E.COLI-SPECIFIC, NORMAL
 LIVER AND PLASMACYTOMA, MOUSE
 (5637)*
 METHYLZOXYMETHANOL ACETATE
 TUMORIGENESIS, RNA SYNTHESIS INHIBI-
 TION, LIVER, RAT (5128)
 METHYLCHOLANTHRENE
 THYROID TUMOR, INDUCTION, C-CELLS,
 RAT (5090)
 3-METHYLCHOLANTHRENE
 ARYL HYDROCARBON HYDROXYLASE, PHYTO-
 HEMAGGLUTININ, LEUKOCYTE, HUMAN
 (5121)
 BENZO(A)PYRENE FIXATION, DNA, RAT
 (5130)
 EPIDERMIS, CARCINOMA, ANTIGENS, MOUSE
 (5361)
 HEPATOMA, SARCOMA, EMBRYONIC ANTIGEN,
 RAT (5332)
 INDUCED VIRUS PRODUCTION, TRANSFORMED
 CELL LINE, HAMSTER (5271)
 KIDNEY TUMOR, RAT (5183)
 LEUKEMIA AND SARCOMA DEVELOPMENT,
 AGE FACTOR, MOUSE (5149)
 RHABDOMYOSARCOMA, KARYOLOGY, RAT
 (5112)
 TUMOR-SPECIFIC ANTIGEN, INDUCTION,
 CELLS, MOUSE (5353)
 20-METHYLCHOLANTHRENE
 CARCINOGENESIS, ADRENAL CORTEX FUNC-
 TION, VITAMIN B12, MOUSE (5185)*
 3-METHYL-4-DIMETHYLAMINOAZOBENZENE
 ALPHA-FETOPROTEIN, HEPATOCARCINOGENE-
 SIS, RAT (5098)
 LIVER, PROTEIN DISTRIBUTION, RAT
 (5100)
 LIVER-PROTEIN CONJUGATE, RAT (5102)
 7-METHYL GUANINE
 URINARY EXCRETION, CHEMICAL CARCINOGEN
 ADMINISTRATION, RAT (5076)
 METHYL METHANE SULFONATE
 RNA METHYLATION, LIVER, RAT (5122)
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
 FREE RADICAL CONVERSION, ELECTRON SPIN
 RESONANCE (5094)
 MALIGNANT TRANSFORMATION, THYMUS CELL,
 LUNG CELL, RAT (5104)
 METHYLNITROSUREA
 CENTRAL NERVOUS SYSTEM, GIANT CELL
 TUMORS, DOG, RAT (5109)
 CYTOTOXICITY, NERVE CELLS, RAT (5078)
 TUMOR INDUCTION, NERVOUS SYSTEM, RAT
 (5178)
 N-METHYLNITROSUREA
 TUMORS, PERIPHERAL NERVOUS SYSTEM, DOG
 (5088)
 N-METHYL-N-NITROSUREA
 EXTRANEURAL TUMORS, RAT (5118)
 METHYLTHIOURACIL
 IODINE, THYROID TUMOR, HAMSTER (5170)
 THYROID TUMOR, IODINE UPTAKE, RAT
 (5087)
 6-METHYLTHIOURACIL
 BLASTOMOGENESIS, THYROID, RAT (5296)
 MIDDLE EAR
 EPITHELIOMA, PATHOGENESIS, CHILD,
 CASE REPORT (5408)*
 MINERAL OIL
 CANCER, INCIDENCE, HUMAN (5426)
 MITOCHONDRIA
 CRABTREE AND PASTEUR EFFECTS, PHOS-
 PHATE MEDIATION, ENERGY METABOLISM,
 CARCINOGENESIS, REVIEW (5008)
 RESPIRATION, ISLET-CELL TUMOR, LIVER,
 HAMSTER (5640)*
 MITOSIS
 ATYPICAL, BRAIN TUMORS, HUMAN (5452)
 MONONUCLEOTIDE
 ACID-SOLUBLE, RRNA, 32P-PHOSPHATE

INCORPORATION, MYELOID TUMOR, MOUSE (5499)*
 MONOSACCHARIDE
 SERUM PROTEIN-BOUND FUCOSE LEVELS, GYNECOLOGIC CANCER PATIENTS (5484)*
 MORPHOLOGY
 TUMORS, ALKYLATION, NERVOUS SYSTEM, ANIMALS (5107)
 MORTALITY
 CANCER
 1950-1967, AMERICAN INDIANS (5421)
 1960'S, UNITED STATES, REVIEW (5050)*
 GEOGRAPHIC CLUSTER, UNITED STATES (5415)
 NONWHITE, WHITE, UNITED STATES (5413)
 ENVIRONMENTAL HAZARD, URANIUM, LANDFILL, COLORADO (5412)
 MUCOSA
 COLONIC, CARCINOSARCOMA IMPLANTATION, RAT (5487)*
 MULTIPLE MYELOMA
 BONE MARROW, CYTOLOGY, IMMUNOLOGY, HUMAN (5390)*
 LEUKEMIA, MALIGNANT LYMPHOMA, MORTALITY, NEW ZEALAND (5411)
 MUTAGEN
 N-METHYL-4-AMINOAZOBENZENE, CARCINOGEN FRUIT FLY (5164)
 MUTANT
 POLYOMA VIRUS, REVIEW (5026)
 ROUS SARCOMA VIRUS, REVIEW (5003)
 MUTATION
 TEMPERATURE-SENSITIVITY, MURINE SARCOMA VIRUS, ISOLATION (5232)
 MYELOBLASTOMA
 GRANULAR CELL, CASE REPORT (5548)*
 MYELOID
 TUMOR (GRAFFI)
 ACID-SOLUBLE NUCLEOTIDES, CONCENTRATION AND SYNTHESIS, LIVER, MOUSE (5500)*
 32P-PHOSPHATE INCORPORATION, ACID-SOLUBLE AND RNA MONO-NUCLEOTIDES, MOUSE (5499)*
 MYELOMA
 BETA 1 A/C CONCENTRATION, SERUM, HUMAN (5354)
 GROWTH, AUTOMATIC MONITORING, TISSUE CULTURE CELLS, MOUSE (5550)*
 IGA PROTEIN, PLASMA CELL TUMOR, MOUSE (5314)
 IMMUNOCYTOLOGY, GROWTH REQUIREMENT, PHAGOCYTIC CELL FACTOR, MOUSE (5302)

IMMUNOGLOBULIN A, INTERCHAIN DISULFIDE BOND FORMATION, MOUSE (5374)*
 MULTIPLE, BONE MARROW, CYTOLOGY, IMMUNOLOGY, HUMAN (5390)*
 BETA-NAPHTHYLAMINE
 HAPTENE, CARCINOGENESIS, DOG (5291)
 NASAL CAVITY
 PAPILLOMATOSIS, PARANASAL SINUSES, CLINICOPATHOLOGIC STUDY (5508)*
 PARANASAL SINUSES, CANCER, CLINICAL STUDY (5642)*
 NEONATAL ONCOLOGY
 DIAGNOSIS, TREATMENT, HISTOLOGICAL FINDINGS (5442)
 NEOPLASIA
 CUTANEOUS TUMOR IRREVERSIBILITY, HUMAN REVIEW (5037)*
 GASTRIC CARCINOSARCOMA, CASE REPORT (5496)*
 PROTEOLYTIC ENZYMES, INHIBITORS, HUMAN (5450)
 TROPHOBLASTIC, TISSUE CULTURE, HUMAN (5645)*
 URETERAL STUMP, PARTIAL NEPHRO-URETERECTOMY, CASE REPORT (5661)*
 VIRUS, HUMAN, REVIEW (5052)*
 NEOPLASM
 MEDIASTINAL ENDOCRINE, MULTIPLE ENDOCRINE ADENOMATOSIS, CASE REPORTS (5576)*
 PRIMARY MEDIASTINAL ENDOCRINE, CLINICAL STUDY (5575)*
 SPONTANEOUS, INCIDENCE, MOUSE (5254)
 TRIPLE PRIMARY MALIGNANT, UTERUS, CAECUM, STOMACH, CASE REPORT (5460)*
 NERVE
 BRAIN CELL, CYTOTOXICITY, ETHYLNITROSUREA, METHYLNITROSUREA, RAT (5078)
 MALIGNANT NEURINOMA
 SCHWANN CELL, CLONAL LINE, ETHYLNITROSUREA, RAT (5167)
 TRANSPLACENTAL INDUCTION, ETHYLNITROSUREA, MORPHOLOGY, HAMSTER (5110)
 TUMOR, NERVOUS SYSTEM-SPECIFIC PROTEIN RAT (5363)
 NERVOUS SYSTEM
 AZOXYMETHANE, TUMORIGENICITY, RAT (5103)
 NEUROGENIC TUMORS
 N-BUTYL-NITROSUREA, RAT (5144)
 MEDIASTINUM, CLINICAL STUDY (5656)*
 PERIPHERAL, N-METHYLNITROSUREA,

TUMORS, DOG (5068)
 TUMOR FORMATION, METHYLNITROSUREA,
 RAT (5178)
 TUMOR INDUCTION, PHENYL-DIMETHYL-
 TRIAZENE, RAT (5111)
 TUMORS, MORPHOLOGY, ALKYLATION,
 ANIMALS (5107)
 NEURINOMA
 MALIGNANT, TRANSPLACENTAL INDUCTION,
 ETHYLNITROSUREA, MORPHOLOGY,
 HAMSTER (5110)
 NEUROBLASTOMA
 ABDOMINAL TUMORS, CLINICAL STUDY,
 CHILDREN (5449)
 BONE MARROW, HISTOLOGIC STUDY,
 CHILDREN (5598)*
 ENZYME REGULATION, CELLS, MOUSE
 (5627)*
 NEVUS
 BALLOON CELL, ULTRASTRUCTURE, CASE
 REPORT (5572)*
 NICKEL
 CARCINOGENESIS, OCCUPATIONAL HAZARD,
 HUMAN, REVIEW (5009)
 4-NITROGUINOLINE-1-OXIDE
 KIDNEY TUMOR, RAT (5183)
 NITROSAMINE
 FORMATION, TERTIARY AMINES, NITRITES
 (5156)
 METABOLISM, RNA ACTIVITY, LIVER, RAT
 (5160)
 NITROSO COMPOUNDS
 BIOCHEMISTRY, CARCINOGENESIS, REVIEW
 (5007)
 FORMATION, STOMACH, ANIMALS (5188)*
 N-NITROSO COMPOUNDS
 CARCINOGENIC PROPERTIES, IMMUNE
 REACTIONS, RAT (5294)
 N-NITROSOBUTYLUREA
 LEUKEMIA, MAMMARY TUMOR, RAT (5136)
 N-NITROSODIMETHYLAMINE
 KIDNEY TUMOR, RAT (5183)
 NITROSOGUANIDINE
 KINETICS OF DECOMPOSITION (5137)
 N-NITROSOHEPTAMETHYLENEIMINE
 LUNG CANCER, INDUCTION, RAT (5113)
 N-NITROSOMETHYLUREA
 CANCER INDUCING EFFECT, HORMONAL
 CONTRACEPTIVE ADMINISTRATION, RAT
 (5146)
 N-NITROSO-N-METHYLURETHANE
 INDUCED LESIONS, ULTRASTRUCTURE,
 CRYSTALLINE CELLULAR INCLUSIONS,
 LUNG, MOUSE (5101)
 N-NITROSOMORPHOLINE
 URINARY 7-METHYL GUANINE EXCRETION,
 RAT (5076)
 NITROSOQUINOLINE
 GRANULOMA, MACROPHAGE, GIANT CELL,
 RAT (5097)
 NITROSOURFA
 RNA POLYMERASE, POLYCYTIDYLATE
 TEMPLATE (5138)
 NOREPINEPHRINE
 GLUCOSE METABOLISM, GLIOBLASTOMA CELLS
 NEUROBLASTOMA CELLS, RAT (5558)*
 NUCLEIC ACID
 ETHYLNITROSUREA, ETHYLATION, FETUS,
 ADULT, RAT (5172)
 HARDING-PASSEY MELANOMA, KIDNEY TUMOR,
 CYTOCHEMISTRY, MOUSE, HAMSTER
 (5457)*
 LIVER MITOCHONDRIA, LEUKEMIA, MOUSE
 (5439)
 METABOLISM, POLYOMA, ROUS SARCOMA
 VIRUS, EMBRYO CELL CULTURES, MOUSE,
 CHICKEN (5274)
 RNA, AVIAN MYELOBLASTOSIS VIRUS,
 TISSUE DISTRIBUTION, CHICKEN (5215)
 NUCLEOLUS
 MODIFICATION, AFLATOXIN B1, FISH LIVER
 SNAIL (5116)
 NUCLEOTIDE
 ACID-SOLUBLE, CONCENTRATION AND
 SYNTHESIS, MYELOID TUMOR, LIVER,
 MOUSE (5500)*
 RNA, FELINE LEUKEMIA VIRUS, CAT, HUMAN
 (5247)
 TUMOR INDUCTION, MURINE SARCOMA VIRUS,
 MOUSE (5223)
 NUCLEUS
 CHROMATIN FRACTION, IMMUNOSUPPRESSIVE
 ACTIVITY, EHRLICH ASCITES TUMOR
 CELLS, MOUSE (5368)*
 OCCUPATIONAL HAZARD
 ANIMAL STUDIES, REVIEW (5021)
 AROMATIC AMINE, REVIEW (5012)
 BITUMENS, CARCINOGENESIS, HUMAN,
 REVIEW (5027)
 CHROMIUM AND NICKEL, CARCINOGENESIS,
 HUMAN, REVIEW (5009)
 LUNG CANCER, AIR POLLUTION, SMOKING,
 REVIEW (5018)
 OIL
 OVERHEATED COOKING, CARCINOGENICITY,
 BENZO(A)PYRENE, RAT (5159)
 PENTAERYTHRITE ESTER, DIETHYLENE
 GLYCOL, LEUKEMIA, MOUSE (5106)
 ONCOGENESIS
 INITIATION MECHANISM HYPOTHESIS,

RESONANT TRANSFER OF ENERGY (5476)*
 POLYOMA VIRUS, RAT (5266)
 ORAL CONTRACEPTIVE
 CARCINOGENICITY, RAT, MOUSE, REVIEW
 (5056)*
 OSTEOBLASTOMA
 MANDIBLE, CASE REPORTS (5566)*
 OSTEOSARCOMA
 MURINE SARCOMA VIRUS, VIRUS-PERSISTENT
 CELL LINE, RAT (5204)
 PRIMARY, HEART, CASE REPORT (5466)*
 OVARY
 ANDROBLASTOMA, RADIATION-INDUCED,
 MOUSE (5201)
 BILATERAL FIBROSARCOMA, HYSTERECTOMY,
 CASE REPORT (5622)*
 BRENNER TUMOR
 LEYDIG CELL HYPERPLASIA, CASE
 REPORT (5611)*
 PROLIFERATIVE, MALIGNANT, CLINICAL
 STUDY (5569)*
 CARCINOMA, EPIDEMIOLOGY, BULGARIA
 (5423)
 EPITHELIAL TUMORS, CHILDREN,
 ADOLESCENTS, CLINICAL STUDY (5687)*
 PRIMARY CARCINOMA, CASE REPORT (5590)*
 TUMORS
 FREQUENCY, CHILDREN, ADOLESCENT
 (5453)
 HUMAN, REVIEW (5036)*
 OVULATION
 URETHANE, RAT (5196)*
 OXYGEN
 CONSUMPTION, GLUCOSE INCORPORATION,
 ATMOSPHERIC MICROCONSTITUENT
 INOCULATION, BUCCAL CELL CULTURES,
 CALF (5179)
 PAGET'S DISEASE
 EXTRAMAMMARY, HISTOCHEMISTRY,
 ULTRASTRUCTURE, CASE REPORT (5685)*
 PALATE
 CARCINOMA, REVERSE SMOKING, INDIA
 (5193)*
 DUCT ALTERATIONS, REVERSE SMOKERS,
 INDIA (5191)*
 SQUAMOUS CELL CARCINOMAS, HISTOLOGICAL
 STUDY (5581)*
 PANCREAS
 ACINAR CELLS, 4-ACETYLAMINOFLUORENE,
 RAT (5169)
 NON-G CELL GASTRIN-PRODUCING TUMORS,
 HUMAN (5618)*
 PAPILLOMA
 CHOROID PLEXUS, ULTRASTRUCTURE,
 CASE REPORTS (5469)*

SPONTANEOUS, SHOPE PAPILLOMA VIRUS,
 RABBIT KIDNEY VACUOLATING, RABBIT
 (5259)
 PAPILLOMATOSIS
 NASAL CAVITY, PARANASAL SINUSES,
 CLINICOPATHOLOGIC STUDY (5508)*
 PARASITISM
 GROWTH, TUMOR CELLS, HAMSTER, RAT
 (5301)
 PELVIS
 CARCINOMA, PHENACETIN, CASE REPORTS
 (5134)
 PENIS
 CANCER, METASTASIS TO THUMB, CASE
 REPORT (5674)*
 PERIPHERAL NERVOUS SYSTEM
 N-METHYLNITROSOUREA, TUMORS, DOG
 (5088)
 PERITONEAL CAVITY
 LYMPHOCYTE, CYTOTOXICITY, LEUKEMIA,
 MOUSE (5307)
 PESTICIDE
 LEUKEMIA, ENVIRONMENTAL HAZARD, POLAND
 (5417)
 PHAGOCYTOSIS
 LIVER, KUPFFER CELL, HUMORAL
 RECOGNITION FACTOR, LEUKEMIA, RAT
 (5298)
 PHENACETIN
 PELVIC CARCINOMA, CASE REPORTS (5134)
 PHENOBARBITAL
 2-ACETYLAMINOFLUORENE, LIVER TUMOR,
 RAT (5084)
 LIVER BINDING, RAT (5127)
 PHENYL-DIMETHYL-TRIAZENE
 NERVOUS SYSTEM TUMORS, INDUCTION, RAT
 (5111)
 PHOSPHOLIPID
 ACYL GROUP CHANGE, TRANSFORMED CELL,
 ROUS SARCOMA VIRUS, CHICKEN (5248)
 PHTHIVAZID
 TUBAZID, CARCINOGENESIS, MOUSE (5096)
 PHYTOHEMAGGLUTININ
 ARYL HYDROCARBON HYDROXYLASE,
 3-METHYLCHOLANTHRENE, LEUKOCYTE,
 HUMAN (5121)
 PITUITARY
 ACIDOPHIL ADENOMAS, INTRACITOPLASMIC
 FILAMENTOUS AGGREGATES, ULTRASTRUCTURE,
 HUMAN (5694)*
 TUMORS
 CAPILLARY BED, ULTRASTRUCTURAL
 CHANGES, HUMAN (5528)*
 HIGH PLASMA THYROTROPHIN LEVELS,
 CASE REPORTS (5614)*

PLACENTA
ANTIGEN, MALIGNANT TUMOR, HUMAN (5318)

PLASMA
AMINO ACID ANALYSIS, ABNORMAL OROSOMUCOID, ACUTE LEUKEMIA PATIENTS (5511)*

PLASMA CELL TUMOR
IGA MYELOMA PROTEIN, MOUSE (5314)

PLASMACYTOMA
GROWTH QUANTITATION, PARAPROTEIN IMMUNOASSAY, MOUSE (5312)

PLEURA
MALIGNANT FIBROUS MESOTHELIOMA, ULTRASTRUCTURE, CASE REPORT (5475)*

PLUTONIUM
RADIATION, BONE, RAT (5196)

POLYAMINE
CONTENT, HEPATOMA, RAT (5620)*

POLYCYCLIC AROMATIC HYDROCARBON
TRANSFORMATION, MICROSOMAL MIXED-FUNCTION OXIDASE, INDUCTION, MOUSE PROSTATE CELL (5173)

POLYCYCLIC HYDROCARBON
ENZYME INDUCTION, METABOLISM, PREGNANT AND FETAL RATS (5133)
MOLECULAR MECHANISMS, K AND L REGIONS (5147)

POLYINOSINIC-POLYCYTIDYLIC ACID
TUMOR GROWTH, INHIBITION MECHANISM, IMMUNITY, RAT (5350)

POLYNUCLEAR HYDROCARBON
ANTHRARENE, SKIN CARCINOGENESIS, MOUSE (5142)

POLYPEPTIDE
SYNTHESIS, MURINE SARCOMA-LEUKEMIA VIRUS, IMMUNOLOGICAL STUDIES, RAT CELLS (5347)

PORPHYRIN
ORGAN CONTENTS, KIDNEY, LEAD ACETATE, RAT (5065)

PROLIFERATION
BLAST CELL, CHROMOSOMAL TRANSLOCATION, PERINATAL LEUKEMIA, CASE REPORT (5477)*

PROPIONITRIL
DUODENAL ULCERS, RAT (5194)*

PROSTATE
SARCOMA, CLINICAL STUDY (5650)*

PROTEIN
ALPHA-FETOPROTEIN, SYNTHESIS, INHIBITION, LIVER, RAT (5300)
ANTIGEN, FELINE LEUKEMIA VIRUS, MURINE LEUKEMIA VIRUS, ASSAY (5358)
BLOOD SERUM, ISOLATION, REGENERATING LIVER AND HEPATOMA, RAT (5393)*

DISTRIBUTION, LIVER, 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE, RAT (5100)

F1 HISTONE, MOLECULAR NATURE, PHOSPHORYLATION, CULTURED HEPATOMA CELLS (5506)*

H FRACTION, LIVER, CARCINOGEN SUSCEPTIBILITY, RAT, MOUSE, GUINEA PIG, RABBIT, HAMSTER (5082)

HISTONE TURNOVER, HEPATOMA TISSUE, CULTURE CELLS (5504)*

IGA MYELOMA, PLASMA CELL TUMOR, MOUSE (5314)

LEUCINE INCORPORATION, INHIBITION, TUMOR-BEARING BLOOD, RAT (5524)*

NERVOUS-TISSUE-SPECIFIC, BRAIN TUMOR, PERIPHERAL NERVOUS SYSTEM, RAT (5363)

POLYOMA VIRUS, DISRUPTION (5275)

SERUM
CANCER ASSOCIATED (5367)*
HODGKIN'S DISEASE, ACUTE MYELOID LEUKEMIA, IMMUNOELECTROPHORETIC INVESTIGATIONS, PATIENTS (5378)*
SERUM GLYCOPROTEIN LEVELS, ASCITES HEPATOMA 109A, RAT (5385)*
STRUCTURAL, SV40, PHOSPHOPROTEINS (5230)
STRUCTURE, UTERINE CERVIX CARCINOMA, IMMUNOLOGY, HUMAN (5295)

SYNTHESIS
ADRENAL GLAND, DIMETHYLNITROSAMINE RAT (5171)
RETICULOCYTE INITIATION FACTORS, CELL-FREE SYSTEM, KREBS II ASCITES CELLS (5651)*
RNA SYNTHESIS, COMPARATIVE STUDY, LIVER AND LUNG, RAT (5192)*
SV40-INFECTED CELL, MONKEY (5263)

1-PYRIDYL-3,3-DIETHYL-TRIAZENE
CARDIAC TUMORS
ORAL ADMINISTRATION, RAT (5162)
RAT (5108)

RACE
NONWHITE, WHITE, CANCER MORTALITY, UNITED STATES (5413)

RADIATION
ATOMIC BOMB, LYMPHOMA, LEUKEMIA, PATHOGENESIS, REVIEW (5013)
INDUCED ANDROBLASTOMAS, OVARIES, MOUSE (5201)
LEUKEMIA, GUINEA PIG (5202)
PLUTONIUM, BONE, RAT (5198)
SKIN TUMOR FORMATION, HAIR-FOLLICLE DAMAGE, MOUSE, RAT (5200)
THERAPEUTIC, LEUKOCYTE, CHROMOSOME,

ABNORMALITY, HUMAN (5454)
 ULTRAVIOLET, SKIN CANCER, SUNLIGHT,
 HUMAN, REVIEW (5019)
 ADON
 BRONCOPULMONARY CARCINOMA, INHALATION,
 RAT (5197)
 ECTUM
 CARCINOMA, ADENOMATOUS POLYPS, BIOPSY,
 ORGAN TISSUE CULTURE, HUMAN (5470)*
 EGRESSION
 SPONTANEOUS, MALIGNANT TUMORS,
 CASE REPORTS (5379)*
 EPLICATION
 HERPESVIRUS, TURKEY (5284)*
 ESISTANCE
 FRIEND LEUKEMIA VIRUS, IMMUNOSUPPRESS-
 ION, MOUSE (5352)
 MOLONEY SARCOMA VIRUS, MOUSE (5209)
 ESPIRATION
 ENZYME CHANGES, MORRIS HEPATOMA,
 REVIEW (5011)
 MITOCHONDRIA, ISLET-CELL TUMOR,
 LIVER, HAMSTER (5640)*
 ESPIRATORY TRACT
 BRONCHIAL CANCER, TOBACCO SMOKING,
 HUMAN, REVIEW (5006)
 CARCINOGENESIS, BENZO(A)PYRENE, FERRIC
 OXIDE, HAMSTER (5176)
 CARCINOMA, ORAL CAVITY, ESOPHAGUS,
 EAR, CLINICAL STUDY, TUBERCULOSIS
 PATIENTS (5465)*
 ETICULAR SYSTEM
 TUMOR, SELECTIVE METASTASIS, REVIEW
 (5017)
 ETICULUM CELL SARCOMA
 IMMUNOLOGICAL INDUCTION, VIRUS, MOUSE
 (5228)
 ABDOMYOMA
 FETAL, ANALYSIS OF CASES (5571)*
 ABDOMYOSARCOMA
 3-METHYLCHOLANTHRENE-INDUCED,
 KARYOLOGY, RAT (5112)
 INOPHARYNX
 TUMORS, PULMONARY METASTASES, CASE
 REPORTS (5589)*
 BOSOME
 PROTEIN CONTENT, BIOLOGICAL ACTIVITY,
 KREBS II ASCITES CARCINOMA CELLS
 (5440)
 FAMPICIN
 FOCUS FORMATION, INHIBITION, FIBRO-
 BLASTS, CHICK (5533)*
 A
 AVIAN MYELOBLASTOSIS VIRUS, TISSUE
 DISTRIBUTION, CHICKEN (5215)
 BOUND TO NASCENT DNA, EHRlich ASCITES
 TUMOR CELLS (5545)*
 COMPONENTS, SMALL MOLECULAR WEIGHT,
 EHRlich ASCITES TUMOR CELLS (5436)
 DNA LINKAGE, AVIAN MYELOBLASTOSIS
 VIRUS, DNA POLYMERASE (5219)
 FELINE LEUKEMIA VIRUS, NUCLEOTIDE
 COMPOSITION, CAT, HUMAN (5247)
 METABOLISM, LIVER, RAT (5630)*
 METHYLASE, KIDNEY, DIMETHYLNITROSAMINE
 RAT (5123)
 METHYLATION, LIVER, METHYL METHANE
 SULPHONATE, NN-DIMETHYLNITROSAMINE,
 RAT (5122)
 ONCOGENIC VIRUSES, MALIGNANT TRANS-
 FORMATION, REVIEW (5028)
 POLYMERASE
 CHROMATIN TEMPLATE ACTIVITY,
 FIBROBLASTS, HUMAN (5535)*
 POLYCYTIDYLATE TEMPLATE,
 NITROSOUREAS (5138)
 SELECTIVE INHIBITION, AFLATOXIN B1
 LIVER, RAT (5150)
 RIBOSOMAL, OLIGONUCLEOTIDE SEQUENCES,
 LIVER, HEPATOMA ASCITES CELLS, RAT
 (5529)*
 ROUS SARCOMA VIRUS, CELLULAR DNA,
 CHICKEN (5226)
 SIMIAN ADENOVIRUS 7, TRANSFORMED CELL,
 HAMSTER (5251)
 SUBUNIT, DNA POLYMERASE TEMPLATE,
 ROUS SARCOMA VIRUS (5207)
 SYNTHESIS
 BACTERIOPHAGE (5229)
 PROTEIN, COMPARATIVE STUDY, LIVER
 AND LUNG, RAT (5192)*
 3H URIDINE AND 3H ADENINE
 INCORPORATION, CELL CYCLE,
 HAMSTER CELLS (5606)*
 SYNTHESIS INHIBITION, METHYLAZOXY-
 METHANOL ACETATE, TUMORIGENESIS,
 LIVER, RAT (5128)
 3' TERMINUS, CYTOPLASMIC POLYHDEIOSIS
 VIRUS, WOUND TUMOR VIRUS, REOVIRUS
 (5217)
 TRANSFER
 METHIONINE-ACCEPTING, CELL-FREE
 SYSTEMS, E.COLI, ASCITES TUMOR
 CELLS, YEAST (5503)*
 METHYLASE, ETHIONINE, YEAST CELL
 (5126)
 METHYLATION
 COLONIC TUMOR, 1,2-DIMETHYL-
 HYDRAZINE, MOUSE (5093)
 E.COLI-SPECIFIC NORMAL LIVER

AND PLASMACYTOMA, MOUSE
(5637)*
UPTAKE AND AMINO ACYLATION,
LEUKEMIA CELLS, MOUSE (5629)*
SALIVARY GLAND
OAT CELL CARCINOMA, CLINICAL STUDY
(5521)*
TUMORS
HUMAN, REVIEW (5054)*
RECURRENCE, INCIDENCE, HUMAN
(5438)
SARCOMA
DEVELOPMENT, 3-METHYLCHOLANTHRENE,
AGE FACTOR, MOUSE (5149)
7,12-DIMETHYLBENZANTHRACENE, SKIN
TRANSPLANTS, MOUSE (5270)
EPITHELIOID, FIBROCYTIC DERIVATION,
CASE REPORTS (5407)*
JENSON'S, CARDOLIPINS, MITOCHONDRIA,
MICROSOMES (5671)*
KAPOSÍ'S, TISSUE CULTURE (5696)*
PRIMARY LIVER, SPONTANEOUS RECOVERY,
CASE REPORT (5380)*
PRIMARY ROUS, CHROMOSOME ANALYSIS, RAT
(5462)*
PROSTATE GLAND, CLINICAL STUDY (5650)*
RETICULUM CELL
IMMUNOLOGICAL INDUCTION, MOUSE
(5246)
LYMPHOCYTOSARCOMA, INCIDENCE,
GERMANY (5420)
SOLUBLE ANTIGEN FRACTIONATION,
MACROPHAGE MIGRATION INHIBITION TEST
GUINEA PIG (5351)
SPERMATIC CORD, CLINICAL STUDY (5579)*
YOSHIDA, MARKER CHROMOSOMES, RAT
(5525)*
SCHWANN CELL
MALIGNANT NEURINOMA, CLONAL LINE,
ETHYLNITROSOUREA, RAT (5167)
SCHWANNOMA
MALIGNANT, CASE REPORT (5613)
SEMINAL GLAND
TUMORS, CELLOPHANE-INDUCED, RAT (5199)
SERUM
PROTEINS
ISOLATION, REGENERATING LIVER AND
HEPATOMA, RAT (5393)*
SYNTHESIS, DEGRADATION, MORRIS
HEPATOMA, RAT (5451)
SI NUS
PARANASAL, NASAL CAVITY, CANCER,
CLINICAL STUDY (5642)*
SKIN
ACTINOMYCIN-U, PERSISTENCE,

7,12-DIMETHYLBENZ(A)ANTHRACENE,
TUMOR INHIBITION, MOUSE (5072)
ALTERATION, GROSS LEUKEMIA, TUMOR
CELLS, MOUSE (5340)
BASAL CELL EPITHELIOMA
COLLAGENOLYTIC ENZYMES
HUMAN (5600)*
ULTRASTRUCTURE, HUMAN (5604)*
CANCER
COAL TAR, SYNTHETIC TAR, MOUSE
(5155)
UV RADIATION, SUNLIGHT, HUMAN,
REVIEW (5019)
CARCINOGENESIS, ANTHRENE, POLY-
NUCLEAR HYDROCARBON, MOUSE (5142)
7,12-DIMETHYLBENZ(A)ANTHRACENE,
BENZO(A)PYRENE, COMBINED EFFECT,
MOUSE (5186)*
FIBROSARCOMA, 5-HYDROXY-3,4-BENZO(A)-
PYRENE, MOUSE (5141)
HETEROGENIZATION FACTOR,
7,12-DIMETHYLBENZANTHRACENE-INDUCED
TUMOR TRANSPLANT, LATENT VIRUS,
MOUSE (5270)
MALIGNANT MELANOMA, IMMUNOSTIMULATION
PROCEDURES, THERAPY, PATIENTS
(5376)*
TUMOR
DNA AND HISTONE PROTEIN CONTENT,
CYTOPHOTOMETRIC MEASUREMENTS,
RAT, MOUSE (5120)
INCIDENCE, INDIA (5497)*
TUMOR FORMATION, HAIR-FOLLICLE DAMAGE,
RADIATION-INDUCED, MOUSE, RAT (5200)
TUMOR IRREVERSIBILITY, CYTOECOLOGICAL
PROBLEM, HUMAN, REVIEW (5037)*
SODIUM
REVERSE ION CONCENTRATION GRADIENTS,
ELECTROGENIC SODIUM PUMP, AMINO ACID
CONCENTRATION, ASCITES-TUMOR CELLS,
MOUSE (5544)*
SOIL
MAGNESIUM CONTENT, LEUKEMIA INCIDENCE,
POLAND (5427)*
SPERMATIC CORD
SARCOMA, CLINICAL STUDY (5579)*
SPINAL CORD
LUMBO-SACRAL, GIGANTO-CELLULAR GLIO-
BLASTOMA, CASE REPORT (5560)*
SPINDLE CELL
CARCINOMA, BURN SCAR, UPPER LIMB,
CASE REPORT (5564)*
SPLEEN
TRANSPLANTABLE COLONY-FORMING UNITS,
RAUSCHER LEUKEMIA VIRUS, MOUSE

(5285)*
 QUAMCUS CELL CARCINOMA
 ARTIFICIAL VAGINA, CASE REPORT (5586)*
 PALATE, HISTOLOGICAL STUDY (5581)*
 TEEL
 MANUFACTURE, FLUORIDE, LUNG CANCER,
 CANADA (5414)
 TILBESTROL
 VAGINAL CANCER, HUMAN, REVIEW (5039)*
 TOMACH
 CANCER
 INCIDENCE, HAWAII, JAPAN (5416)
 PRECANCEROUS STAGES, HUMAN, REVIEW
 (5001)
 GASTRIC CANCER
 ALIMENTARY FACTORS, EPIDEMIOLOGY,
 NEW YORK (5424)
 FOOD PREPARATION, CARCINOGENIC
 HYDROCARBON FORMATION, HUMAN
 (5148)
 GASTRIC CANCER INDUCTION, THYROID
 GLAND HORMONES, RAT (5187)*
 GASTRIC CARCINOSARCOMA, CASE REPORT
 (5496)*
 GASTRIC FIBROMA, CASE REPORT (5660)*
 GASTRIC TUMORS, MUSCULAR ORIGIN, CASE
 REPORT (5562)*
 R
 COAL, SYNTHETIC TAR, SKIN CANCER,
 MOUSE (5155)
 KATOMA
 CYSTIC, EPIDERMOID CARCINOMA, CASE
 REPORTS (5659)*
 STES
 GERMINAL TUMORS, HUMAN, REVIEW (5033)*
 INTERSTITIAL CELL TUMORS, CADMIUM
 CHLORIDE-INDUCED, RAT (5132)
 MICROBODIES, LEYDIG CELL TUMORS, RAT
 (5543)*
 SEMINAL GLAND TUMORS, CELLOPHANE-
 INDUCED, RAT (5199)
 TUMORS, CHILDREN, CASE REPORTS (5431)
 YMECTOMY
 CELL-MEDIATED IMMUNITY, ROUS SARCOMA
 VIRUS, RAT (5324)
 YMOMA
 IMMUNOGLOBULIN LEVELS, HUMAN (5326)
 YMUS
 CELL CULTURE, MALIGNANT TRANSFORMATION
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
 RAT (5104)
 LEUKEMIA, 7,12-DIMETHYLBENZ(A)-
 ANTHRACENE, MOUSE (5168)
 LIVER CARCINOMA, INHIBITION, DIETHYL-
 NITROSAMINE, RAT (5145)

PRIMARY MEDIASTINAL ENDOCRINE NEOPLASM
 CLINICAL STUDY (5575)*
 THYMECTOMY, TRANSPLANTATION, LEUKEMIA,
 ANTILYMPHOCYTE, HAMSTER, HUMAN
 (5313)
 TUMORS, MYASTHENIA GRAVIS, CASE
 REPORTS (5626)*
 THYROID
 BLASTOMAGENESIS, 6-METHYLTHIOURACIL,
 RAT (5296)
 CANCER, PATHOLOGY, CLINICAL STUDY
 (5646)*
 CARCINOMA, CLINICAL STUDY (5662)*
 CARCINOMA, CLINICAL STUDY, CHILDREN
 (5461)*
 IODINE, METHYLTHIOURACIL, HAMSTER
 (5170)
 MALIGNANCY, SOLITARY NODULE, CLINICAL
 STUDY (5480)*
 MEDULLARY CANCER, AMYLOID STROMA,
 CASE REPORT (5594)*
 MEDULLARY CARCINOMA
 ARGYROPHIL SECRETORY GRANULES,
 HISTOLOGIC AND ULTRACYTOCHEMICAL
 STUDIES (5509)*
 ULTRASTRUCTURE, RAT (5686)*
 SPINDLE-CELL TUMOR, GIANT-CELL TUMOR,
 CLINICAL STUDY (5567)*
 TUMOR, IODINE UPTAKE, METHYLTHIOURACIL
 RAT (5087)
 TUMOR INDUCTION, METHYLCHOLANTHRENE,
 C-CELLS, RAT (5090)
 TOBACCO
 BRONCHIAL CANCER, PATHOLOGY, HUMAN,
 REVIEW (5006)
 CIGARETTE SMOKE, LUNG CANCER, TISSUE
 CULTURES, MOUSE (5154)
 CIGARETTE-SMOKE CONDENSATE, BENZO(A)-
 PYRENE FIXATION, DNA, RAT (5130)
 CIGARETTE SMOKING, LUNG CANCER, REVIEW
 (5010)
 LUNG CANCER, OCCUPATIONAL HAZARD, AIR
 POLLUTION, REVIEW (5018)
 REVERSE SMOKING
 HARD PALATE CARCINOMA, INDIA
 (5193)*
 HARD PALATE DUCT ALTERATIONS,
 INDIA (5191)*
 TRANSDIMETHYLAMINOSTILBENE
 URINARY 7-METHYL GUANINE EXCRETION,
 RAT (5076)
 TRANSFORMATION
 ADENOVIRUS, HORMONAL MODIFICATION,
 HAMSTER CELLS (5267)
 BLASTIC, LYMPHOCYTES, NEOPLASTIC

- DISEASES, HUMAN, REVIEW (5044)*
 CELLULAR, DNA ONCOGENIC VIRUSES,
 REVIEW (5030)*
 MALIGNANT
 IMMUNE INDUCTION, CELL-TO-CELL
 INTERACTION, BONE MARROW, HUMAN
 (5394)*
 RNA ONCOGENIC VIRUSES, REVIEW
 (5028)
 MALIGNANT CELLULAR, KARYOLOGIC
 MODIFICATIONS, INTRASPECIFIC SOMATIC
 HYBRIDIZATION, HAMSTER (5299)
 NEOPLASTIC, SERUM EFFECTS, CHROMOSOME
 STABILITY, EMBRYONIC CELLS, MOUSE
 (5430)
 POLYCYCLIC AROMATIC HYDROCARBON,
 MICROSOMAL MIXED-FUNCTION OXIDASE,
 INDUCTION, MOUSE PROSTATE CELL
 (5173)
 POLYOMA VIRUS
 R TYPE VIRUS PARTICLE, HAMSTER
 (5240)
 REVERSION, DNA COPYING, HAMSTER
 (5222)
 ROUS SARCOMA VIRUS, PHOSPHOLIPID,
 ACYL GROUP CHANGE, CHICKEN (5248)
 SINIAN ADENOVIRUS 7, RNA, HAMSTER
 (5251)
 SPONTANEOUS NEOPLASTIC, MURINE
 LEUKEMIA VIRUS, SERUM FRACTIONS,
 MOUSE (5265)
 SV40, ANTIGEN, MONKEY (5333)
 THYMUS CELL, LUNG CELL,
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
 RAT (5104)
 TRANSPLANTABILITY, KARYOTYPE, CELL
 SURFACE, EMBRYO CELLS, HAMSTER
 (5433)
 TRANSPLANTATION
 LEUKEMIA, THYMECTOMY, ANTILYMPHOCYTE
 SERUM, HAMSTER, HUMAN (5313)
 TROPHOBLASTIC NEOPLASIA
 TISSUE CULTURE, HUMAN (5645)*
 TRYPAH BLUE
 TUMORS, ULTRASTRUCTURE, LIVER, RAT
 (5103)
 TRYPTOPHAN
 METABOLISM, BLADDER CANCER, AROMATIC
 AMINE, HUMAN (5124)
 TUBAZID
 PHTHIVAZID, CARCINOGENESIS, MOUSE
 (5096)
 TUMOR
 ALLOGRAFT IMMUNITY, T CELL, MOUSE
 (5310)
 EXTRANEURAL, N-METHYL-N-NITROSOUREA,
 RAT (5118)
 FORMATION, PARAPROTEIN PRODUCTION,
 TRANSPLANTED MOUSE PLASMACYTOMA
 CELLS, HAMSTER (5492)*
 INCIDENCE, CHILDREN, INFANTS, AUSTRIA
 (5428)*
 INTRAOCULAR MEDULLOEPITHELIOMA,
 RHABDOMYOSARCOMATOUS DIFFERENTIATION,
 CASE REPORTS (5643)*
 MALIGNANT
 CHROMOSOME ABERRATIONS, VIRAL
 ETIOLOGY, HUMAN, REVIEW (5042)
 MICROORGANISMS, REVIEW (5031)*
 SPONTANEOUS REGRESSION, CASE
 REPORTS (5379)*
 MOLONEY SARCOMA, RESORPTION, IMMUNITY,
 MOUSE (5348)
 MULTIPLE MALIGNANT, FREQUENCY
 CLINICAL STUDY (5676)*
 SALIVARY GLAND, RECURRENCE, INCIDENCE,
 HUMAN (5438)
 SPINDLE-CELL, GIANT-CELL, THYROID
 GLAND, CLINICAL STUDY (5567)*
 SPONTANEOUS, INCIDENCE, MOUSE (5593)*
 SUCCESSIVE GENERATIONS, SV40, HAMSTER
 (5242)
 TRANSPLANTABLE LYMPHOID, ANEMIA,
 CHICKEN (5519)*
 TUMOR PROMOTION
 ALCOHOLIC BEVERAGE (5180)
 TUMORAL CALCINOSIS
 INCIDENCE, UGANDA (5546)*
 TUMORIGENESIS
 FOREIGN BODY, ULTRASTRUCTURE,
 PRENEOPLASTIC TISSUE REACTIONS,
 MOUSE (5404)
 IMMUNOLOGICAL PROBLEM, REVIEW (5068)*
 ULTRASTRUCTURE
 ADAMANTINOMA, TIBIA, CASE REPORT
 (5649)*
 URANIUM
 ENVIRONMENTAL HAZARD, LANDFILL, CANCER
 MORTALITY, COLORADO (5412)
 URETER
 NEOPLASIA OF URETERAL STUMP, PARTIAL
 NEPHROURETERECTOMY, CASE REPORT
 (5661)*
 URETHANE
 MACROMOLECULAR INTERACTIONS, LUNG AND
 LIVER TISSUES, MOUSE (5114)
 OVULATION, RAT (5196)*
 UPTAKE, CATABOLISM, MOUSE, PEROMYSCUS
 LEUCOPUS (5115)
 URINE

CYTOLOGY, PRIMARY CARCINOMA OF RENAL
 PELVIS AND URETER, HUMAN (5553)*
 UTERUS
 ADENOCARCINOMA, 7,12-DIMETHYLBENZ(A)-
 ANTHRACENE, RAT (5086)
 LEIOMYOBlastoma, CASE REPORT (5595)*
 LEIOMYOMATA, ASCITES AND HYDROTHORAX-
 ASSOCIATED, CASE REPORT (5021)*
 MESODERMAL MIXED TUMOR, CYTOLOGY,
 HISTOLOGY, ULTRASTRUCTURE, HUMAN
 (5463)*
 MYOMA, HORMONAL FACTORS, HUMAN (5048)*
 TUMORS, HUMAN, REVIEW (5036)*
 UVEA
 ADENOID CYSTIC CARCINOMA, CASE
 REPORTS (5663)*
 CARCINOMA
 INCIDENCE, GERMANY, REVIEW (5065)*
 PROTEIN STRUCTURE, IMMUNOLOGY,
 HUMAN (5295)
 PRECANCEROUS CHANGES, HUMAN, REVIEW
 (5058)*
 VAGINA
 CANCER, STILBESTROL, HUMAN, REVIEW
 (5039)*
 CARCINOMA IN SITU, HYSTERECTOMY, HUMAN
 (5482)*
 VIRUS
 ADENO 12, N,N'-DIMETHYLNITROSOUREA,
 CRANIAL TUMOR, MOUSE (5252)
 ADENOVIRUS, TRANSFORMATION, HORMONAL
 MODIFICATION, HAMSTER CELLS (5267)
 AVIAN LEUKOSIS, ANTIGEN TYPE SPECIFIC-
 ITY, CHICKEN CELL (5357)
 AVIAN MYELOBLASTOSIS
 RNA-DNA LINKAGE, DNA POLYMERASE
 (5219)
 VIRUS-SPECIFIC RNA, TISSUE DISTRI-
 BUTION, CHICKEN (5215)
 AVIAN ONCORNAVIRUS
 DNA POLYMERASE
 MONOSPECIFIC ANTISERUM (5214)
 SEROLOGIC ANALYSIS (5234)
 BOVINE ADENOVIRUS TYPE-3, TUMOR
 GROWTH, HAMSTER (5280)*
 BOVINE PAPILLOMA, BRAIN TUMOR, HAMSTER
 (5237)
 BREAST CARCINOMA, HUMAN, REVIEW
 (5040)*
 C-TYPE
 LYMPHOID CELL LINE, MOUSE (5308)
 LYMPHOSARCOMA
 GIBBON (5264)
 TRANSFER, COW, SHEEP (5236)
 PARTICLES, ONCORNA, MORPHOGENESIS,
 ULTRASTRUCTURE (5280)*
 REPLICATION, GROUP-SPECIFIC
 ANTIGEN, LIFE SPAN, MOUSE (5331)
 RNA, ACTIVATION, HORMONE, UTERUS,
 MOUSE (5256)
 CANCER, HUMAN, REVIEW (5071)*
 CONTAMINATION, LEUKEMIA VIRUSES,
 TRANSPLANTABLE TUMORS, MOUSE (5283)*
 CYTOPLASMIC POLYHEDROSIS
 POLYPEPTIDE COMPOSITION, ULTRA-
 STRUCTURE (5213)
 RNA, 3' TERMINUS (5217)
 EPSTEIN-BARR
 ANTIGEN, INFECTIOUS MONONUCLEOSIS,
 ACUTE LYMPHOCYTIC LEUKEMIA,
 HUMAN (5402)
 BURKITT'S LYMPHOMA, REVIEW (5041)*
 DNA, TUMOR CELLS, HUMAN (5225)
 FELINE LEUKEMIA
 MURINE LEUKEMIA, PROTEIN ASSAY
 (5358)
 RNA, NUCLEOTIDE COMPOSITION,
 CAT, HUMAN (5247)
 FRIEND AND RILEY, CONTACT SENSITIVITY,
 IMMUNODEPRESSION, MOUSE (5375)*
 FRIEND LEUKEMIA, RESISTANCE, IMMUNO-
 SUPPRESSION, MOUSE (5352)
 GRAFFI LEUKEMIA, IMMUNODEPRESSIVE
 EFFECT, MOUSE (5322)
 VIRUS - CONTINUED
 HAMSTER SARCOMA, MORPHOLOGY, TPETA
 PARTICLES (5256)
 HERPES, REPLICATION, RENAL ADENO-
 CARCINOMA, FROG (5238)
 HERPES TYPE, RENAL ADENOCARCINOMA,
 FROG (5218)
 HERPESVIRUS, REPLICATION, TURKEY
 (5284)*
 HERPESVIRUS SAIMIRI, INTRACELLULAR AND
 MEMBRANE ANTIGENS, IMMUNO-
 FLUORESCENCE, MONKEY (5345)
 HUMAN ADENOVIRUS TYPE 12, UNDIFFERENT-
 IATED INTRAPERITONEAL TUMORS,
 HAMSTER (5287)*
 INFLUENZA, LUNG CARCINOMA INDUCTION,
 DIETHYLNITROSAMINE, MOUSE (5079)
 LEUKEMIA, INFECTION, TRANSPLANT
 RESISTANCE, MOUSE (5309)
 LEUKEMIA-LIKE
 CYTOLOGY, HUMAN (5289)*
 HEMOCYTOBLASTOSIS, SKIN TUMOR,
 HAMSTER (5208)
 MAMMARY CARCINOGENESIS, REVIEW (5015)
 MAMMARY TUMOR
 BREAST CANCER

- IMMUNOLOGICAL REACTION, HUMAN (5305)
MOUSE (5211)
MARER'S DISEASE
COURSE OF INFECTION, TISSUES, CHICKEN (5273)
PATHOGENICITY, MARMOSET MONKEYS (5262)*
MOLONEY LEUKEMIA, REPLICATION, HUMAN CELL, MOUSE HYBRID (5245)
MOLONEY SARCOMA
RESISTANCE, MOUSE (5209)
TUMOR RESORPTION, IMMUNITY, MOUSE (5348)
MOUSE MAMMARY TUMOR, MOUSE LEUKEMIA, ANTIGENIC RELATIONS, MOUSE (5212)
MURINE LEUKEMIA
GENE MAPPING, MOUSE (5258)
GIX ANTIGEN EXPRESSION, GENE, MOUSE (5336)
SPONTANEOUS NEOPLASTIC TRANSFORMATION, SERUM FRACTIONS, MOUSE (5265)
MURINE SARCOMA
OSTEOSARCOMA INDUCTION, VIRUS-PERSISTENT CELL LINE, RAT (5204)
70S RNA, 3' TERMINUS IDENTIFICATION (5281)*
TEMPERATURE-SENSITIVE MUTANT, ISOLATION (5232)
TUMOR INDUCTION, NUCLEOTIDE, MOUSE (5223)
MURINE SARCOMA-LEUKEMIA, POLYPEPTIDE SYNTHESIS, IMMUNOLOGICAL STUDIES, RAT CELLS (5347)
NEOPLASIA, HUMAN, REVIEW (5052)*
ONCOGENIC
DNA, CELL TRANSFORMATION, REVIEW (5030)*
REVIEW (5004)
ONCORNIA, CHICKEN, REVIEW (5035)*
PARTICLE, MALIGNANT MELANOMA, HUMAN (5224)
VIRUS - CONTINUED
POLYOMA
ANTIBODY RESPONSE, HAMSTER (5260)
T ANTIGEN SYNTHESIS, GLYCOLYTIC ENZYMES, HAMSTER, MOUSE (5225)
DISRUPTION, PROTEIN STRUCTURE (5275)
INFECTION, VIRUS PRODUCTION TIME COURSE, MOUSE (5261)
MUTANTS, REVIEW (5026)
ONCOGENIC ACTIVITY, RAT (5266)
REVERSION, DNA COPYING, HAMSTER (5222)
ROUS SARCOMA, NUCLEIC ACID METABOLISM, EMBRYO CELL CULTURES, MOUSE, CHICKEN (5274)
R TYPE PARTICLE, POLYOMA, TRANSFORMED CELL, HAMSTER (5246)
RADIO-LEUKOSIS, LEUKEMOGENESIS, MOUSE (5276)
RAUSCHER, ULTRASTRUCTURE, SPLEEN, MOUSE (5203)
RAUSCHER LEUKEMIA
DNA POLYMERASE, REVERSIBLE INACTIVATION (5257)
NUCLEIC ACIDS, MOUSE (5210)
TRANSPLANTABLE COLONY-FORMING UNITS, SPLEEN, MOUSE (5285)*
REOVIRUS
POLYPEPTIDE COMPOSITION, ULTRA-STRUCTURE (5213)
RNA, 3' TERMINUS (5217)
RETICULUM CELL SARCOMA
IMMUNOLOGICAL INDUCTION, MOUSE (5228), (5246)
RNA ONCOGENIC, MALIGNANT TRANSFORMATION, REVIEW (5028)
ROUS-ASSOCIATED, DNA POLYMERASE, INFECTED CELL, CHICKEN (5220)
ROUS SARCOMA
ALPHA DNA POLYMERASE DEFICIENCY (5233)
BRAIN TUMOR, RAT (5277)
GENOME EXPRESSION, MOUSE (5244)
MURINE C-TYPE, PARTICLE PRODUCTION, MOUSE (5253)
MUTANTS, REVIEW (5003)
REVERSE TRANSCRIPTASE INDUCTION, ARGININE DEPRIVATION (5262)
RNA SEQUENCE, CELLULAR DNA, CHICKEN (5226)
RNA SUBUNIT, DNA POLYMERASE TEMPLATE (5207)
SARCOMA, CHROMOSOME, SEQUENTIAL CHANGE, RAT (5221)
THYMECTOMY, CELL-MEDIATED IMMUNITY RAT (5324)
TRANSFORMED CELL, PHOSPHOLIPID, ACYL GROUP CHANGE, CHICKEN (5248)
TUMOR GROWTH, BURSECTOMY, HYPO-GAMMAGLOBULINEMIA, CHICKEN (5239)
SHOPE FIBROMA, DNA SIZE (5241)
SHOPE PAPILLOMA, RABBIT KIDNEY VACUOLATING, SPONTANEOUS PAPILLOMA, RABBIT (5259)

SIMIAN ADENO 7, RNA, TRANSFORMED CELL,
HAMSTER (5251)
IRUS - CONTINUED
SV40

ANTIGEN, TRANSFORMED CELL, MONKEY
(5333)

S ANTIGEN, HAMSTER (5329)

DNA HYBRIDIZATION, RNA (5235)

DNA REPLICATION, MOLECULAR ORIGIN
(5231)

DNA SYNTHESIS

GEL ELECTROPHORESIS ANALYSIS
(5227)

TEMPERATURE-SENSITIVE MUTANT
(5216)

INFECTED CELL, PROTEIN SYNTHESIS,
MONKEY (5263)

RECOVERY FROM TRANSFORMED CELLS,
INFECTIOUS DNA, MONKEY (5206)

REPLICATING DNA (5243)

REPRESSION, INDUCTION, MONKEY CELL
(5205)

STRUCTURAL PROTEIN, PHOSPHOPRO-
TEINS (5230)

TRANSFORMATION, NEOANTIGENS,
FIBROSARCOMA CELLS, HAMSTER
(5349)

TUMOR, GENERATIONS, HAMSTER (5242)

TUMOR ANTIGEN, TUMOR IMPRINT TEST,
HAMSTER (5321)

TUMOR

HUMAN, ANIMAL, REVIEW (5046)*

SV40, BASIC RESEARCH, REVIEW
(5051)*

TURKEY HERPESVIRUS

COURSE OF INFECTION, TISSUES,
CHICKEN (5273)

PATHOGENICITY, MARMOSSET MONKEYS
(5282)*

VIRUS-LIKE PARTICLES, OOGONIA, OOCYTES

GUINEA PIG (5268)

WOUND TUMOR

GROWTH (5249)

POLYPEPTIDE COMPOSITION, ULTRA-
STRUCTURE (5213)

RNA, 3' TERMINUS (5217)

VITAMIN B12

20-METHYLCHOLANTHRENE CARCINOGENESIS,

ADRENAL CORTEX FUNCTION, MOUSE

(5185)*

VA

BIZARRE LEIOMYOMA, CASE REPORT (5682)*

HEMANGIOPERICYTOMA, METASTASIS TO BLADDER

CASE REPORT (5542)*

HYDRAIDENOMA PAPILLIFERUM, ULTRA-

STRUCTURE, HUMAN (5592)*
MELANOMA, CLINICAL STUDY (5483)*
WALDENSTROM'S DISEASE
BETA 1 A/C CONCENTRATION, SERUM, HUMAN
(5354)

WILSON'S TUMOR

ABDOMINAL TUMORS, CLINICAL STUDY,
CHILDREN (5449)

MYOGENESIS, ULTRASTRUCTURE, CASE
REPORT (5485)*

ZINC

CONTENT, AVIAN LEUKOSIS COMPLEX,
TISSUES, FOWL (5527)*

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Editor

Robert Love, M.D.
Jefferson Medical College, Philadelphia

Associate Editor

George P. Studzinski, M.D.
Jefferson Medical College, Philadelphia

NCI Staff Consultants

Elizabeth Weisburger, Ph.D.
Sidney Siegel, Ph.D.
Louis P. Greenburg, M.S.

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PREFACE

Carcinogenesis Abstracts is a publication of the National Cancer Institute. The journal serves as a vehicle through which current documentation of carcinogenesis research highlights are compiled, condensed, and disseminated on a regular basis. It represents an integral part of the Institute's program of fostering and supporting coordinated research into cancer etiology. Issues of *Carcinogenesis Abstracts* normally contain three-hundred-fifty abstracts and three-hundred-fifty citations (unaccompanied by corresponding abstracts). Abstracts and citations refer to the current scientific literature that describes the most significant carcinogenesis research carried on at the National Cancer Institute, other governmental agencies, and private institutions. *Carcinogenesis Abstracts* is intended to be a highly useful current awareness tool for scientists engaged in carcinogenesis research or related areas. The great number and diversity of publications relevant to carcinogenesis make imperative the availability of this service to investigators whose work requires that they keep abreast with current developments in the field.

Carcinogenesis Abstracts is normally published monthly. Volume X covers the scientific literature published from July 1971 through Dec 1972. A cumulative subject and author index for Volume X will be published shortly after the final regular issue. This journal is available free of charge to libraries and to individuals who have a professional interest in carcinogenesis. Requests for *Carcinogenesis Abstracts* from qualified individuals should include statements of their relationship to carcinogenesis research. All correspondence should be addressed as follows.

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NOTE

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LANGUAGE ABBREVIATIONS

Afr.	Afrikaans	It.	Italian
Ar.	Arabic	Jap.	Japanese
Bul.	Bulgarian	Kor.	Korean
Ch.	Chinese	Latv.	Latvian
Cz.	Czech	Lith.	Lithuanian
Dan.	Danish	Nor.	Norwegian
Dut.	Dutch	Pol.	Polish
E.	English	Por.	Portuguese
Eston.	Estonian	Rum.	Rumanian
Fin.	Finnish	Rus.	Russian
Fl.	Flemish	Ser.	Serbo-Croatian
Fr.	French	Sl.	Slovak
Ger.	German	Sp.	Spanish
Gr.	Greek	Sw.	Swedish
Heb.	Hebrew	Th.	Thai
Hun.	Hungarian	Turk.	Turkish
Ic.	Icelandic	Uk.	Ukrainian
In.	Indonesian	Viet.	Vietnamese

ABBREVIATIONS USED IN ABSTRACTS

ACTH	adrenocorticotrophic hormone	mg	milligram(s)
ADP	adenosine diphosphate	min	minute(s)
AMP	adenosine monophosphate	ml	milliliter(s)
ATP	adenosine triphosphate	mm	millimeter(s)
C	degrees centigrade	MTD	maximum tolerated dose
cm	centimeter(s)	ng	nanogram (10 ⁻⁹)
CNS	central nervous system	pg	picogram (10 ⁻¹²)
cpm	counts per minute	p.O.	orally
DNA	deoxyribonucleic acid	ppm	parts per million
e.g.	for example	r	Roentgen
g	gram(s)	RBC	red blood cells (erythrocytes), red blood count
µg	microgram(s)	resp.	respectively
hr	hour(s)	Rev.	review (only in citations)
i.m.	intramuscular	RNA	ribonucleic acid
i.p.	intraperitoneal	s.c.	subcutaneous
IU	international unit(s)	sec	second(s)
i.v.	intravenous	U	unit(s)
kg	kilogram(s)	UV	ultraviolet
LD ₅₀	median lethal dose(s)	WBC	white blood cells (leukocytes), white blood count
m	meter(s)	wk	week(s)
M	molar	wt	weight
mEq	milliequivalent(s)	yr	year(s)
mM	millimolar		
µM	micromolar		
mC, µC	milli-,microcurie(s)		

	Cross Reference Abbreviations	Abstracts, Citations	Page
REVIEW.....	(Rev).....	5701-5761	899
CHEMICAL CARCINOGENESIS.....	(Chem).....	5762-5860	905
PHYSICAL CARCINOGENESIS.....	(Phys).....	5861-5875	920
VIRAL CARCINOGENESIS.....	(Viral).....	5876-5956	922
IMMUNOLOGY.....	(Immun).....	5957-6050	936
PATHOGENESIS.....	(Path).....	6051-6072	946
EPIDEMIOLOGY AND BIOMETRY.....	(Epid-Biom).....	6073-6107	948
MISCELLANEOUS.....	(Misc).....	6108-6400	953
AUTHOR INDEX.....			i
SUBJECT INDEX.....			xix

- 5701 HORMONE-ACTIVE TUMORS. (Ger.) Siegenthaler, W. (Bonn, West Germany), K. G. Zimmermann and G. Siegenthaler. *Langenbecks Arch Chir* 329:407-425, 1971.

Hormone-producing tumors can occur in endocrine and nonendocrine tissues. In endocrine organs, tumor-induced hormone production is characterized as *orthotopic* or *dystopic*, according to whether the tumor has invaded the endocrine structure of the gland itself or is found in hormone-active tissue dispersed from the parent organ. *Superimposed* hormone formation refers to increased release of glandotropic hormones due to tumor growth in the pituitary gland region. Ectopic hormone formation describes the secretion of hormones or substances with hormone-like effects by tumors in nonendocrine organs. The following tumor-induced hormones are discussed: antidiuretic, somatotrophic, thyroid stimulating, parathormone, calcitonin, aldosterone, renin, ACTH/cortisol, catecholamines, androgens, estrogens, choriogonadotropin, insulin, glucagon, gastrin, serotonin, and erythropoietin. Each hormone is classified according to tumor location, type of hormone formation, and clinical manifestation of tumor growth. The diagnosis and treatment of hormone-active tumors requires a knowledge of their activity in the system, particularly where surgical intervention is necessary. (84 references)

- 5702 EFFECT OF TROPICAL SUNLIGHT ON DEVELOPMENT OF RODENT AND SQUAMOUS CELL CARCINOMA. (E.) Belisario, J. C. (Sydney, Australia). *Int J Dermatol* 11(3):148-155, 1972.

The relationships between sunlight, skin pigment and skin cancer, especially basal cell (rodent) and squamous carcinoma are reviewed. The number of hours of sunlight exposure is a more important factor in skin carcinogenesis than the intensity of each exposure. Damage to collagen in the dermis by the UV component of sunlight causes degeneration which affects nutrition of the skin and plays an important part in skin carcinogenesis. Fair skins are more susceptible to sunlight UV damage than are darker skins. Accordingly, skin cancer incidence is high among fair-skinned residents of tropical latitudes (e.g., Australians), while it is low among tropical Negroes. Skin cancer is mostly an accompaniment of later life, and is more common in men than women (probably because men in general are more apt to work in sunlight-exposed circumstances than women). Factors which alter the amount of UV radiation reaching the earth, including altitude, ozone and cloud cover, affect skin cancer incidence. (49 references)

- 5703 THE CARCINOGENIC ACTION OF IONIZING RADIATIONS. (Rus.) Aleksandrov, S. N. (Cent. Res. Inst. Radiol., Moscow, USSR). *Vopr Onkol* 18(7):108-117, 1972.

Ionizing radiation has mutagenic and secondary proliferative effects. The mutagenic effect involves somatic cells undergoing radiation. The secondary proliferative effect involves the skin and endocrine

glands (such as thyroid and pituitary) with potential proliferative cells, but not organs or nervous system made up of ganglionic cells. The neoplasms developing due to irradiation depend on its dose. The optimal dose for carcinogenesis due to mutagenic and proliferative effects corresponds to 1700 r. From 7000-14,000 r, sterilization of cells occurs with suppression of carcinogenesis. Radiation-induced mutagenesis can itself cause neoplastic development, as in malignant changes of myeloid elements in myeloid leukemia. In many cases, radiation-induced blastomogenesis in tissues is conditioned by a combination of the mutagenic effect of radiation and unrelated effects, as in neoplasms of repeatedly resected irradiated liver. The carcinogenic effect of penetrating radiation is increased by various carcinogens such as urethane, carbon tetrachloride (which does not cause neoplasms by itself but causes neoplasms in combination with radiation), and dimethylbenzanthracene. The carcinogenic effect of ionizing radiation is due to activation of latent viruses, according to viral carcinogenesis theories. Radiation activation of viruses is not a necessary factor in the pathogenesis of neoplasms of radiation origin. (45 references)

- 5704 BILATERAL RETINOBLASTOMA: A DOMINANTLY INHERITED AFFECTION. (E.) Sorsby, A. (Royal Coll. Surgeons, London, England). *Brit Med J* 5813:580-583, 1972.

Data on the genetic transmission of bilateral retinoblastoma is briefly reviewed. In one study, eight of 14 children born to four mothers and three fathers with retinoblastoma had retinoblastoma; seven of these eight had bilateral retinoblastoma. In another study, 20 of 39 similar offspring were affected, 17 bilaterally. Bilateral retinoblastoma may be transmitted by individuals who are phenotypically normal. Individuals with retinoblastoma in one eye, who may pass as cases of sporadic unilateral retinoblastoma, may in fact have a suppressed bilateral condition. Five to ten percent of supposed unilateral retinoblastoma cases are actually cases of incompletely expressed bilateral condition. Bilateral retinoblastoma is a dominant disorder either in transmission or as a new mutation. (10 references)

- 5705 THE FINE STRUCTURAL CHANGES IN THE BASEMENT MEMBRANE AND TUMOR CELLS OF SQUAMOUS CELL CARCINOMA IN HUMAN SKIN. (E.) Moynahan, E. J. (Guy's Hosp. Med. Sch., London, England). *Ann Ital Derm Clin Sper* 25(2):199-203, 1971.

Microscopic examinations of the basement membrane in epidermal tumors are reviewed. The basement membrane separates epidermis from subjacent dermis. In UV-induced mouse squamous cell carcinoma, the basement membrane became thicker and patchy as malignancy progressed, and disappeared entirely with frank invasive malignancy. The basement membrane was found to remain intact in patients with

Bowen's disease and in mice with malignant and benign 7,12-dimethylbenz(a)anthracene-induced tumors. In senile keratosis lesions with associated squamous cell carcinoma, the basement membrane is disrupted at the dermo-epidermal junction. The membrane may also be disrupted at the dermo-epidermal junction in invasive lesions of the Borst-Jadassohn type. (11 references)

- 5706 PUBLIC HEALTH ASPECTS OF CANCER IN PET DOGS AND CATS. (E.) Dorn, C. R. (Dept. Community Hlth., U. Missouri, Columbia) and R. Schneider. *Am J Pub Health* 62(11):1460-1462, 1972.

Epidemiological evidence for horizontal transmission of leukemia from house pets to humans is briefly reviewed. All studies but one have shown no correlation between exposure to domestic animals (including dogs and cats) and leukemia incidence. An analysis of 300 families with a leukemia case and 831 randomly selected families were investigated showed an excessive leukemia risk for children exposed to sick or dead cats: 7.3% of children under 14 yr with leukemia had been exposed to sick or dead cats compared with 4.6% of control children. (18 references)

- 5707 CELL REPLACEMENT, AGEING, AND CANCER OF THE SKIN. (E.) Bullough, W. S. (Mitosis Res. Lab., U. London, England). *Ann Ital Derm Sper* 25(2):145-156, 1972.

The mechanisms which balance cell loss and cell production in skin tissues are discussed and applications to carcinogenesis are described. It has been shown that skin cells respond to trauma with increased mitosis, because of the loss of a mitotic inhibitor, epidermal chalone. Experiments with rabbit epidermal carcinomas, some of them highly anaplastic and malignant, and with rat granulocytic leukemias, indicated that tumor cells produced chalone. Because this chalone, which is probably a protein or glycoprotein, was quickly lost in the blood, the chalone content of tumor cells contained was less than 10% of normal. In addition, it was found that injecting chalone into tumor-bearing animals often caused temporary permanent tumor regression. (No references)

- 5708 VITAMIN B₁₂ AND THE TUMOR GROWTH PROCESS. (A LITERATURE REVIEW). (Rus.) Ostryanina, A. D. (Inst. Nutr., USSR Acad. Med. Sci., Moscow). *Vopr Pitan* (3):25-31, 1972.

Vitamin B₁₂ can affect division and growth of cells. Disturbances in vitamin B₁₂ exchange lead to disturbances in all cells of humans and animals. Vitamin B₁₂ is known to have a stimulating effect on cellular proliferation and DNA synthesis. Experimental data (with mice, hamsters, and guinea

pigs) show that vitamin B₁₂ accumulation in tissues promotes growth of tumors such as sarcomas. Consumption of vitamin B₁₂ by tumor cells is accompanied by decreased vitamin B₁₂ levels in the rest of the body, with resulting hypovitaminosis. Vitamin B₁₂ also activates tumors induced by various chemical carcinogens, such as dimethyl-aminoazobenzene, 2-acetylaminofluorene, dimethyl-benzanthracene, and methylcholanthrene. The effects of vitamin B₁₂ on the growth of neoplasms depend on the strain of the tumor, method of administration of vitamin B₁₂ to the body, and dosage. Large doses of vitamin B₁₂ seem to activate the growth of transplantable tumors in animals (rats), while small doses inhibit tumor growth. (71 references)

- 5709 PLEURAL MESOTHELIOMA AND ASBESTOSIS. (Fr.) Turiaf, J. (No affiliation). *El Torax* 20(1):117-124, 1972.

Pleural mesothelioma is an exceptional variety of malignant tumor of the pleura, diagnosed by its specific localization and histopathological findings of conjunctive epithelial proliferations. The connection between this tumor and asbestosis has been confirmed by many authors. If not the actual cause of mesothelioma, asbestos certainly favors its development. Other authors argue against the role of asbestos in this etiology, but it must be realized that in many cases the cancer does not develop until long after the subject has been exposed to asbestos (even after 40 yr). The cancer develops along the same lines as primary pleural tumors and can expand to the adjacent lung, the contralateral pleura, and to other areas nearby. Distant metastases are rare, since death intervenes between 6 and 18 months after the first appearance in the pleura. The histopathological picture is the same in mesotheliomas with or without asbestosis: cancer with a double epithelial and conjunctive potentiality; glandular and adenomatous aspects; angiod and fibrosarcomatous formations. In two observations of mesothelioma with asbestosis, pulmonary fibrosis was found only histologically and not through radiological evidence. There is no causal relationship between pulmonary fibrosis and mesothelioma. The mode of intervention of asbestos in carcinogenesis is not clear, but the presence of asbestos fibrils in the cytoplasm of mesothelial cells may have some etiological significance in this disease. (45 references)

- 5710 TUMOR-SPECIFIC ANTIGEN IN GI CANCER. (E.) Gold, P. (Dept. Med., McGill U., Montreal, Quebec, Canada). *Hosp Prac* 7(2):79-88, 1972.

The present state of knowledge of carcinoembryonic antigen (CEA) is reviewed. CEA, originally thought to be confined to tumors of the colon, has been found generalized to entodermally derived digestive system epithelium. It is a tumor-specific system-specific antigen, and is also found in fetuses of less than six months gestation. This may indicate that

appearance of CEA associated with tumors represents derepression of genetic information. Anti-CEA antibodies have been found in pregnant women, in patients with localized digestive system cancer, but in patients whose digestive system tumors metastasized out of their area of origin. CEA is water- and ammonium sulfate-soluble; it has a sedimentation coefficient of 7-8S; and its component carbohydrates include L-fucose, D-mannose, D-galactose, sialic acid and N-acetyl-D-glucosamine. (6 references)

11 AN IMMUNOSTIMULATION THEORY OF TUMOR DEVELOPMENT. (E.) Prehn, R. T. (Inst. Cancer Res., Philadelphia, Pa.) and M. A. Lappe. *Transplant Rev* 7:26-54, 1971.

Evidence suggesting that a low level of immune activity can stimulate rather than retard tumor growth is reviewed. The evidence is divided into three parts: (1) the role of the lymphoreticular system and immune reactivity in pregnancy; (2) lymphoid activity in relation to normal tissue development, regeneration, and grafting; and (3) evidence derived directly from oncogeny and tumor transplantation experiments. If, as a number of studies suggest, low levels of histo-incompatibility and immune reactivity facilitate fetal growth and survival, such conditions can reasonably be expected to facilitate tumor growth as well. Data on lymphoid and/or immune stimulation of normal tissues are in accord with an immunostimulation theory of tumor development. Direct support for the theory is provided by a 1964 study showing that allogeneic tumors grew better when exposed to weekly sensitized lymphocytes than when exposed to unsensitized lymphocytes. (160 references)

12 THE IMMUNOBIOLOGY OF HUMAN MALIGNANT DISEASE. (E.) Ritz, R. G. (Chicago Med Sch., Illinois). *Chicago Med Sch Quart* (1-4):40-44, 1972.

The current status of tumor immunology has its foundation in the vast amount of animal studies which have been conducted within the past 20 yr. From these studies and from numerous clinical observations, the concept of host-tumor interaction is evolved. Whereas antibody production is usually normal in cancer patients, their cell-mediated immunity seems to be impaired. The ability of cancer patients to manifest a delayed hypersensitivity response has been correlated with prognosis. Specific anti-tumor antibodies have been demonstrated in sera of patients with Burkitt lymphoma, malignant melanoma, and osteosarcoma. In addition, a specific tumor-associated antigen (carcinoembryonic antigen) is shown to be present in all human tumors derived from the endothelium of the gastrointestinal tract, and it was shown that all patients with localized cancers of this type produced antibodies against the antigen. Patients with metastatic gastrointestinal cancers lost their ability to

produce antibody. A similar fetal alpha globulin was detected in the blood of 70% of all patients tested who had primary hepatoma. Recent experiments have shown a common fetal antigen to be present in a wide variety of human neoplasms and in fetal tissues, but not in a large number of normal subjects. In some cases, however, the host response may be unable to eradicate the tumor cells since tumor antigen may be masked by antitumor antibody. The defective cell-mediated immunity seen in patients with advanced malignancies could be due either to a depletion of sensitized lymphocytes by the tumor mass or to production of a tumor- or host-directed substance which actually prevents the immune response. (26 references)

5713 ROLE OF HERPESVIRUSES IN MALIGNANT LYMPHOMA IN RABBITS. (E.) Hinze, H. C. (Dept. Med. Microbiol., U. Wisconsin, Madison) and P. J. Chipman. *Fed Proc* 31(6):1639-1642, 1972.

Herpesvirus sylvilagus, an indigenous virus of cottontail rabbits, produces a lymphoproliferative disease which varies in intensity from benign hyperplasia to apparent malignant lymphoma. Virus may be recovered from the cellular portion of the blood as well as from organs showing infiltration with immature, proliferating lymphoid cells. Fluorescent antibody staining, however, shows viral antigen only in a few small foci of cells scattered throughout the spleen and lymph nodes. The possibility is suggested that viral genome may persist in the abnormal lymphocytes without undergoing a complete cycle of virus replication. (11 references)

5714 ROLE OF HERPESVIRUS IN MAREK'S DISEASE, A MALIGNANT LYMPHOMA OF CHICKENS. (E.) Purchase, H. G. (Region Poultry Res. Lab., U.S. Dept. Agriculture, East Lansing, Michigan). *Fed Proc* 31(6):1634-1638, 1972.

Marek's disease was for years the most important cause of economic loss to the poultry industry. This highly infectious disease is characterized by lymphoid infiltration and uncontrolled proliferation in the nerves and visceral organs resulting in paralysis and tumor formation. It can be transmitted readily to genetically susceptible 1-day-old chickens with intact blood or tumor cells. A herpesvirus was isolated in cell culture and later was shown to be the cause of Marek's disease. The virus is highly cell-associated in the tissues and tumors of infected birds and in cell cultures. The feather follicle epithelium is the only location in the body where the virus becomes enveloped. From there it is shed into the environment accounting for the highly infectious nature of the disease. The virus is not transmitted congenitally. Some degree of control has been attained by breeding chickens for resistance to Marek's disease. Eradication of the disease has been possible on a limited scale by rearing chickens in isolation in houses supplied with biologically filtered air.

Several vaccines derived from Marek's disease virus or from a related virus of turkeys have been applied commercially with great success. This was the first neoplastic condition shown unequivocally to be caused by a herpesvirus and the first naturally occurring neoplasm for which a commercially applicable vaccine was developed. (38 references)

- 5715 POSSIBLE ROLE OF *HERPESVIRUS HOMINIS*, TYPE 2, IN HUMAN CERVICAL CANCER. (E.) Aurelian, L. (Johns Hopkins Sch. Med., Baltimore, Md.). *Fed Proc* 31(6):1651-1659, 1972.

Herpesvirus type 2 (HSV-2) has been associated with squamous cancer of the human cervix on the basis of sero-epidemiologic data. Similar studies designed to differentiate between three possible interpretations of this association are described. A herpesvirus, isolated from degenerated cervical tumor cells grown *in vitro* is identified as a type 2 on the basis of biologic and immunologic properties. Herpesvirus antigens and virus are not seen in duplicate cultures of viable cervical tumor cells. HSV-2 antigens are revealed by immunofluorescent techniques in exfoliated, but not in biopsied tumor cells from patients with the disease. The results are discussed in terms of the virus-host cells interaction; it appears that tumor cells harbor the viral genome in a repressed state. Exposure of the cells to high pH induces virus expression. (49 references)

- 5716 FETAL MOLECULAR FORMS OF ENZYMES IN HEPATOMA. (Fr.) Schapira, F. (Inst. Molec. Path., Paris, France) and A. Hatzfeld. *Biochimie* 54(5-6):695-700, 1972.

The fetal pattern of enzymes in certain cancerous tissues is reviewed. The resurgence in hepatoma of two aldolases of the fetal type was demonstrated by the determination of their relative activities with respect to fructose-1-phosphate (FIP) and to fructose-1,6-diphosphate (FDP). The ratio FDP/FIP is above 50 for aldolase A (muscle type), is equal to 1 for aldolase B (liver type) and is between 5 and 10 for type C (brain type). In fetal rat liver the ratio was about 6 on the 15th day of fetal life and decreased to less than 1.5 on the 21st day; in normal rat (or human) liver, this ratio was constant and very close to 1. In human fetal liver this ratio was about 2.0 between the 4th and 6th month and about 3.0 in the second month of gestation. The aldolase activity was moderately increased (1.2-3.0) in primary slow-growing hepatomas, but was extremely high in fast-growing hepatomas. Electrophoresis indicated that changes in the specificity of the aldolase in hepatomas were due to isozymes of muscle type aldolase in slow-growing and to isozymes of the brain type in fast-growing hepatomas. In the fetal liver, all three aldolases are present: aldolase B is hybridized with aldolase A and anodic isozymes are seen which resemble those of brain aldolase. In primary or transplanted slow-growing

hepatomas, the presence of aldolase A hybridized with aldolase B was confirmed, but no anodic isozymes were found. These were, however, clearly seen in fast-growing hepatomas and their migration was identical with those of brain aldolase isozymes. Immunological studies confirmed that slow-growing hepatomas contained a large quantity of aldolase A, whereas fast-growing hepatomas contained both muscle and brain types and very little hepatic aldolase B (less than 5%). It is suggested that in pathological conditions, particularly in carcinogenesis, the biosynthesis of the molecular enzymatic form is repressed, whereas the fetal form is not repressed. (43 references)

- 5717 CELLULAR DNA REPLICATION IN VIRAL INFECTION. (E.) Engsminger, W. D. (No affiliation) and I. Tamm. *Path Ann* 1:33-61, 1971.

The ability of different RNA- or DNA-containing viruses to inhibit cellular DNA replication is reviewed. Although appearing to multiply entirely in the cytoplasm, RNA viruses such as Newcastle disease virus (NDV), mengovirus, and reovirus profoundly affect cellular DNA replication. NDV and mengovirus infection also inhibit cellular RNA and protein synthesis, depression of cellular RNA synthesis by mengovirus occurring only after virus growth is complete. Results obtained with chemical inhibitors of protein synthesis strongly support the possibility that NDV and mengovirus inhibit cellular DNA synthesis secondary to inhibition of cellular protein synthesis. Inhibition of cellular DNA synthesis by reovirus is probably a direct effect of viral infection; it occurs in the absence of effects on cellular RNA or protein synthesis. It is unlikely that inhibition of cellular DNA synthesis by these viruses involves precursor depletion or interference with DNA polymerase and polynucleotide ligase. The inhibition probably results from a reduction in the number of active chromosomal sites of DNA replication in infected cells. Autoradiographic analysis of DNA replication in virus-infected cells showed that the length of the linearly arrayed segments of DNA synthesized in a 30-min period was equal to that in uninfected cells even when synthesis in infected cells was 70% inhibited. (90 references)

- 5718 GONADOBlastomas AND Tumors OF THE Gonadic PRIMORDIUM. (Fr.) Cabanne, F. (Georges-François Leclerc Ctr. Dijon, France). *Ann Anat Path (Paris)* 16(4):387-404, 1971. (49 references)

- 5719 FORMAL PATHOGENESIS OF EXPERIMENTALLY INDUCED BRAIN TUMORS. (Ger.) Mennel, H. D. (Max Planck Inst. Brain Res., Cologne, West Germany) and K. J. Zulch. *Acta Neuropathol (Berl)* 21:140-153, 1972. (28 references)

- 5720 SOME STUDIES AND COMMENTS ON HEPATIC AND EXTRAHEPATIC MICROSOMAL TOXICATION-DETOXICATION SYSTEMS. (E.) Fouts, J. R. (Natl.

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725 BLADDER CANCER AND SMOKING. (E.) Anony-
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 (E.) Walford, R. L. (Sch. Med., U. California,
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729 THE CHANGING PICTURE IN PRIMARY CARCINOMA
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730 CLEAR-CELL HYDRADENOMA. (Rus.)
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5739 SMOOTH-MUSCLE AUTOANTIBODIES, VIRAL INFEC-
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5744 CONTRIBUTIONS TO THE BIOCHEMICAL PATHOGENESIS AND MOLECULAR BIOLOGY OF CANCER. (E.) Valladares, Y. (Natl. Inst. Oncology, City U., Madrid, Spain). *Rev Esp Oncol* 17(2):65-97, 1970. (87 references)

5745 IMMUNOREGULATION, ONCOGENIC VIRUSES, AND MALIGNANT LYMPHOMAS. (E.) Schwartz, R. S. (New England Med. Ctr. Hosp., Boston, Mass.). *Lancet* (7763):1266-1269, 1972. (42 references)

5746 THE ETIOLOGY, EPIDEMIOLOGY AND PATHOLOGY OF LEUKEMIA. (Rus.) Khokhlova, M. P. (Central Inst. Hematol. Blood Transf., USSR Pub. Hlth. Min., Moscow). *Ark Patol* 34(3):3-14, 1972. (133 references)

5747 FROM MEDULLOID CANCER WITH AMYLOID STROMA TO UNKNOWN FORMS OF CALCITONIN-SECRETING TUMORS OF THE THYROID. (Fr.) Gilbert-Dreyfus (Compassion Hosp., Paris, France) and G. Schaison. *Bull Acad Natl Med* 156(2):42-46, 1972. (6 references)

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5749 ULTRASTRUCTURE OF AVIAN SARCOMA VIRUS TRANSFORMED AVIAN AND MAMMALIAN CELLS. (E.) Gazzolo, L. (Virology Unit I.N.S.E.R.M., Lyon, France). *Neoplasma* 19(5):413-436, 1972. (72 references)

5750 THE IMPACT OF MODERN TECHNOLOGY ON THE ENVIRONMENT. THE PROBLEM OF OIL MIST POLLUTION IN FACTORIES. (E.) Lywood, J. G. (Hoccom Developments Ltd., Stanmore Ind. Estate, Bridgnorth, Shropshire, England). *Plant Eng* 16(12):19-28, 1972. (No references)

5751 ONCOGENESIS AND A GENERAL CLASSIFICATION OF NEOPLASTIC PROCESSES. (Rus.) Sokolovskiy, R. M. (No affiliation) and N. I.

Vol'fson. *Vop Onkol* 18(9):106-110; 1972. (24 references)

5752 THE BIOLOGY OF NEOPLASTIC PROCESSES. (Rus.) Sokolovskiy, R. M. (No affiliation). *Vop Onkol* 18(9):102-106; 1972. (10 references)

5753 TUMOR VIRUSES AND CARCINOGENESIS. (Ger.) Sauer, G. (German Cancer Res. Ctr. Heidelberg, W. Germany). *Umschau* 72(22):717-720, 1972. (9 references)

5754 CONSIDERATIONS ON THE SMOKING OF MEAT PRODUCTS. (Fr.) Lenges, J. (Food Technology Service, Brussels, Belgium). *Rev Ferment Ind Aliment* 27(2):53-60, 1972. (33 references)

5755 MALIGNANT MELANOMA IN QUEENSLAND. A REVIEW OF 133 CASES. (E.) Berry, C. G. (Queensland Med. Lab., Brisbane, Australia) and A. Firouz-Abadi. *Acta Med Iran* 14(2):45-64, 1971. (31 references)

5756 PROLIFERATIVE PROPERTIES OF MAMMALIAN CELL SYSTEMS AND THEIR IMPORTANCE FOR TUMOR GROWTH AND CARCINOGENESIS. (Ger.) Rajewsky, M. F. (Tübingen, W. Germany). *11th Meeting German Cancer Assoc Hannover (Sept):*73-74, 1971. (No references)

5757 VIRAL GENOME AND CARCINOGENESIS. (Ger.) Sauer, G. (Heidelberg, W. Germany). *11th Meeting German Cancer Assoc Hannover (Sept):*70-71, 1971. (No references)

5758 TOPICAL ASPECTS OF CARCINOGENESIS. (Ger.) Hecker, E. (Heidelberg, W. Germany). *11th Meeting German Cancer Assoc Hannover (Sept):*69-70, 1971. (No references)

5759 IMMUNOLOGICAL ASPECTS OF GESTATIONAL CHORIOCARCINOMA AND INVASIVE MOLE. (E.) Mogensen, B. (Aarhus, W. Germany). *11th Meeting German Cancer Assoc Hannover (Sept):*5-6, 1971. (No references)

5760 THE ROLE OF THE HL-A-ANTIGEN SYSTEM IN CANCER RESEARCH. (Ger.) Kuwert, E. (Essen, W. Germany) and J. Bertrams. *11th Meeting German Cancer Assoc Hannover (Sept):*3-5, 1971. (No references)

5761 IMMUNE SUPPRESSION, TUMORIGENESIS, AND TUMOR GROWTH. (Ger.) Reis, H. E. (Essen, W. Germany). *11th Meeting German Cancer Assoc Hannover (Sept):*1-3, 1971. (No references)

62 LEUKEMIA EVOKED WITH 7,8,12-TRIMETHYLBENZ(A)-ANTHRACENE IN RAT. 1. CHANGES IN SPLEEN AND LYMPH. (E.) Bird, C. (Ben May Lab., U. Chicago, Ill.) and C. Huggins. *J Exp Med* 134(5):1285-1297, 1971.

Leukemia was evoked in a group of 12 male rats with four or five i.v. pulse-doses of 7,8,12-trimethylbenz(a)anthracene (7,8,12-TMBA), 30-35 mg/kg, at 10-day intervals beginning at age 28 days. The first evidence of leukemia was nodule formation in the spleen. Subsequently, the red pulp of the spleen was massively infiltrated with leukemic stem cells but malpighian corpuscles were not involved. The leukemic stem cells consisted of large mononuclear cells with vesicular nuclei, one or several prominent dark nucleoli, and variable amounts of basophilic cytoplasm; they were usually mixed with erythroblasts. Enzyme levels were determined in the spleens of 12 leukemic male rats age 82-145 days and ten untreated male controls of comparable age. In the spleens of the normal adult male rat, the activity of malate dehydrogenase (MDH) exceeded that of lactate dehydrogenase (LDH). In leukemic rats, LDH activity in the spleen was increased while MDH activity was reduced. Acid phosphatase activity in the spleen was significantly reduced in leukemia whereas alkaline phosphatase was increased. The initial effects of i.v. pulse doses of 7,8,12-TMBA, 30-35 mg/kg at 10-day intervals were followed in 36 male rats, eight of which were sacrificed three days after each pulse. The pulse doses markedly affected normal growth of spleen and thymus; however, only minimal changes occurred in the activity of critical enzymes measured after each dose of hydrocarbon.

763 MORPHOLOGY OF EXPERIMENTALLY INDUCED TUMORS OF THE SKIN IN THE RAT AND IN THE HAIRLESS MOUSE. (Ger.) Lau, M. (Path. Inst., U. Freiburg, West Germany), R. Rohrbach and C. Thomas. *Beitr Pathol* 146:33-54, 1972.

Diazo-acetic ester was used to induce skin tumors in rats (i.v.) and mice (i.p.) and these tumors were examined morphologically and compared with N-nitroso-compound induced tumors referred to in a previous experiment. The rats received weekly injections of 25 or 50 mg/kg diazo-acetic ester, in aqueous solution. The mice received semiweekly injections of 125 mg/kg of the carcinogen. Of 18 rats thus treated, 12 revealed tumors. The tumors were predominantly located in skin of the dorsal area and occasionally in the vicinity of the tail. They were epithelial tumors, squamous cell carcinomas and basal cell carcinomas. Among the premalignant changes, hyperplasias and papillomas of the epidermis, squamous epithelial cysts and sebaceous gland hyperplasias or adenomas were in the process of development. Of 40 mice, 12 died prematurely of pneumonia and the other 28 all developed skin tumors which were mainly papillomas and carcinomas, with one tumor resembling a basal cell carcinoma. The histological findings were about the same as those in the rat. These experimentally induced tumors are attributed to the absorptive action of

diazo-acetic ester, the tumors developing from epidermal cells or skin appendages. Exogenous carcinogens in the etiology of human tumors are discussed and the experimentally induced basal cell carcinoma is compared with the nodular ulcerative form of the human tumor.

5764 PROGRESSION IN MOUSE TUMORS INDUCED BY BP: CYTOGENETIC INVESTIGATIONS OF TUMORS, EXPERIMENTALLY INDUCED AND TRANSPLANTED METASTASES AND OF CELL LINES *IN VITRO*. (Ger.) Saul, G. (Inst. Cancer Res., German Acad. Sci., Berlin, East Germany) and R. Widmaier. *Arch Geschwulstforsch* 39(1):24-39, 1972.

Chromosome analyses were performed on monolayer cultures of six mouse primary tumors (PT) induced by s.c. injection of 1 mg benzo(a)pyrene, three primary metastases (PM) developing after i.v. injection of PT cells, and seven transplanted tumor metastases (TM). While *in vivo* tumor cell growth rate increased from PT to TM, *in vitro* growth rate decreased with tumor progression. Aneuploid and hyperdiploid cells were frequent in PTs. Hypotetraploid and tetraploid cells were also observed. The PT showed relatively few chromosome structural anomalies. All the PMs had cells with 80 or more chromosomes; two had many hyperdiploid cells; and two had many cells with altered chromosome structure. Transplanted metastases had mainly diploid, tetraploid, and cells with more than 100 chromosomes. Chromosomal anomalies included one PT with 17.5% cell breakage and frequent reunions; a PM with 25% breakage in chromosomes; a TM with frequent meta- and submetacentric chromosomes; and a TM with ring and allocyclic chromosomes. Tumor progression was by evolution with mutation and selection.

5765 INDUCTION OF HEART TUMORS IN RATS BY TREATMENT WITH METHYLNITROSOUREA. (Ger.) Schreiber, D. (Med. Acad. Erfurt, East Germany), H. Batka, R. Warzok and E. Quentin. *Zentralbl Allg Pathol* 115:31-39, 1972.

The induction of cardiac tumors by methylnitrosourea (MNU) in 72 out of 774 rats of both sexes and of two different strains, by various doses and two different routes of administration, is described. Group I consisted of Hauben rats administered 25 mg/kg MNU, four times weekly, i.v. (maximal dose 250 mg/kg) and developed 37 cardiac tumors within a mean latency period of 273 days. Group II received 20 mg/kg, four times weekly, i.p. (maximal dose 200 mg/kg) and developed 25 tumors within a mean latency period of 255 days. Group III received 10 mg/kg, biweekly, i.p. (maximal dose 180 mg/kg) and developed four tumors within a latency period of 211 days. The rats of groups II and III were also Hauben strain. Groups IV and V comprised Wistar rats who received 10 mg/kg MNU biweekly, i.v. and i.p., resp. (maximal dose 180 mg/kg) and developed four and two tumors, resp., the latency period being 284 and 290 days, resp., the incidence of tumor

formation was 10.5% in the Hauben rats and 4.1% in the Wistar rats; following i.v. injection of MNU, 8.1% of the animals developed cardiac tumors, while i.p. injections resulted in 11.6% tumor development. The effects of additional experimental conditions such as castration and testosterone administration were investigated in part of the population. In one group, whose ovaries had been extirpated prior to tumor induction, cardiac tumors were induced by MNU in 41% of the animals; other malignant tumors were also observed in combination with the cardiac tumors. The possibility of hormonal effects in the emergence of these tumors is discussed. The preferred location of the tumors was in the left ventricle. Morphologically, various developments from fibromas to spindle sarcomas and newly developed polymorph cell sarcomas were observed. A detailed study of the morphological picture may offer evidence of the origin of these tumors.

- 5766 ON A POSSIBLE BLASTOMOGENECITY OF DDT.
(*Rus.*) Shabad, L. M. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow), T. S. Kolesnichenko and T. V. Nikonova. *Vopr Pitan* 31(1):63-66, 1972.

The possible carcinogenic effect of DDT was studied in five consecutive generations of mice. Mice of line A received 10 mg/kg or 50 mg/kg of DDT daily from the age of 6-8 wk until the lactation period. Embryonal lungs were used for organ cultures 19-20 days from the beginning of pregnancy in each consecutive generation. A dose of 10 mg/kg DDT caused various changes in the organ cultures of all generations. Growth stimulation was seen in F₁, F₂, and F₃ generations. Diffuse and local hyperplasia of the epithelium increased with each generation: 8.9% in F₁, 16.4% in F₂, and 39.3% in F₃. The frequency of dystrophic changes in experimental cultures of F₁, F₂, and F₃ was lower than that in the control cultures, while it was higher in the experimental cultures of F₄ (30.1%) and F₅ (20.1%) than in the control cultures. Adenomatous changes were seen in the latter two generations. A 50 mg/kg dose of DDT had stronger transplacental effect. Hyperplastic changes were seen in 32.2% and adenomatous changes in 9.6% of F₁ cultures. Adenomas and other tumors were not observed in all organ cultures studied. It is concluded that the blastomogenic effect of DDT is weak.

- 5767 INDUCTION OF SMALL INTESTINAL CARCINOMAS IN RABBITS THROUGH METHYLNITROSOUREA.
(*Ger.*) Schreiber, D. (Med. Acad., Erfurt, East Germany), A. Lagerman and M. Geyer. *Zentralbl Allg Pathol* 115:40-47, 1972.

The induction of carcinomas of the small intestine in two groups of rabbits exposed to methylnitrosourea is reported. The sixty animals in Group I received 10 mg/kg methylnitrosourea i.v. at two wk intervals, while the 67 animals in Group II received 20 mg/kg of the carcinogen i.v. at four wk intervals. Tumor incidence was 25% in Group I and 68.7% in Group II. The first tumor appeared 194 days from the beginning

of the experiment. Most of the carcinomas (90%) appeared in multiple form. Metastases developed in the mesenteric lymph nodes, reticulum, peritoneum, and less often in the lungs and liver. Histologically, the picture was one of adenocarcinoma with prevalent scirrhous tumor formations. In their last weeks or months of life, the animals manifested loss of weight and diarrhea, ileus symptomatology or abdominal swelling with ascites. Species-dependent differences in the incidence and location of digestive tract tumors following methylnitrosourea administration are considered. In the rat, this carcinogen produces tumors in the forestomach, large intestine and only rarely in the small intestine.

- 5768 LUNG CANCER INCIDENCE AMONG CHLOROPRENE-HANDLING WORKERS. (*Rus.*) Khachatryan, E. A. (Fifth Clin. Hosp., USSR). *Vopr Onkol* 18(6):85-86, 1972.

A study of 2934 chloroprene-handling workers (working over 25 years) revealed 34 patients (1.24%) with lung cancer. The average age of these patients was 44.5 years and the average length of their service was 8.7 years. In the first control group of 4780 workers including chauffeurs, furniture makers, firemen, benzene storehouse workers, and house painters, there were 22 patients with lung cancer (0.46%). In the second group of 6045 workers including electricians, carpenters, electric welders, tinsmiths, and furnace workers, 11 had lung cancer (0.8%). There were only four patients with lung cancer (0.0064%) among 6220 office workers. Sixteen patients with lung cancer were found among the factory workers studied (number not given). Thus, the workers in contact with chloroprene showed a high incidence of lung cancer as compared with other occupational groups. Of the total 87 patients with lung cancer, 66 (75.8%) had chronic bronchitis, 3 (3.4%) tuberculosis, 1 (1.1%) bronchial asthma, and 4 (3.4%) pneumonia.

- 5769 THE ACTION OF PREGNANEDIOL AND ALLOPREGNANEDIOL ON THE CARCINOGENIC PROCESS IN PARADIMETHYLAMINOAZOBENZENE-TREATED MALE RAT LIVERS.
(*Fr.*) Lacassagne, A. (Fac. Med. Paris, France), M.-F. Jayle, L. Hurst and B. Desfosses. *C R Acad Sci [D] Paris* 274(1):141-143, 1972.

Two hypotheses concerning the mechanism of inhibition of p-dimethylaminoazobenzene (DAB)-induced rat liver canceration by progesterone and pregnenolone were tested. One theory attributed the inhibitory action of these steroids to the double bond at C-4 or C-5; the other attributed the effect to metabolites resulting from reduction of 21-desoxysteroids in the liver by 5- α -reductase, 5- β -reductase as well as by 3- and 20-hydroxy NAD-oxidoreductases, namely to pregnanediol and allopregnanediol. Male Wistar rats were fed a diet containing 600 mg/kg DAB plus 40 mg of 5 β -pregnanediol or 20 mg of 5 α -pregnane-3 β ,20 β -diol, 5 α -pregnane-3 β -ol-20-one or pregnenolone plus o,p'-DDD per kg of food. The two 5 α -steroids

had only a very weak or no effect on DAB-induced hepatocarcinogenesis, while 5 β -pregnanediol produced complete inhibition of hepatocarcinogenesis. Of the 13 rats fed the DAB- and pregnanediol-containing diet, none had precancerous lesions 452 days after the beginning of the experiment. Pregnenolone counteracted the degenerating effects of *o,p'*-DDD of the Leydig cells and prevented oncogenesis in 11 rats subjected to the combination treatment. Apparently, the double bond at C-4 or C-5 has no role in the inhibition of the DAB-induced carcinogenesis. The action of progesterone and pregnenolone, which are precursors of pregnanediol, seems to be mediated by this latter steroid. The configuration of the progesterone and pregnenolone metabolites appears to be decisive for their carcinogenesis inhibition effect: while the *trans*-configuration of the A and B rings of the 5 α -derivatives is inactive, the 5 β -pregnanediol with the A and B rings in a *cis*-configuration has a strong inhibitory effect on carcinogenesis.

5770 QUANTITATION OF CHEMICALLY INDUCED NEOPLASTIC TRANSFORMATION OF BALB/3T3 CLONED CELL LINES. (E.) DiPaolo, J. A. (Nat'l. Cancer Inst., Bethesda, Md.), K. Takano and N. C. Popescu. *Cancer Res* 32(12):2686-2695, 1972.

Cloned BALB/3T3 cell lines derived from a BALB/3T3 line are sensitive to the toxicity of known chemical carcinogens and undergo chemically induced transformation *in vitro*. A quantitative system of chemical transformation resulted in cell lines that caused fibrosarcomas when injected into mice (10^6 cells/mouse); no tumors developed from control lines (10^8). Transformation, indicated by criss-crossing of fibroblast-like cells not seen in controls, was scored in discrete colonies at 10 to 11 days or in foci after three weeks. Transformation was observed with carcinogenic polycyclic hydrocarbons, aflatoxin B₁, *N*-acetoxy-2-fluorenylacetyamide, and *N*-methyl-*N'*-nitro-*N*-nitrosoguanidine but not with diethylnitrosamine or noncarcinogens. Transformation rate increased (based on transformed colonies/total colonies or original cell inoculum used), and cloning efficiency decreased as concentration of carcinogen was increased. The dose-response relationship was consistent with a one-hit phenomenon. The Poisson distribution of frequency of transformed colonies per dish indicates that transformation is due to induction. Transformed cell lines from carcinogen-transformed colonies or foci had decreased doubling time and increased saturation densities relative to control lines. Recloned, carcinogen-sensitive, BALB/3T3 cell lines present a reliable *in vitro* quantitative bioassay model for the study of chemical carcinogenesis.

5771 A DISTINCTION BETWEEN 3-METHYLCHOLANTHRENE AND ESTROGEN BINDING IN THE UTERUS. (E.) Toft, D. O. (Vanderbilt Med. Sch., Nashville, Tennessee) and T. C. Spelsberg. *Cancer Res* 32(12):2743-2746, 1972.

The binding of methylcholanthrene-³H to macromolecular components of the uterine cytosol fraction was analyzed and compared with the specific binding of estradiol to its receptor. Methylcholanthrene-³H binds to a component which sediments as a 5S complex on sucrose gradients and can be easily distinguished from the 8S estradiol-receptor complex. Unlabeled estradiol does not interfere with methylcholanthrene-³H binding, nor does unlabeled methylcholanthrene have any effect on the formation or sedimentation of the estradiol-³H-receptor complex. These results negate the possibility that the carcinogen acts in estrogenic target tissues by directly interfering with the normal interaction of estrogens with their receptor sites.

5772 THE CELLULAR ANALYSIS OF LIVER CARCINOGENESIS. VI. GROWTH AND ULTRASTRUCTURAL CHARACTERISTICS OF N-2-FLUORENYLACETAMIDE HYPERPLASTIC LIVER NODULE CELLS GROWN *IN VITRO*. (E.) Slifkin, M. (Allegheny Gen. Hosp., Pittsburgh, Pa.), L. P. Merkow, S. M. Epstein and M. Pardo. *Arch Path* 94(1):1-10, 1972.

Hyperplastic liver nodules (HLN) from male rats fed *N*-2-fluorenylacetyamide (*N*-2-FAA) for 15 wk were cultured *in vitro* and compared with malignant liver carcinoma tissue and normal liver tissue. HLN showed no evidence of malignancy. They were made up of uniform large cells which, in immunofluorescence, isotopic and ultrastructural studies, appeared to be hepatocytes. Growth dynamics of HLN distinguished them from liver carcinomas; HLN did not grow on glass surfaces, while carcinoma tissue did.

5773 REVERSIBILITY IN SKIN CARCINOGENESIS. (E.) Carter, R. L. (No affiliation), F. J. C. Roe and E. Hecker. *Ann Ital Derm Clin Sper* 25(2):222-226, 1971.

No tumors developed in female outbred Swiss mice given a single 100 μ g dose of 7,12-dimethylbenz(a)-anthracene (DMBA) on dorsal skin. When the single dose of DMBA was followed three wk later by a 15 wk course of twice weekly applications of Hecker Compound A₁ (HCA₁), a purified preparation of croton oil, 85% of treated mice developed one or more skin papillomas. In contrast, only 4% of mice developed papillomas when the interval between DMBA application and start of HCA₁ treatment was extended from three wk to one yr. Repeated applications of HCA₁ alone did not induce skin tumors. These results indicate that the tumor-initiating effect of 100 μ g DMBA is largely lost between 3-50 wk after its application to the skin.

5774 BINDING OF K-REGION EPOXIDES AND OTHER DERIVATIVES OF BENZ[a]ANTHRACENE AND DIBENZ[a,h]-ANTHRACENE TO DNA, RNA, AND PROTEINS OF TRANSFORMABLE CELLS. (E.) Kuroki, T. (Med. Sch., U. Wisconsin, Madison), T. E. Huberman, H. Marquardt, J. K. Selkirk, C. Heidelberger, P. L. Grover and P. Sims. *Chem-Biol*

Interact 4(6):389-397, 1972.

The binding of ^3H -labeled benz(a)anthracene (BA) and dibenz(a,h)anthracene (DBA) and their K-region epoxides, cis-dihydrodiols, and phenols to DNA, RNA and proteins of exponentially growing cells was studied. The epoxide of BA bound to all macromolecules purified from hamster embryo cells to a much greater extent (20 to 60 times) than the parent hydrocarbon or its other derivatives. The binding of the epoxide to DNA, RNA and protein reached a maximum after three hr, and thereafter gradually declined. The epoxide of DBA was highly bound to RNA and protein but not to DNA of the hamster embryo cells. The extent of binding of all compounds to DNA, RNA, and proteins of transformable mouse prostate cells was less than to hamster cells, and the binding to malignant mouse tumor cells was very much lower. From these and previously published results, it was concluded that, in at least some cases, the metabolism of hydrocarbons to epoxides is necessary for binding to macromolecules, for the production of mutations, and for malignant transformation.

- 5775 ORAL CONTRACEPTIVES AND CANCER. (E.)
Wendel, H. A. (U. Oregon Med. Sch.,
Portland). *Lancet* 2(7787):1139, 1972.

Animal toxicity data must be interpreted in terms of the therapeutic index derived from the ratio of the toxic to the therapeutic dose in the same species. The potential hazard of a drug to man cannot be estimated by expressing the toxic animal dose of the drug in multiples of its human therapeutic dose. Thus the wide safety margin for oral contraceptives indicated by tests in which mice and rats were given 50-400 times the human doses can only be regarded as spurious. Moreover, the period of exposure and the total amount of drug taken over time must be considered when evaluating the carcinogenic hazards. A woman on oral contraceptive medication takes in a yr two to three times more drug than the total amount tested in mice at the maximum (400 multiples) dose level.

- 5776 CHARGE TRANSFER IN THE MOLECULAR INTERACTION OF CARCINOGENIC 4-NITROQUINOLINE 1-OXIDES AND DNA, WITH SPECIAL REFERENCE TO ANALYSIS AT THE NUCLEOSIDE LEVEL. (E.) Okano, T. (Pharmaceut. Inst., Tohoku U., Sendai, Japan), A. Isebe and H. Matsumoto. *Gann* 63(4):427-436, 1972.

Calf thymus DNA or DNA nucleosides were mixed with 4,6-dinitroquinoline 1-oxide, 6-chloro-4-nitroquinoline 1-oxide, 4-nitroquinoline 1-oxide, 2-methyl-4-nitroquinoline 1-oxide, 4-nitroquinoline or quinoline 1-oxide. A recording spectrophotometer was used to measure visible difference spectra produced by quinoline interactions with DNA and deoxyribonucleosides. Difference spectra of DNA and each quinoline all showed a new absorption band in the visible region, as did spectra of

interaction systems containing quinolines and nucleosides. It was concluded that a π - π charge transfer between quinolines and the base moiety of the macromolecule played an important role in the DNA-quinoline interactions. Extent of charge transfer correlated with carcinogenicity for all quinolines except 4,6-dinitroquinoline 1-oxide, which showed a strong antitumor activity.

- 5777 CONTRIBUTION TO THE COCANCEROGENIC EFFECT OF CIGNOLIN IN ANIMALS. (Ger.) Langbein, W. (Radiol. Clin., Stralsund, East Germany). *Radiobiol Radiother (Berl)* 13(2):233-240, 1972.

Skin tests were conducted in male AB mice for the effects of a combination of tar and cignolin or a combination of 9,10-dimethyl-1,2-benzanthracene (DMBA) and cignolin. Ten groups of 20 animals each were tested: animals in first three groups received a single dose of 0.125 mg DMBA in 0.25 ml acetone (0.05%); animals in three other groups received five drop-treatments with 50% coal-tar solution in 0.25 ml acetone. Following an interval of one or two weeks, cignolin drops were applied in concentrations of 0.01, 0.03 or 0.05%. Three further groups were treated only with cignolin initially administered five times weekly, then three times and finally once weekly. The tenth group of mice served as the control. The application of cignolin to the skin of mice pretreated with DMBA or with tar promoted the formation of skin tumors in more than one-third of the animals. Following DMBA, the application of cignolin in increasing concentrations resulted in a tumor frequency of 62%. The first tumor appeared within 10 weeks, and in 20% of the animals of each experimental group, tumor formation occurred within about four months. With tar pretreatment, the tumor rate was only slightly dependent on cignolin concentration, with the highest tumor frequency (47%) after the 0.03% concentration. In tar-pretreated animals, the first tumor appeared two weeks following cignolin application; 20% of the animals exhibited tumors after five weeks. Cignolin application alone did not promote tumor development. Histologically, all the tumors were papillomas, some with numerous cell types and atypical nuclei, but without definite carcinomatous degeneration. Spontaneous regression of the tumors was observed in 21 out of 33 animals, even in some with multiple macroscopic tumors, after some weeks or months. The cocarcinogen effects of cignolin in animal experiments is discussed in connection with the use of cignolin in the treatment of psoriasis.

- 5778 SYNTHESIS OF HEPATOTOXIC AGENTS IN GERM-FREE AND CONVENTIONAL MICE WHICH HAD BEEN FED NaNO_2 AND DIMETHYLAMINE. (E.) Pollard, M. (Lobund Lab., U. Notre Dame, Ind.), N. Sharon and C. F. Chang. *Proc Soc Exp Biol Med* 140(3):1073-1076, 1972.

in vivo production of toxic agent(s) was demonstrated in conventional and germfree (GF) CFW and Swiss-Webster mice fed subtoxic doses of NaNO_2 and dimethylamine (DMA). Two responses were observed in the mice: acute death of some mice within 24 hr after simultaneous administration of the two drugs; and extensive necrosis in the livers of survivors. GF CFW mice tolerated 75 mg NaNO_2 , but this dose combined with 3500 mg DMA resulted in 100% mortality in 75 mice within 24 hr. Conventional CFW mice tolerated up to 150 NaNO_2 , while conventional and GF Swiss-Webster mice tolerated 100 mg NaNO_2 . However, these mice were toxic for many mice when administered with 100 or 3500 mg DMA. Microbial flora did not appear to be required for the *in vivo* synthesis of toxic agent(s) from NaNO_2 and DMA. The agent is assumed to be nitrosamine.

779 CYTOPHOTOMETRIC INVESTIGATIONS OF CELL NUCLEI FROM EXPERIMENTALLY INDUCED NEOPLASIA. (Ger.) Goerttler, K. (Inst. Exp. Path., U. Heidelberg, West Germany), D. Haag and C. Tasca. *Krebsforsch* 76(3):155-166, 1971.

The relationship between nuclear volume and nucleic acid content was studied as a measure of differentiation or initiation of neoplastic growth. For this purpose, hyperchromic tumors were induced in mouse skin with benzo(a)pyrene, and hypochromic tumors (hepatocellular adenoma) were induced in rats with diethylnitrosamine (DENA). Skin carcinomas and papillomas were produced in the subcutis of the NMRI mice by a single application of 0.1 ml of a 0.5% solution of benzo(a)pyrene in benzene, and hepatomas were produced in Sprague-Dawley rats by a daily dose of 3 mg/kg DENA in drinking water for a two-month period. A stochastic relationship was found (correlation coefficient of 0.85) between DNA content and nuclear volume in normal hepatocytes by means of cytophotometric determinations. After DENA administration, the cell nuclei in the still intact areas showed a much more marked eugenic reaction than nuclei in the epithelia of untreated animals, and tetraploid nuclei in the regenerating rat liver. The correlation between DNA content and nuclear volume in these cells was higher than in normal liver cells; this was due to the increased participation of cell nuclei with higher DNA content. This more marked correlation was expressed quantitatively in the higher slope of the regression line which reflects the relative acceleration in DNA synthesis following increased regeneration in the intact part of the liver. Increased aneuploidy was seen in advanced mouse skin carcinomas which was reflected in a rise in the regression lines with the concomitant increase of DNA values. The cytophotometric measurements of the DENA-induced hepatoma, however, showed increased nuclear volumes and a decrease in DNA content. The equation representing the correlation between DNA content and nuclear volume, $\text{DNA} = c \times \text{nuclear volume} + \text{constant}$ (where c is the degree of synchronization and the constant represents the degree of ploidy) may be applied in early detection of neoplastic processes.

5780 MUTAGENIC SELECTIVITY FOR THE RNA-FORMING GENES IN RELATION TO THE CARCINOGENICITY OF ALKYLATING AGENTS AND POLYCYCLIC AROMATICS. (E.) Fahmy, O. G. (Chester Beatty Res. Inst., London, England) and M. J. Fahmy. *Cancer Res* 32(3):550-557, 1972.

Drosophila melanogaster were exposed to a series of chemical carcinogens and the induction of mutant genes was observed. Marker genes observed for mutagenic activity of compounds included the RNA-forming loci *Minutes (M)*, an autosomal dominant, and *bobbed (bb)*, a sex-linked recessive. Nonspecific overall genetic damage, as indicated by X chromosome recessive lethals and visibles, was also observed. Test compounds included alkylating and nitroso compounds which react with cellular macromolecules, and nonreactive polycyclic hydrocarbons, aromatic amines, and azo dyes. Alkylating agents, represented by sulfur mustards (mustard gas and half-mustard gas) were mutagenically active on all investigated loci; nitroso compounds (including *N*-methyl-*N'*-nitro-*N*-nitrosoguanidine and *N*-ethyl-*N'*-nitro-*N*-nitrosoguanidine) were also mutagenic on all loci investigated, though generally less so than sulfur mustards. General mutagenic activity on the X chromosome was invariably high with alkylating and nitroso compounds, but low or lacking with nonreactive compounds (including 3-methylcholanthrene, 7,12-dimethylbenz(a)-anthracene, acetylaminofluorene and diethylaminoazobenzene). Relative response to mutagens at the *bb* locus was measured as the ratio of the transmissible induced number of *bb* mutants to the corresponding X recessive lethals and visibles expected. Polycyclic aromatics gave ratios approaching unity while alkylating compounds gave ratios at least two orders of magnitude lower. Carcinogens among all chemical series were highly active on the *bb* loci.

5781 SHIFT OF TARGET ORGANS IN CYCASIN CARCINOGENESIS. (E.) Fukunishi, R. (Kagoshima U. Sch. Med., Japan), K. Watanabe, S. Terashi and K. Kawaji. *Gann* 62(5):353-358, 1971.

Rats were given cycasin orally in daily 4 mg/kg doses for life, in 50 mg/kg "pulse" doses weekly for 12 wk, or in a single 250 mg/kg dose. The small dose induced mammary adenocarcinomas in five of 29 Sprague-Dawley females and testicular tumors in six of 15 ACI mice. No mammary cancer was detected in ACI females and no testicular tumors in Sprague-Dawley males. The latent period of tumor induction was 349-595 days for mammary tumors and 704 days for testicular tumors. Multiple pulse doses of cycasin and a single large dose caused intestinal tumors in tested Sprague-Dawley rats, but the incidence was higher (81.3%) in the 16 males of each group. The latent period was 323.3 days \pm 31.4 days in the pulse-dose group and 414.4 days \pm 94.6 days in the large-dose group. Kidney tumors, including ten nephroblastomas and six adenocarcinomas, were induced in 11 of 15 females in the large-dose group. The latent

period was 349.9 days \pm 83.2 days. Cirrhosis of the liver (three cases) and hepatomas (five cases) were found only in the pulse-dose group.

5782 PATHOLOGY OF CARCINOMA OF THE LUNG ASSOCIATED WITH ASBESTOS EXPOSURE. (E.)

Kannerstein, M. (Barnert Mem. Hosp. Ctr., Paterson, N.J.) and J. Churg. *Cancer* 30(1):14-21, 1972.

A retrospective study was conducted on the morphologic, anatomic and histologic characteristics of carcinoma of the lung in 50 males with a history of asbestos exposure. The data were compared with similar data obtained from the records of 50 randomly chosen males who had lung carcinoma without a history of asbestos exposure. Although no difference between the two groups was found in the histologic cell types, the position of tumors within a lobe, or the incidence of metastases, the two series differed significantly in the distribution of tumors in relation to upper and lower lobes. Lower lobe tumors predominated in the asbestos-associated cases (19 lower lobe vs 13 upper lobe tumors), while upper lobe tumors predominated in the controls (29 upper lobe vs 12 lower lobe tumors). The asbestos-exposed group also showed a somewhat higher frequency of severe pleural involvement although its significance was questionable. The similarities between the lung tumors found in the control and in the asbestos-exposed groups were consistent with previously published epidemiologic and experimental studies indicating that asbestos functions as a cocarcinogen rather than as a carcinogen.

5783 HIGH YIELD OF HEPATIC TUMORS IN RATS BY CYCASIN. (E.) Fukunishi, R. (Kagoshima U. Sch. Med., Japan), S.-I. Terashi, K. Watanabe and K. Kawaji. *Gann* 63(5):575-578, 1972.

Hepatic tumors were induced in male and female Sprague-Dawley rats by continuous administration of 10 mg/kg/day of cycasin (a component of the seeds of cycads) in drinking water beginning at age 21 or 50 days. Liver tumor incidence was 80-90% in all groups. The latent period of tumor induction was 167-480 days in the 21-day-old groups and 251-556 in the 50-day-old groups. Autopsy and histologic examination of all tumor-bearing rats revealed both hepatomas and hepatic sarcomas. Hepatomas, whose incidence was slightly higher than that of hepatic sarcomas in all but the 50-day-old male group, were often disseminated into the peritoneal cavity. Lung metastases were observed in nine of 35 cases. The sarcomas, which were predominantly fibrosarcomas, showed moderately atypical spindle-shaped cells. Mitotic figures were abundant. In addition to the liver tumors, a small number of tumors of other sites was seen (kidney, intestine, thymus and ear duct). There were no apparent age or sex differences in the incidence of the hepatic tumors other than the higher incidence of hepatic sarcomas in older males.

5784 THE TRANSPLACENTAL EFFECT OF DIMETHYLBENZANTHRACENE (DMBA) AND ITS NONCANCEROGENIC ANALOGUE-ANTHRACENE--IN ORGANIC CULTURES OF MOUSE EMBRYONAL KIDNEYS. (Rus.) Sorokina, Yu. D. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow). *Biull Eksp Biol Med* 72(9):86-89, 1971.

The organ cultures of 19-21 day embryonal kidneys from mice (C57BL x CBA) which had received 7,12-dimethylbenzanthracene (2 mg x 4) and anthracene (2 mg x 4) in the last week of their pregnancy were incubated and studied electron-microscopically. The viability of cultures grown for 26 and 30 days was greater in both experimental groups (8/36 in the anthracene group and 21/49 in the 7,12-dimethylbenzanthracene group) than in the control group (0/27). Hyperplastic changes of the epithelium after introduction of anthracene and 7,12-dimethylbenzanthracene were similar, but their intensity and frequency were higher in the 7,12-dimethylbenzanthracene group (30.9%, 42/179) than in the anthracene group (15.6%, 24/205).

5785 REGIONAL AND PERIPHERAL LYMPH NODE LYMPHOCYTIC NUCLEI DNA CONTENT UNDER METHYLCHOLANTHRENE-INDUCED CARCINOGENESIS CONDITIONS. (Rus.)

Gudim-Levkovich, K. A. (Inst. Exp. Clin. Oncol., Ukrainian SSR Acad. Sci., Kiev, USSR), L. P. Lysyuk, and Yu. A. Umanskiy. *Vopr Onkol* 18(2):60-64, 1972.

The DNA content of the nuclei of regional and peripheral lymph node lymphocytes was studied after tumor induction by methylcholanthrene. Methylcholanthrene (1 mg/0.1 ml peach oil) was injected into the right hind paw of BALB/c mice. The mice were decapitated one to four months after the carcinogen introduction. The DNA levels of the nuclei of regional (right inguinal) and peripheral (left axillary) lymph node lymphocytes were determined by their optic density. Before methylcholanthrene administration the DNA content of the lymphocytic nuclei of the peripheral lymph nodes was essentially the same as that of the regional lymph nodes. In the process of tumor development (one to two months after the carcinogen introduction) in the mice, there was an increase in the DNA content of the lymphocytic nuclei of both regional and peripheral lymph nodes. This was due to an increase in the number of the nuclei whose DNA content was increased with respect to the diploid set of chromosomes. In the pretumor period, i.e., three months from the carcinogen introduction, the DNA content in the nuclei of the small lymphocytes of the regional lymph nodes was higher than that of the peripheral lymph nodes. After four months, when the tumors had actually developed, the DNA content in the lymphocyte nuclei of the regional lymph nodes was lower than that of the peripheral lymph nodes.

5786 ATYPICAL LYMPHOPROLIFERATIVE AND EPITHELIAL LESIONS OF THE HAMSTER

CHEEK POUCH INDUCED BY TOPICAL EXCESS OF VITAMIN A. (E.) Polliack, A. (Hadassah U. Hosp. Med. Sch., Jerusalem, Israel) and I. S. Levij. *Ann Ital Derm Clin Sper* 25(2):184-191, 1971.

The right cheek pouches of 48 Syrian hamsters were painted with vitamin A palmitate three times/wk for 2-12 wk. The animals were sacrificed after treatment and both cheek pouches were examined histologically. No changes in treated cheek pouches were noted after two wk. After four wk, there was a diffuse, subacute inflammatory infiltrate in the lamina propria. Focal acanthosis with formation of rete pegs was observed. Focal epithelial hyperplasia progressed with continued treatment and eventually led to the development of foci of marked epithelial atypia. In the latter stages, there were dense mononuclear cell infiltrates in the lamina propria and muscular wall. The infiltrates consisted mainly of lymphocytes and resembled the lymphoreticular hyperplasia seen in malignant lymphomas.

5787 CARCINOGENS AS FRAMESHIFT MUTAGENS: METABOLITES AND DERIVATIVES OF 2-ACETYL-AMINOFLUORENE AND OTHER AROMATIC AMINE CARCINOGENS. (E.) Ames, B. N. (Biochem. Dept., U. California, Berkeley), E. G. Gurney, J. A. Miller and H. Bartsch. *Proc Nat Acad Sci USA* 69(11):3128-3132, 1972.

The potency as frameshift mutagens of several metabolites of carcinogenic chemicals was studied by adding metabolites in crystalline form to cultures of *Salmonella typhimurium*. The mutagenicity tests used four *Salmonella* strains which require histidine. The test measured the effect of putative mutagens on the reversion to growth of the strains in histidine-free media. The potency of fluorene derivatives as frameshift mutagens was in the order: 2-nitroso > N-hydroxy-2-amino >> N-hydroxy-2-acetyl-amino > 2-amino. 4-Nitrosobiphenyl, 4-nitroso-trans-stilbene, 2-nitrosonaphthalene and 2-nitrosophenanthrene were also potent frameshift mutagens. The compounds may be mutagens of the type that intercalate into DNA and react covalently with it.

5788 SERUM ALPHA-FETOPROTEIN. VIII. SERUM LEVELS DURING DIETHYLNITROSAMINE POISONING OF BABOONS. (E.) Purves, L. R. (Div. Life Sci., Atomic Energy Board, Pretoria, South Africa). *Int J Cancer* 10(3):552-556, 1972.

Serum alpha-fetoprotein (AFP) levels during various stages of poisoning of baboons with diethylnitrosamine (DENA) were determined by a radioimmunoassay method. A group of three young baboons given five i.p. injections of 20 mg/kg DENA showed a dramatic increase in AFP. This effect was repeated during subsequent treatment with 5 mg/kg DENA administered orally three times a wk, and the AFP peaks were paralleled by rises in serum alkaline

phosphatase. Weight gain was affected and treatment was stopped on days 64, 135, and 256. After a 150-day lag, there was a sudden spurt of growth, alkaline phosphatase reached a peak and a transient increase in AFP occurred. The response to more DENA after day 560 was a rise in AFP unaccompanied by a rise in alkaline phosphatase. With continued DENA treatment, serum AFP rose or fell in individual animals. No animal has yet manifested clinical signs of a liver tumor. Three possible mechanisms of AFP synthesis in human disease are discussed.

5789 QUANTITATIVE ASPECTS OF TRANSPLACENTAL TUMOR INDUCTION WITH ETHYLNITROSOUREA IN RATS. (E.) Swenberg, J. A. (Dept. Vet. Pathobiol., Ohio State U., Columbus), A. Koestner, W. Wechsler and R. H. Denlinger. *Cancer Res* 32(12):2656-2660, 1972.

Dose-response relationships of transplacental tumor induction with the resorptive carcinogen, ethylnitrosourea, were investigated in Sprague-Dawley and Fischer rats. Neuroectodermal tumors were produced in offspring of all rats exposed to a single dose of ethylnitrosourea, 1, 5, 20, or 50-mg/kg, near the end of gestation. The incidence of experimentally induced neoplasms was directly proportional to the dose of carcinogen, while mean survival time was inversely related to exposure. The incidence of tumors varied with the dose of carcinogen and strain of rat. Brain tumors were the cause of death for 69% of the Fischer rats exposed to ethylnitrosourea, 50 mg/kg, whereas only 27% of similarly exposed Sprague-Dawley rats died of brain tumors. A significantly longer survival time was demonstrated for rats that died of gliomas compared with those that died of neurinomas or ependymomas. The investigation demonstrates that the age at which an animal develops neoplasia following transplacental exposure to a carcinogen depends on the level of exposure and the tumor type. It is suggested that tumors of adults, as well as of children, may be due to transplacental exposure to carcinogenic agents.

5790 CHEMILUMINESCENCE COUPLED WITH THE FORMATION OF LIPID PEROXIDES IN BIOLOGICAL MEMBRANES. VI. EFFECT OF CARCINOGENIC HYDROCARBONS ON THE LUMINESCENCE AND ACCUMULATION OF PEROXIDES IN THE MITOCHONDRIA. (E.) Tafel'shtein, E. Ye. (Second Moscow State Med. Inst., USSR), O. E. Utkin and V. A. Vladimirov. *Soyuzdiz* 16(5):949-951, 1971.

Mitochondria were treated, in the presence of the ions of bivalent iron, with 7,12-dimethylbenz(a)-anthracene, 3-methylcholanthrene, benzo(a)pyrene, or anthracene. The intensity of chemiluminescence was increased two- or three-fold by treatment with the carcinogens. However, the agents did not affect the accumulation of lipid peroxides (malonic dialdehyde) in mitochondria. The intensification of chemiluminescence was apparently the result of energy migration to the hydrocarbons.

- 5791 THE EFFECT OF LONG-TERM EXPOSURE TO DDT ON CF-1 MICE. (E.) Tomatis, L. (Int. Agency Res. Cancer, Lyons, France), V. Turusov, N. Day and R. T. Charles. *Int J Cancer* 10(3):489-506, 1972.

CF-1 minimal inbred mice were given technical DDT mixed into the diet at the dose levels of 2, 10, 50 and 250 parts per million (ppm) for the entire life span for two consecutive generations. Exposure to all four levels of DDT resulted in a significant increase of liver tumors in males, this being most evident at the highest level used. In females, the incidence of liver tumors was slightly increased following the exposure to 10 and 50 ppm, while a marked increase was observed following exposure to 250 ppm. In DDT-treated animals the liver tumors were observed at an earlier age than in untreated controls. The age at death with liver tumors and the incidence of liver tumors appeared to be directly related to the dose of DDT to which the mice were exposed. Four liver tumors all occurring in DDT-treated mice, gave metastases. Histologically, liver tumors were either well-differentiated nodular growths, pressing but not infiltrating the surrounding parenchyma, or nodular growths in which the architecture of the liver was obliterated showing glandular or trabecular patterns.

- 5792 URETHAN AND X-RAY EFFECTS ON MICE OF A TUMOR-RESISTANT STRAIN, X/Gf. (E.) Goldfeder, A. (Dept. Hlth. Hosp., New York U., New York). *Cancer Res* 32(12):2771-2777, 1972.

Inbred X/Gf mice with an extremely low incidence of spontaneous neoplasms were tested for their response to urethan and X-irradiation. Newborn, infant, and adult mice of both sexes were treated weekly with various doses of urethan [0.5 mg/g body weight (7 times) for newborn mice; 1.0 mg/g body weight (12 times) for infant and adult mice applied i.p., and 24 mg/mouse/week applied cutaneously]; with X-irradiation ranging from 300 rads (1 time) to 80 rads (10 times) and with combined treatments [urethan, 1.0 mg/g body weight (4 to 12 times) and X-irradiation, 75 to 150 rads (4 times)]. The incidence of neoplasms was very low in all age groups regardless of the mode of treatment, and it reached 3.4% for the total of 1023 mice. The only statistically significant difference was noticed between the group subjected to combined treatments and pooled data on all experimental groups ($p < 0.05$ for the "both-tail" test). Differences between other modes of treatment and between pooled data for both sexes were not statistically significant. Among 38 recorded neoplasms, 18 were thymomas of the lymphoblastic type, 13 were thymomas of the lymphocytic type, three were reticulum cell sarcomas, and four were mammary tumors. The very low incidence of neoplasms induced by urethan and X-irradiation in X/Gf mice is explained on the basis of (a) their high endogenous immune competence, (b) the absence of leukemia viruses, and (c) the very low incidence of mammary tumor virus.

- 5793 AGGREGATE-FORMING ABILITY OF LIVER CELL LINES DERIVED FROM DAB-FED RATS IN ROTATION CULTURE. (E.) Chikata, E. (Okayama U. Med. Sch., Japan). *Acta Med Okayama* 25(1):57-64, 1971.

Five liver cell lines from rats fed diethylaminoazobenzene (DAB) for different lengths of time were grown in rotation cultures for 3 to 8 days. The size of aggregates formed by cells from DAB-fed rats was observed. It was found that cell lines from rats fed DAB for longer periods in general produced larger aggregates. Differences in aggregate formation between cell lines were apparent after 24 hr in rotation cultures, but became more pronounced after three days of culture. Histologically, aggregates from cell lines cultured for three days consisted of cuboidal epithelial cells.

- 5794 A CASE CONTROL STUDY INTO THE POSSIBLE EFFECTS OF BIRTH CONTROL PILLS ON PRECLINICAL CARCINOMA OF THE CERVIX. (E.) Worth, A. J. (Brit. Columbia Cancer Inst. Vancouver, Canada) and D. A. Boyes. *J Obstet Gynaecol Br Commonw* 79(8):673-679, 1972.

A study was conducted to determine the possible effects of birth control pills and socio-economic factors on the development of preclinical squamous cell carcinoma of the cervix in 310 women between the ages of 20 and 30 in the Province of British Columbia, Canada. The data were collected by questionnaires during 1969 and 1970 and were tabulated by the Division of Vital Statistics, British Columbia. No difference was noted between the positive cases and 682 matched controls in the mean interval between first use of oral contraceptives and entry into the study. There were also no difference in the overall usage of contraceptives, the type of hormonal contraception used, the household income, or religion. The use of the different contraceptive methods in the screened population of the entire province of British Columbia was similar to that of the selected case control study group, except for a slightly lower incidence of usage of sequential preparations in the overall population. The positive case group did have a higher incidence of separations, divorces, abnormal marital situations, and marital and extramarital pregnancies than did the control group. This suggested that the pattern of social behavior, rather than the use of oral contraceptives, was a more likely cause of the increased incidence of preclinical cervical carcinoma in the positive group.

- 5795 COFFEE AND BLADDER CANCER. (E.) Zeitlin, B. R. (General Foods Corp., Technical Ctr., White Plains, N.Y.). *Lancet* (7759):1066, 1972.

Instant-coffee solids were administered for two years to male and female Sprague-Dawley rats, starting at age 21 days. The 144 males and 144 females consumed the equivalent of 85 cups of strong coffee

ly (6.7 g caffeine/cup). Histopathological examination of the urinary bladders of 94 males and females showed no abnormalities related to the free diet. No tumors were found and hyperplasia of the bladder epithelium was not observed. Only one rat, a control, had bladder stones. These results do not support an epidemiological study suggesting an association between coffee drinking and bladder-cancer risk.

6 CARCINOGENESIS IN TISSUE CULTURE. 19: PHOTODYNAMIC ACTION OF 4-NITROQUINOLINE OXIDE (4NQO) ON MAMMALIAN CELLS IN CULTURE. (E.) Tsutsu, H. (Inst. Med. Sci., U. Tokyo, Japan) and T. Takaoka. *Jap J Exp Med* 42(4):341-354, 1972.

Photodynamic action of 4NQO on the following six cell strains was exhibited in culture; 1 strain derived from normal rat liver cells, 2 from rat liver cells transformed, 1 from rat ascites hepatoma L-929 and its substrain. Cells were treated after two weeks of culture with $3.3 \times 10^{-6}M$ 4NQO only once for 10 min in the dark and subsequently by irradiation with 365 nm light for 120 min. The cultivation was carried out at 37°C in the dark. Most of the strains showed severe cell degeneration and destruction by 4NQO-treatment alone depending upon 4NQO concentration, but the cytotoxic effect was markedly enhanced by additional irradiation. This enhancing effect of irradiation was gradually reduced with time after 4NQO-treatment, e.g., when irradiated four days after 4NQO-treatment, cells were able to maintain their growth. Irradiated 4NQO was remarkably low in its cytotoxic effect. Irradiated medium showed low toxicity to cells. A substrain of L which had been serially grown in a protein- and lipid-free synthetic medium showed a response quite different from that of the others including its parent L-929 which was resistant to irradiation; the substrain was highly resistant to 4NQO but extremely sensitive to irradiation.

7 CELL DIVISION IN NORMAL AND NEOPLASTIC MAMMARY GLAND TISSUE IN THE RAT. (E.) Hamme, R. E. (Fac. Med. Dent., U. Manitoba, Winnipeg, Canada) and F. D. Bertalanffy. *Anat Rec* (1):1-7, 1972.

Mitotic rates of epithelial cells in female Sprague-Dawley rat mammary glands were determined in virgin rats, and during pregnancy, lactation and involution. Mitotic rates were determined for mammary tumors induced by a single administration of 7,12-dimethylbenz(a)anthracene (DMBA) via gastric intubation. Mitotic rates were determined from sectioned tissues taken from rats 6 hr after colchicine injection. The mitotic rate of virgin mammary epithelium was 1.69% and showed no apparent diurnal variation. On the 12th day of pregnancy, the mitotic rate increased to 13.2% and it showed a statistically significant diurnal fluctuation. On the second day after parturition, the mitotic rate again returned to very low levels (0.51%) and remained low (0.73%) throughout the period of lactation. The mitotic

rates of 19 DMBA-induced mammary tumors, which varied from 0.39% to 8.43%, showed a definite correlation with the histologic grade of the tumor, with the anaplastic tumors having the highest mitotic rates.

5798 THE RELEVANCE OF CHEMICO-BIOLOGICAL INTERACTIONS FOR THE TOXIC AND CARCINOGENIC EFFECTS OF AROMATIC AMINES: V. THE PHARMACOKINETICS OF RELATED AROMATIC AMINES IN BLOOD. (E.) Groth, U. (Max Planck Inst. Biochem., Munich, Germany) and H.-G. Neumann. *Chem-Biol Interact* 4(6):409-419, 1971/72.

Young adult Wistar rats were given 1.2 mg of tritium-labeled carcinogenic (*trans*-4-dimethylaminostilbene (*trans*-DAS), noncarcinogenic *cis*-4-dimethylaminostilbene (*cis*-DAS), or 4-dimethylaminobiphenyl (DABB) by stomach tube. Blood was removed, and plasma and erythrocytes were isolated and analyzed for radioactivity. Blood levels of tightly bound radioactivity were higher in rats given *trans*-DAS than in rats given *cis*-DAS or DABB. This difference may have been due to differential binding of radioactivity to plasma proteins and red cell constituents; most radioactivity was carried by hemoglobin. When blood from treated rats was subjected to gel filtration on Sephadex G-200, total radioactivity in blood was again two or three times higher in rats given *trans*-DAS. However, radioactivity was associated with plasma proteins to a comparable extent for all three substances. Most *cis*-stilbene and biphenyl activity in plasma proteins was only loosely bound and could be extracted with organic solvents. Only part of the *trans*-stilbene activity was extractable in this way. Erythrocytes contained considerable more radioactivity after administration of *trans*-DAS than after the other two agents. On gel filtration, most radioactivity migrated with hemoglobin and was only partly extractable with organic solvents. When rats were given unlabeled *trans*-DAS and DABB, the pattern of unbound metabolites in plasma analyzed by radio gas chromatography was very similar to that in liver and kidney. In rats given labeled and unlabeled compounds, more than 90% of *trans*-aminostilbene and 55% of *trans*-acetylaminostilbene in blood were bound to hemoglobin in an extractable form.

5799 LEUKAEMIA EVOKED WITH 7,8,12-TRIMETHYLBENZ(A)ANTHRACENE IN RAT III. CHANGES IN LYMPHOID TISSUES. (E.) Bird, C. C. (Ben May Lab. Cancer Res., U. Chicago, Illinois) and K. Mainzer. *Br J Cancer* 26(5):373-379, 1972.

Profound changes in the level of certain dehydrogenase enzymes were observed in lymphoid tissues of rats involved by erythroblastic stem cell leukemia. In lymphoid tissues free of leukemic involvement, activity of malate dehydrogenase (MDH) always exceeded that of lactate dehydrogenase (LDH). In those which contained substantial infiltrates of

leukemic cells, activity of LDH was increased while MDH activity was reduced. In leukemic spleen significant changes were observed in the molecular forms of LDH; the proportion of LDH-5 (muscle-type LDH) was greatly increased while the other molecular forms were reduced. The spleen of rats with leukemia exhibited a marked increase in the normal level of aerobic and anerobic glycolysis but the rate of respiration was unchanged. The terminal stages of stem cell leukemia in the rat are characterized by wide-spread leukemic infiltration of liver and other tissues. Lymph node involvement, however, was found to be selective. Coeliac lymph nodes greatly exceeded other lymph node groups in their incidence of leukemic involvement. It is considered that the selective nature of lymph node involvement in stem cell leukemia derives from topographical considerations.

5800 CHANGES IN THE COMPOSITION OF RAT LIVER CHROMATIN FRACTIONS DURING DIETHYLNITROSAMINE CARCINOGENESIS. (E.) Gronow, M. (Dept. Exp. Path. Cancer Res., U. Leeds, England). *Biochem J* 130(1):11, 1972.

Attempts were made to prepare and characterize chromatin fractions from liver nuclei of rats which had received the carcinogen, diethylnitrosamine, in their drinking water for 70 days. Centrifugation of nuclear sonicates resulted in three chromatin fractions (I, II and III) which contained 12, 64 and 24%, resp., of the total cellular DNA. The specific activities of fractions I and II prepared from animals which had been given ^3H -orotate were the same, whereas that of fraction III was three to four times greater. Preliminary results indicated that there was no difference in specific activity between the three chromatin fractions prepared from normal livers of control rats. Polyacrylamide gel electrophoresis of non-histone proteins from the three chromatin fractions showed that, except for the loss of one polypeptide ($M_w=15,500$) from fraction III of carcinogen-treated rat livers, there was no difference.

5801 RAPID INDUCTION OF SARCOMAS IN RATS BY COMBINATION OF NICKEL SULFIDE AND 3,4-BENZPYRENE. (E.) Maenza, R. M. (U. Connecticut Hlth. Ctr., Farmington), A. M. Pradhan and F. W. Sunderman, Jr. *Cancer Res* 31:2067-2071, 1971.

Male Fischer strain rats were injected bilaterally in the thigh muscles with a suspension containing 10 mg nickel sulfide powder and 5 mg 3,4-benzpyrene powder. Both the mean latent period for tumor development and the mean survival time of rats which received the nickel-benzpyrene injections were significantly shorter than those of animals which received only nickel or only benzpyrene. No tumors developed in control rats which received only injection vehicle. The proportion of sarcomas which developed at the site of injection and which were classified histologically as rhabdomyo-

sarcoma was 91% in the group injected with nickel-benzpyrene compared with 81% in the group injected with nickel and 13% in the group receiving benzpyrene only. The incidence of metastases to lungs and regional lymph nodes was equally higher in the nickel-benzpyrene (53%) and nickel-treated (57%) groups than in the benzpyrene-treated group (20%). These results provide additional support for a possible carcinogenic interaction between nickel compounds and polycyclic hydrocarbons.

5802 A REINVESTIGATION OF EPIDERMAL TRANSPLANTATION DURING CHEMICAL CARCINOGENESIS. (E.) Steinmuller, D. (U. Utah Med. Ctr., Salt Lake City). *Cancer Res* 31:2080-2084, 1971.

A study was undertaken to determine whether carcinomas produced by topical application of a carcinogen are due to direct carcinogenic action on the epidermis or to indirect effects on the dermis ("stromal permutation hypothesis.") (C57BL/6xBALB/c) F_1 hybrid mice received topical applications of 0.3% methylcholanthrene (MCA) once a wk for 12 wk. Two wk after the final MCA treatment, the epidermis at the site of application was removed and all treated mice received a transplant of epidermis from one of the untreated inbred parental strains. This technique thus provided a strong (H-2) histocompatibility marker for determining the origin of the tumors which subsequently developed. Of the 14 carcinomas which arose at the graft sites in the F_1 primary hosts, none grew progressively in the parental strains; however, all grew in the F_1 host cells. In previously reported tests of the stromal permutation hypothesis, the bases of hair follicles had been left intact in the preparation of the graft beds in the MCA-treated hosts. In addition, histocompatibility markers had not been employed. Therefore, the possibility had existed that the tumors which arose in the grafts actually arose from the residual epithelial tissue and not from untreated epidermal grafts. The results from the current study indicate that this latter possibility was indeed true and that the original interpretation in favor of stromal permutation was incorrect.

5803 INFLUENCE OF POLLUTANT GASES ON BENZPYRENE HYDROXYLASE ACTIVITY. (E.) Palmer, M. S. (Environmental Protection Agency, Research Triangle Park, N.C.), R. W. Exley and D. L. Coffin. *Arch Environ Hlth* 25(6):439-442, 1972.

Rabbits were exposed for three hr to ozone (O_3) or nitrogen dioxide (NO_2); immediately after exposure, or one, three or seven days after exposure, rabbits were killed and tracheobronchial mucosa was assayed for benzo(a)pyrene hydroxylase activity. Exposure to 0.75, 3.0, or 10 ppm O_3 caused an early inhibition of enzyme activity. However, enzyme activity recovered by one day after exposure to O_3 . Neither early nor delayed effects on benzo(a)pyrene

hydroxylase activity were seen for NO₂, even at levels as high as 50 ppm.

5804 PERSISTENT BINDING OF A NEW REACTION PRODUCT OF THE CARCINOGEN *N*-HYDROXY-*N*-2-ACETYLAMINOFLUORENE WITH GUANINE IN RAT LIVER DNA *IN VIVO*. (E.) Kriek, E. (The Netherlands Cancer Inst., Amsterdam). *Cancer Res* 32(10):2042-2048, 1972.

The binding of 2-acetylaminofluorenyl residues (-AAF) to rat liver DNA *in vivo* was studied at different periods of time after administration of *N*-hydroxy-*N*-2-acetylaminofluorene-2'-³H. Liver DNA was hydrolyzed at pH 6 with a mixture of spleen phosphodiesterase and wheat germ acid phosphatase. The enzymatic digests were analyzed by Sephadex LH-20 column chromatography. Maximum levels of bound radioactivity were found in liver DNA at 16 to 18 hr following a single injection of *N*-hydroxy-*N*-2-acetylaminofluorene-2'-³H. The major part (80%) of the bound radioactivity was identified as *N*-(deoxyguanosin-8-yl)-2-acetylaminofluorene (dGuo-AAF), which disappeared rapidly from DNA with a biological half-life of approximately seven days. A second product, however, constituting 20% of the bound radioactivity, remained associated with DNA for periods of up to 8 wk after injection. Unlike dGuo-AAF, the minor product was not deacetylated by the action of 0.1 N NaOH or 0.1 N HCl at 75 C for 2 hr. The persistent -AAF residue was not detected in rRNA and tRNA from rat liver. The minor product with chemical and chromatographic properties similar to those of the persistent -AAF moiety *in vivo* was isolated from ¹⁴C-labeled DNA, which had been reacted with *N*-acetoxy-*N*-2-acetylaminofluorene-2'-³H *in vitro*. The ³H:¹⁴C ratio of this product was identical to the theoretical ³H:¹⁴C ratio, which was calculated for the reaction product dGuo-AAF, thus indicating that the persistent -AAF moiety in DNA is also bound to guanine. Persistent binding of radioactivity to rat liver DNA *in vivo* was also observed following a single injection of 2-acetylaminofluorene-9-¹⁴C-2'-³H. Previous reports that 70% of the total carcinogen bound to DNA at 24 hr had lost the *N*-acetyl group were confirmed. Approximately 20% of bound -AAF at 24 hr (5% of total carcinogen) remained associated with DNA at 4 wk after injection. The ³H:¹⁴C ratio of DNA at 4 wk was identical to the ³H:¹⁴C ratio of the isolated reaction product dGuo-AAF, indicating that there are no persistent 2-amino-fluorene residues. Administration of 2-acetylaminofluorene-9-¹⁴C-2'-³H resulted in 53% exchange of *N*-acetyl groups, but injection of *N*-hydroxy-*N*-2-acetylaminofluorene-9-¹⁴C-2'-³H did not result in significant exchange of the *N*-acetyl group.

5805 OBSERVATIONS ON THE EFFECT OF THYMECTOMY ON CHEMICAL CARCINOGENESIS IN THE HAMSTER CHEEK POUCH. (E.) Polliack, A. (Hadassah U. Hosp., Hebrew U.-Hadassah Med. School, Jerusalem, Israel),

I. S. Levi and R. Pfefferman. *Br J Cancer* 26(5): 368-377, 1972.

The effects of thymectomy and sham operation on 9,10-dimethyl-1,2-benzanthracene (DMBA) induced tumors of the hamster cheek pouch were studied in Syrian golden hamsters. The incidence of carcinomata and papillomata with intra-epithelial carcinoma (atypical papillomata) in these animals was compared with that in control animals treated with DMBA alone, without surgical intervention. In 32 non-operated control animals, the average tumor yield after 12 weeks' DMBA application was 2.13 carcinomata and 1.22 atypical papillomata per treated pouch. In 14 animals thymectomized at the age of two weeks, the tumor yield was 0.21 and 0.36, resp., and in ten animals thymectomized when adult, it was 0 and 0.1 resp. In nine animals sham operated on at the age of two weeks, an average of 1.56 carcinomata and 1.22 atypical papillomata were found, but in 13 animals which were sham operated when adult, the tumor yield was 0.54 and 0.15 per treated pouch, resp. The results suggest that the time of thymectomy in relation to DMBA treatment may be of importance and that thymectomy, when performed in 2-week old hamsters, inhibits DMBA tumorigenesis. The major effect of thymectomy performed in adult hamsters appears to be related to stress following surgery.

5806 INCREASED CYCLIC AMP LEVELS IN MALIGNANT HEPATIC NODULES OF ETHIONINE TREATED RATS. (E.) Chayoth, R. (U. Pittsburgh Sch. Med., Pa.), S. Epstein and J. B. Field. *Biochem Biophys Res Commun* 49(6):1662-1670, 1972.

Cyclic AMP levels were measured *in vivo* and *in vitro* in uninvolved liver, benign and malignant hepatic nodules of ethionine treated rats. The *in vivo* cyclic AMP concentration of 5.0 ± 0.5 nmoles/gm protein in malignant nodules was twice that in benign nodules and uninvolved liver. Values in tissue slices after sacrifice of anesthetized animals were identical to the *in vivo* levels. Cyclic AMP levels were higher in animals sacrificed by decapitation, but were not influenced by 20 minutes incubation. Concentrations in malignant nodules still exceeded those in other two tissues. The increased cyclic AMP concentrations in malignant nodules persisted whether the data was expressed on the basis of wet weight, protein or DNA.

5807 DETECTION OF THE PRINCIPAL PROTEIN TARGET OF A HEPATIC CARCINOGEN. (E.) Sami, B. P. (Inst. Cancer Res., Fox Chase, Philadelphia, Pa.), D. M. Mott, S. M. Szajman and S. Sorof. *Biochem Biophys Res Commun* 49(6):1598-1604, 1972.

Antiserum was prepared against the principal liver protein conjugate of the hepatic carcinogen, 3'-methyl-4-dimethylaminoazobenzene. One precipitin band was obtained when the antiserum reacted with the purified conjugate in double immunodiffusion gel analysis. The same anti-serum detected two proteins

in rat liver cytosol. Of these two proteins, one was immunoreactively identical to the purified antigen; in contrast, the other protein was only partly identical to it. Absorption of the antiserum with rat kidney cytosol yielded specific antiserum that reacted only with the protein that was immunologically identical to the purified conjugate. That protein, detected in normal rat liver cytosol, is apparently the principal protein target of the azocarcinogens in liver carcinogenesis.

- 5808 THE FORMATION OF VARIANTS WITH A REVERSION OF PROPERTIES OF TRANSFORMED CELLS. VII. *IN VITRO* LIMITED LIFE SPAN OF VARIANTS ISOLATED FROM TUMORS. (E.) Rabinowitz, Z. (Weizmann Inst. Sci., Rehovot, Israel) and L. Sachs. *Int J Cancer* 10(3):607-612, 1972.

Tumors were induced in hamsters following the s.c. inoculation of hamster embryo cells transformed *in vitro* by dimethylnitrosamine (DMNA). Cultures which were subsequently established from these tumor cells showed morphological and growth properties which differed from the original DMNA-transformed cell lines. These revertant cultures had a decreased saturation density and showed contact inhibition of cell replication. Revertant cells were able to form colonies on glutaraldehyde-fixed normal cells (unlike the original lines) and showed a decreased cloning efficiency on feeder layers and in soft agar. Like variants from tumors induced by polyoma virus-transformed cells, the revertant lines showed a higher tumor formation following s.c. inoculation into adult hamsters than did the original DMNA-transformed lines. Most (82-89%) of the variant colonies from tumors produced by DMNA-transformed cells exhibited a finite *in vitro* life span as compared to only 4% of the variant colonies from tumors produced by polyoma-transformed cells. Sixteen to 18% of the variant colonies isolated from DMNA-transformed cell tumors re-reverted to a transformed state as evidenced by re-establishment of a high saturation density and increased cloning efficiency on feeder layers and in soft agar.

- 5809 THE LEVELS OF SOME TRACE ELEMENTS IN TISSUES OF ANIMALS IN THE PROCESS OF THEIR SENSITIZATION TO METHYLCHOLANTHRENE. (Rus.) Kozhevnikova, E. P. (Orenburg Med. Inst., USSR). *Patol Fiziol Eksp Ter* 16(4):32-36, 1972.

CC57 mice received 0.2 mg methylcholanthrene into the right kidney; the same carcinogen in a benzene solution was brushed on the interscapular skin of these mice two months later. A control group of mice received the same dose of methylcholanthrene into the right kidney but did not receive the skin application. Trace elements in various tissues were determined by a spectral emission method four and six months after the first administration of the carcinogen and before the onset of morphological alterations associated with malig-

nant neoplasia. Zinc content in the kidney of experimental mice was significantly higher than that of controls four months after treatment. This difference disappeared by six months. Zinc tissue content for liver, spleen and skeletal muscle was comparable for both groups four months and six months after treatment. Copper content was higher in the spleen and lower in the skeletal muscle tissue of experimental mice at six months after treatment. No significant differences in manganese levels were found in the two groups of mice. In comparison with intact mice, zinc and copper levels were higher for both groups for all tissues studied, whereas manganese content was increased only in the kidney.

- 5810 TYPE C VIRUS FROM CELL CULTURES OF CHEMICALLY INDUCED RAT HEPATOMAS. (E.) Weinstein, I. B. (Columbia U. Coll. Physicians Surgeons, New York, N.Y.), R. Gebert, U. C. Stadler, J. M. Orenstein and R. Axel. *Science* 178(4065):1098-1100, 1972.

Evidence has been obtained for C-type virus production in cultures of various chemically induced rat hepatoma cell lines. Sucrose density centrifugation of medium from ³H-uridine prelabeled hepatoma cells consistently revealed a band of radioactivity at a density of 1.16 gm/cm³. Virus yield was markedly enhanced when the cells were first treated with bromodeoxyuridine followed by dimethyl sulfoxide. Electron microscopic observation of rat hepatoma cells revealed characteristic C-type particles associated with the plasma membrane. DNA polymerase assays suggested that the DNA polymerase associated with the C-type particles was deficient in reverse transcriptase activity. These results thus raise the possibility that activation of C-type viruses may play a role in the chemical induction of rat hepatomas.

- 5811 RESPONSE OF LYMPHOCYTES IN CHRONIC LYMPHOCYTIC LEUKAEMIA TO PLANT MITOGENS. (E.) Smith, J. L. (Dept. Med., U. Cambridge, England), D. C. Cowling and C. R. Barker. *Lancet* (7744):229-233, 1972.

Lymphocytes from 13 patients with chronic lymphocytic leukemia (CLL) were treated with each of three plant mitogens: phytohemagglutinin (PHA), pokeweed mitogen (PWM) or concanavalin A (Con A). Stimulation of CLL lymphocytes (and of normal cells as controls) by the three agents was measured by observing uptake of ³H-thymidine by treated cells. The reaction of CLL cells to PWM was of special interest in view of the theory that CLL arises from B cells, which are transformed by PWM. PHA caused maximal transformation of normal cells (a mean of 69% of cells in cultures were transformed by PHA); Con A caused a mean of 47% transformed cells and PWM caused a mean of 25% transformed cells. Lymphocytes from CLL donors showed markedly impaired responses to all three mitogens. One patient

with a high peripheral-blood lymphocyte-count gave a moderate response to Con A. It was suggested that leukemic cells may originate from B-cells, but that the cells are defective in that their recognition sites for PWM are altered or blocked.

- 5812 INDUCTION OF MALIGNANT TUMORS IN RATS AFTER TRANSPLACENTAL EXPOSURE TO N-ISOPROPYL- α -2-(METHYL-HYDRAZINE)-p-TOLUAMIDE HYDROCHLORIDE. (Ger.) Ivankovic, S. (German Cancer Res. Ctr., Heidelberg). *Arzneimittelforschung* 22(5):905-907, 1972.
- 5813 NUCLEOTIDE COMPOSITION OF MICE LUNG TISSUE DNA AND ITS REACTIVITY DURING BLASTOMOGENESIS INDUCED BY URETHAN. (Rus.) Grigorovich, N. A. (Sci. Res. Inst. Oncol. Med. Radiol. BSSR Min. Publ. Hlth., Minsk, USSR). *Dokl Akad Nauk SSSR* 16(7):661-663, 1972.
- 5814 LACK OF LONG-TERM EFFECTS OF THE ADMINISTRATION OF HEPTACHLOR TO SUCKLING RATS. (It.) Cabral, J. R. (Natl. Inst. Study Cure Tumors, Milan, Italy), M. C. Testa and B. Terracini. *Tumori* 88 (1):49-53, 1972.
- 5815 HISTOPATHOLOGICAL FEATURES OF MEDULLARY TUMORS INDUCED BY ONCOGENIC HYDROCARBON ADMINISTRATION INTO RAT BONE MARROW. (It.) Cotti, L. (Dept. Histopathol. Tech. Diagn. U. Genova, Italy). *Riv Anat Pat Oncol* 36(5-6-7-8):204-222, 1970.
- 5816 BRONCHIAL CARCINOMA AND SMOKING IN WOMEN. (Fr.) Lemoine, J. M. (Laennec Hosp., Paris, France) and J. Fauvet. *Rev Tuberc* 36(2):297-300, 1972.
- 5817 PRIMARY EPIDERMOID CARCINOMA OF THE BRONCHI AND SMOKING. (Fr.) Meyer, A. (Boucicaut Hosp., Paris, France), J. Rochemaure, G. Nadjar-Fosse and M. Bientz. *Rev Tuberc* 36(2):312-316, 1972.
- 5818 EMBRYONAL TISSUE CULTURE OF MURINE KIDNEYS AFTER TRANSPLACENTAL ACTION OF 4-DIMETHYL-AMINOAZOBENZENE AND DIETHYLAMINOAZOBENZENE. (Rus.) Golub', N. I. (Inst. Exp. Clin. Oncol. USSR Acad. Med. Sci., Moscow). *Bull Eksp Biol Med* 73(3):83-87, 1972.
- 5819 TRANSFORMATION *IN VITRO* BY POLYOMA VIRUS OF CELLS OF A HAMSTER TUMOR, INDUCED WITH 20-METHYLHOLANTHRENE. (Rus.) Parkhomenko, I. I. (Inst. Chem. Phys. USSR Acad. Sci., Moscow) and I. S. Irlin. *Vop Onkol* 18(2):52-57, 1972.
- 5820 THE EFFECT OF ALIMENTARY FACTORS ON THE GASTRIC FUNCTIONS AND GASTRIC CARCINOGENESIS. (Rus.) Arkhipov, G. N. (Inst. Nutr., USSR Acad. Med. Sci., Moscow). *Vop Pitan* 31(4):43-48, 1972.

- 5821 A STUDY OF THE POSSIBLE BLASTOMOGENIC ACTION OF TUBAZID AND PHTIVAZID IN EXPERIMENTAL ANIMALS. (Rus.) Linnik, A. B. (Inst. Exp. Clin. Oncol., Moscow, USSR). *Vop Onkol* 18(6):54-56, 1972.
- 5822 HORMONAL SHIFTS AND TUMOR LOCALIZATION IN RATS WITH A PERSISTENT ESTRUS. (Rus.) Anisimov, V. N. (N. N. Petrov Res. Inst. Oncol. USSR Ministry Public Hlth., Leningrad) and M. V. Pavlova. *Vop Onkol* 18(5):68-71, 1972.
- 5823 MESOTHELIOMA AND ASBESTOS. (Nor.) Solheim, O. P. (Norwegian Radium Hosp., Oslo) and O. Mathisen. *Nord Hyg T* 53(2):53-59, 1971.
- 5824 CHROMOSOME BREAKAGE BY 1-METHYL-2-BENZYL-HYDRAZINE IN MOUSE CANCER CELLS. (E.) Therman, E. (Dept. Med. Genetics, U. Wisconsin, Madison). *Cancer Res* 32(6):1133-1136, 1972.
- 5825 PHYSICAL STUDIES ON DEOXYRIBONUCLEIC ACID AFTER COVALENT BINDING OF A CARCINOGEN. (E.) Fuchs, R. (Res. Ctr. Macromolecules, Strasbourg, France) and M. Daune. *Biochemistry* 11(14):2659-2666, 1972.
- 5826 DIETHYLSTILBESTROL A KNOWN CANCER-INCITING DRUG IN MEATS FOR AMERICANS. (E.) Hunter, B. T. (No affiliation). *Consumer Bull* 55(8):17-19, 1972.
- 5827 HEPATOMAS INDUCED BY AFLATOXIN IN THE SOCKEYE SALMON (*ONCORHYNCHUS NERKA*). (E.) Wales, J. H. (Dept. Food Sci., Oregon State U., Corvallis) and R. O. Sinnhuber. *J Nat Cancer Inst* 48(5):1529-1530, 1972.
- 5828 THE EFFECT OF MEMBRANE-ACTIVE AGENTS ON THE MITOTIC FREQUENCY IN NORMAL AND CARCINOGEN-TREATED EPITHELIUM. (E.) Levi, I. S. (Hadassah U. Hosp., Jerusalem, Israel) and A. Polliack. *Experientia* 28(6):683-684, 1972.
- 5829 MAMMARY GLAND NUCLEAR RNA POLYMERASE ACTIVITIES IN PREGNANT, LACTATING, AND 7,12-DIMETHYLBENZ(a)ANTHRACENE-INDUCED MAMMARY TUMOR-BEARING RATS. (E.) Mendelson, I. S. (Dept. Path. Chem., U. Toronto, Ontario, Canada) and K. M. Anderson. *Can J Biochem* 50(6):644-653, 1972.
- 5830 TRANSPLACENTAL INDUCTION OF TUMORS OF THE NERVOUS SYSTEM. COMPARISON OF THE EFFECTS OF METHYL- AND ETHYLNITROSOUREA. (Ger.) Janisch, W. (Med. Acad., Erfurt, East Germany), D. Schreiber, R. Warzok and J. Schneider. *Arch Geschwulstforsch* 39(2):99-106, 1972.
- 5831 THE EFFECT OF THYMECTOMY ON TRANSPLACENTAL SENSITIZATION WITH SMALL DOSES OF 3-METHYL-

CHOLANTHRENE AND BENZOPYRENE. (Rus.) Andrianova, M. M. (Inst. Nutr., Acad. Med. Sci. USSR, Moscow). *Vopr Onkol* 17(12):63-66, 1971.

5832 ENHANCEMENT OF DRUG OXIDATION AND CONJUGATION BY CARCINOGENS IN DIFFERENT RAT TISSUES. (E.) Aitio, A. (Dept. Physiol., U. Turku, Finland), E. Vainio and O. Hänninen. *FEBS Letters* 24(3):237-240, 1972.

5833 ELECTRON MICROSCOPIC STUDY OF NEOPLASMS INDUCED BY URETHAN AND X-RAYS IN X/GF MICE. (E.) Goldfeder, A. (Cancer Radiobiol. Res. Lab., New York U., N.Y.). *Cancer Res* 32(12):2778-2792, 1972.

5834 TOXIC EFFECT OF 7,12-DIMETHYLBENZ- α -ANTHRACENE ON NEOPLASTIC CELLS GROWN IN MIXED CULTURES WITH NORMAL FIBROBLASTS. (E.) Mittelman, L. A. (Lab. Mathematical Biol., Moscow St. U., USSR), Ju. Ju. Sharovskaya and Ju. M. Vasiliev. *Int J Cancer* 10(3):667-674, 1972.

5835 ISOLATION AND CHARACTERIZATION OF AN ACTIVE DNA-BINDING METABOLITE OF BENZO(a)PYRENE FROM HAMSTER LIVER MICROSOMAL INCUBATION SYSTEMS. (E.) Wang, I. Y. (Cancer Res. Inst., U. California, San Francisco), R. E. Rasmussen and T. T. Crocker. *Biochem Biophys Res Commun* 49(4):1142-1149, 1972.

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5837 SEIZING MECHANISM AND FATE OF INTRANUCLEAR MITOCHONDRIA. (E.) Matsuyama, M. (Aichi Cancer Ctr. Res. Inst., Nagoya, Japan) and H. Suzuki. *Experientia* 28(11):1347-1348, 1972.

5838 LONG TERM RETENTION OF COLLOIDAL THORIUM DIOXIDE IN THE LIVER AND SPLEEN OF *XENOPUS LAEVIS* DAUDIN. (E.) Coleman, R. (Dept. Zoology, Bedford Coll., U. London, England) and A. D. Phillips. *Experientia* 28(11):1326-1327, 1972.

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5841 EPOXY DERIVATIVES OF AROMATIC POLYCYCLIC

HYDROCARBONS. THE SYNTHESIS OF DIBENZ-[a,e] ANTHRACENE 10,11-OXIDE AND ITS METABOLISM BY RAT LIVER PREPARATIONS. (E.) Sims, P. (Royal Cancer Hosp., London, England). *Biochem J* 130(1):27-35, 1972.

5842 MORPHOLOGICAL STUDIES OF ANGIOSARCOMAS INDUCED BY 1,2-DIMETHYLHYDRAZINE DIHYDROCHLORIDE IN SYRIAN GOLDEN HAMSTERS. (E.) Toth, B. (U. Nebraska Coll. Med., Omaha). *Cancer Res* 32(12):2818-2827, 1972.

5843 ASSOCIATION OF ANDROGENIC-ANABOLIC STEROID THERAPY WITH DEVELOPMENT OF HEPATOCELLULAR CARCINOMA. (E.) Johnson, F. L. (Children's Orthopedic Hosp., Med. Ctr., Seattle, Wash.), K. G. Lerner, M. Siegel, E. D. Thomas, J. R. Feagler, P. W. Majerus and J. R. Hartmann. *Lancet* 2(7790):1273-1276, 1972.

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5850 AN *IN VITRO* STUDY OF TRANSPLACENTAL EFFECT OF 7,12-DIMETHYLBENZ[a]ANTHRACENE IN

VARIOUS DOSES. (Rus.) Sorokina, Yu. D. (Inst. Exp. Clin. Oncol., Acad. Med. Sci. USSR, Moscow) and S. P. Bogovskii. *Biull Eksp Biol Med* 72(8):87-91, 1971.

5851 INFORMATION PROVIDED BY X-RAY DIAGNOSTICS IN SMALL ANIMALS DURING TUMOR INDUCTION AND THERAPY EXPERIMENTS. (Ger.) Bürkle, G. (Tübingen, W. Germany). *11th Meeting German Cancer Assoc Hannover (Sept):112-113, 1971.*

5852 NITROSAMINE SYNTHESIS OCCURRING IN BACTERIAN CULTURES. (Ger.) Sander, J. (Tübingen, W. Germany). *11th Meeting German Cancer Assoc Hannover (Sept):76-77, 1971.*

5853 ON THE RELATIONSHIP BETWEEN THE INFLAMMATORY AND COCARCINOGENIC ACTION OF PHORBOL DERIVATIVES. (Ger.) Fürstenberger, G. (Heidelberg, Germany), E. Henseleit and E. Hecker. *11th Meeting German Cancer Assoc Hannover (Sept):78, 1971.*

5854 ALKYLATION OF RAT LIVER AND RAT EMBRYO NUCLEIC ACIDS BY MEANS OF ETHYLNITROSOUREA AND DIETHYLNITROSAMINE. (Ger.) Goth, R. (Tübingen, W. Germany), J. Oberbarnscheidt and M. F. Rajewsky. *11th Meeting German Cancer Assoc Hannover (Sept):78-80, 1971.*

5855 REVERSIBLE AND IRREVERSIBLE CYTOPLASMIC ALTERATIONS OCCURRING IN NITROSAMINE-POISONED HEPATOCYTES. (Ger.) Bannasch, P. (Würzburg, W. Germany), J. Papenburg and W. Ross. *11th Meeting German Cancer Assoc Hannover (Sept):80-81, 1971.*

5856 REVERSIBILITY OF NUCLEAR SIZE ALTERATIONS OCCURRING IN THE NITROSAMINE-POISONED RAT LIVER. (Ger.) Romen, W. (Würzburg, Germany), W. Ross and P. Bannasch. *11th Meeting German Cancer Assoc Hannover (Sept):82-83, 1971.*

5857 CARCINOGENESIS *IN VITRO*: STUDIES ON THE MECHANISM OF ACTION OF BIOLOGICALLY ACTIVE ESTERS. (Ger.) Süß, R. (Heidelberg, W. Germany), J. Horn, M. Ebenhöf, J. Steinmann, I. Schubert and V. Kinzel. *11th Meeting German Cancer Assoc Hannover (Sept):75-76, 1971.*

5858 INDUCTION OF MALIGNANT OVARIAN TUMORS IN RATS. (Ger.) Hilfrich, J. (Hannover, W. Germany) and U. Mohr. *11th Meeting German Cancer Assoc Hannover (Sept):67-68, 1971.*

5859 MOUSE EMBRYO SKIN EPIDERMIS CELL CULTURES - A POSSIBLE MODEL IN THE STUDY OF CHEMICAL CARCINOGENESIS *IN VITRO*. (Ger.) Fusenig, N. E. (Heidelberg, W. Germany), W. Thom and S. M. Amer. *11th Meeting German Cancer Assoc Hannover (Sept):21-22, 1971.*

5860 THE ACTION OF VARIOUS CELL-FREE EXTRACTS ON CHEMICAL CARCINOGENESIS IN MICE. (Ger.) Stoldt, H. (Hamburg, W. Germany), D. Krebs, H. Horst and M. Zimmer. *11th Meeting German Cancer Assoc Hannover (Sept):20-21, 1971.*

See also:

- * (Rev): 5709, 5719, 5720, 5733, 5741, 5754
- * (Phys): 5862, 5871
- * (Immun): 5968, 5993, 6019, 6048, 6049
- * (Epid-Biom): 6098, 6099

- 5861 UNSCHEDULED DNA SYNTHESIS IN SOME SPONTANEOUS HUMAN TUMORS. (E.) Norman, A. (UCLA Sch. Med., Los Angeles, Calif.), R. E. Ottoman, P. Chan and I. Klisak. *Mutat Res* 15(3):358-360, 1972.

Seventeen histologically identified spontaneous human tumors were studied to determine whether or not they had the ability to undergo unscheduled DNA synthesis (DNA repair) following exposure to UV irradiation. Single cell suspensions of ovarian, endometrial, cervical, breast, colonic, and oral cancers obtained surgically were first exposed to UV light and then grown for a period in medium containing ^3H -thymidine. The extent of thymidine incorporation into DNA was determined by autoradiography. All of the tumor samples exhibited unscheduled DNA synthesis. The median grain counts over the nuclei of irradiated samples were at least five times those over the nuclei of the unirradiated controls. It was thus concluded that the mutations which occur in xeroderma pigmentosum cells, and which result in a severely depressed ability to undergo DNA repair, are not commonly associated with spontaneous tumors in man.

- 5862 EXAMINATION OF THE CARCINOGENIC AND COCARCINOGENIC EFFECTS OF GRENZ RADIATION. (E.) Epstein, J. H. (U. California Sch. Med., San Francisco). *Cancer Res* 32(12):2625-2629, 1972.

The effects of the chemical carcinogen 7,12-dimethylbenz(a)anthracene (DMBA) on long-wavelength ionizing radiation (grenz ray)-induced carcinogenesis in the skin of hairless mice were examined. The hairless mice were divided into four groups. In Group I (35 mice), the back of each mouse received a single application of acetone. Four weeks later, the backs of these animals were exposed to 100 R from a grenz ray source three times a week for 4.5 months and five times a week for seven months (a total of 20,500 R). In Group II (32 mice), the back of each mouse received a single 100- μg application of DMBA followed by irradiation as in Group I. The 25 Group III mice received the DMBA application as in Group II but no grenz ray exposures. The 41 Group IV mice received the acetone application but no irradiation. A single application of DMBA four weeks before the initiation of the grenz ray exposures resulted in a significant acceleration of tumor growth and an increased incidence of deeply invading cancers. Over a 12 month period 7 of 32 surviving Group I mice developed tumors; 18 of 28 Group II surviving mice developed tumors; 9 of 23 Group III surviving mice developed tumors and none of 32 surviving Group IV mice developed tumors. These findings demonstrate the influence of 7,12-dimethylbenz(a)anthracene on ultraviolet-induced cancer formation and confirm the additive effects of physical and chemical carcinogenic stimuli.

- 5863 THE REJOINING OF X-RAY-INDUCED DNA STRAND BREAKS IN NUCLEI ISOLATED FROM EHRLICH ASCITES TUMOR CELLS. (E.) Matsudaira, H. (Natl.

Inst. Radiol. Sci., Chiba, Japan) and I. Furuno. *Biochim Biophys Acta* 272(2):202-211, 1972.

Ehrlich ascites tumor cells from albino ddN mice were irradiated (340 R/min for 5 min) to induce single-stranded DNA breaks. After irradiation, isolated nuclei were incubated with cytoplasmic supernatants prepared from unirradiated Ehrlich cells and supplemented with ATP, NAD or NMN and sodium 3-phosphoglycerate. Other irradiated nuclei were incubated under similar conditions but in a solution containing bovine plasma albumin. Nuclear suspensions in cytoplasmic supernatants or bovine plasma-containing solution were subjected to sedimentation through alkaline sucrose gradients to observe the rejoining of X-ray induced DNS breaks. Incubation of DNA with cytoplasmic supernatant supplemented with ATP, NAD and 3-phosphoglycerate produced optimal rejoining. No rejoining was observed following incubation without cytoplasmic supernatant. Bovine plasma albumin was ineffective even in the presence of ATP, NAD and 3-phosphoglycerate, or when supplemented with pyruvate kinase and phosphoenolpyruvate. Possible mechanisms, including polynucleotide ligase reaction, underlying the rejoining of X-ray induced single-strand breaks are discussed.

- 5864 IMMUNE CYTOLYSIS AND X IRRADIATION: INDEPENDENT LETHAL ACTION IN CHINESE HAMSTER CELLS IN VITRO. (E.) Shipley, W. U. (Nat Cancer Inst., Bethesda, Md.). *J Nat Cancer Inst* 48(3):651-655, 1972.

Chinese hamster lung cells (CHL) in culture were exposed to 600 rads X-irradiation before and after addition of rabbit hyperimmune antiserum prepared against whole CHL cells. The extent of complement-mediated cytolysis in CHL pretreated with radiation, and in CHL irradiated after pretreatment with antiserum, was measured by the loss of colony-forming ability. The anti-serum survival curve (single cell surviving fraction vs. antiserum concentration) for cells surviving irradiation pretreatment was similar to that for unirradiated cells. Moreover, the X-ray survival curve for cells treated with antiserum was identical to that for cells not exposed to antiserum. It was concluded that there is no interaction between cytolysis by X-ray and cytolysis by immune serum.

- 5865 GROWTH DYNAMICS OF THE Pu^{239} -INDUCED OSTEOSARCOMA. (Rus.) Pesternikov, V. M. (Biophys. Inst., USSR Min. Pub. Hlth., Moscow) and Z. M. Bukhtoyarova. *Med Radiol* 17(3):19-22, 1972.

- 5866 LONG-TERM EFFECTS OF LOW IRRADIATION DOSES IN URANIUM MINE WORKERS AND POSSIBILITIES OF THEIR PREVENTIVE TREATMENT WITH DRUGS. (Ger.) Adámek, M. (Natl. Hlth. Inst. of Uranium Industry, Příbram, Czechoslovakia), K. Roth and M. Stepánková. *Österreichische Z Krebskrankh* 26(3):192-200, 1971.

5867 Ph_1 CHROMOSOME ASSOCIATED WITH CHANGES OF CLONAL EVOLUTION IN ACUTE LEUKEMIA. (Rum.) Motoiu-Raileanu, I. (Inst. Internal Med., Bucharest, Romania) and St. Berceanu. *Stud Cercet Med Interna* 12(6):537-548, 1971.

5868 EXPERIMENTAL STUDIES OF RENAL DAMAGE FOLLOWING IRRADIATION. (Jap.) Tanaka, T. (Sch. Med., Showa U., Japan). *J Showa Med Assoc* 31(6):16-26, 1971.

5869 NEURINOMA AS A RESULT OF TRAUMA. (Ger.) Radochay, L. (Med. U. Pecs, Hungary) and M. Temesi. *Arch Orthop Unfallchir* 73(1):66-71, 1972.

5870 MALIGNIZATION OF OSTEOSTEOSTOMA FOLLOWING RADIATION THERAPY APPLIED LONG AGO. (Rus.) Kaliteyevsky, P. F. (City Clin. Hosp., Moscow, USSR) and R. A. Kheifets. *Arkhl Patol* 34(5):78-81, 1972.

5871 A MUTATIONAL ASSAY SYSTEM USING THE THYMIDINE KINASE LOCUS IN MOUSE LYMPHOMA CELLS. (E.) Clive, D. (Natl. Inst. Environmental Hlth. Sci., Research Triangle Park, N.C.), W. G. Flamm, M. R. Machesko and N. J. Bernheim. *Mutat Res* 16(1):77-87, 1972.

5872 EARLY ULTRASTRUCTURAL EFFECTS OF IONIZING RADIATION. I. MITOCHONDRIAL AND NUCLEAR CHANGES. (E.) Jordan, S. W. (U. New Mexico Sch. Med., Albuquerque), P. N. Dean and J. Ahlquist. *Lab Invest* 27(6):538-549, 1972.

5873 COPPER AND MANGANESE IN NUCLEIC ACIDS IN NORMAL AND WITH EXPERIMENTAL LEUCOSIS IN RATS. (Rus.) Bala, Yu. M. (Med. Inst., Voronezh, USSR) and V. M. Lifshits. *Ukr Biokhim Zh* 44(4):465-467, 1972.

5874 ALTERATIONS IN SOME PROPERTIES OF ADENOVIRUS, TYPE 12 AFTER UV-IRRADIATION. (Rus.) Ageenko, A. I. (P. A. Herzen Res. Inst. Oncology, Moscow, USSR), N. A. Chutkov, N. M. Kholmukhamedova and A. N. Saprin. *Vopr Onkol* 18(9):43-45, 1972.

See also:

5875 ROLE OF TRAUMA IN TUMORIGENESIS OF THE JAW AND FACIAL REGION. (Ger.) Momma, W. (Düsseldorf, W. Germany) and H. Koch. *11th Meeting German Cancer Assoc Hannover (Sept)*:63-64, 1971.

* (Rev): 5702, 5703, 5755
* (Chem): 5792, 5833
* (Viral): 5890
* (Immun): 5968

- 5876 RNA-DEPENDENT DNA POLYMERASE ACTIVITY OF RNA TUMOR VIRUSES: II. DIRECTING INFLUENCE OF RNA IN THE REACTION. (E.) Leis, J. P. (Albert Einstein Coll. Med., Bronx, N.Y.) and J. Hurwitz. *J Virol* 9(1):130-142, 1972.

The role of RNA in DNA synthesis catalyzed by the purified DNA polymerase from avian myeloblastosis virus (AMV) was studied. Heat inactivation studies with AMV polymerase showed that polymerase activity with either DNA or RNA primers was inactivated at the same rate, indicating that one enzyme was responsible for both activities. Synthesis of DNA from an AMV RNA template by an AMV polymerase preparation containing no detectable ribonuclease activity (pII) required Mg^{++} , sulfhydryl reagents, and all four deoxyribonucleotide triphosphates. Activity showed a broad pH range (7.8-9.0), with a maximum at pH 8.2. AMV polymerase pII also directed DNA synthesis from RNA templates isolated from Rous sarcoma virus, Rauscher leukemia virus, phages f2, MS2 and Q β , bulk *E. coli* tRNA, and the synthetic homopolymer poly(A).poly(U). From 30 to 75% of the template activity of RSV and AMV RNA remained after heating at 80°C in buffer of low ionic strength. Incorporation experiments showed that only a limited amount of deoxynucleotide (equivalent to 3% of the added RNA primer) was incorporated into newly synthesized DNA. The single-stranded regions of AMV RNA were essential for template activity. Examination of the product of the AMV DNA polymerase and AMV RNA by various chemical and enzymatic methods identified it as DNA. It sedimented in alkaline sucrose gradients at 6 to 7S. The immediate polymerase product was identified as an RNA-DNA hybrid linked by covalent bonding, on the basis of the banding pattern in neutral sucrose gradients, digestion patterns with *Neurospora* or mung bean I nucleases, and analysis by Cs_2SO_4 equilibrium density gradient centrifugation. Deoxynucleotide incorporation occurred at the 3'-OH end of a poly d(AT) copolymer primer strand.

- 5877 TRANSFORMATION OF RHESUS FORESKIN CELLS BY MASON-PFIZER MONKEY VIRUS. (E.) Pienta, R. J. (Litton Bionetics, Bethesda, Md.), D. L. Fine, T. Hurt, C. K. Smith, J. C. Landon and H. C. Chopra. *J Nat Cancer Inst* 48(6):1913-1917, 1972.

Continuous lines of rhesus foreskin cells (rhfs-1 and rhfs-2) were infected with Mason-Pfizer monkey virus (M-PMV). Transformed cells were detected by their ability to grow in suspension when inoculated into semisolid agar medium. Further evidence for *in vitro* transformation by M-PMV was loss of contact inhibition on continued culture and the ability to grow in factor-free medium (Dulbecco's modified medium containing 10% agamma bovine serum previously heated at 70°C for 30-45 min). Transformed colonies showed altered morphology and contained both multinucleated and giant cells. The cells released virus as determined by electron microscopy and the ability to induce cytopathic effects in rhfs-2 cells. Tumorigenicity of transformed cells was shown by the ability to form palpable tumors at the site of inoculation within one wk following s.c. injection of 2×10^6 cells into newborn rhesus monkeys.

- 5878 SIALYL TRANSFERASE ACTIVITY IN NORMAL AND RNA- AND DNA-VIRUS TRANSFORMED CELLS UTILIZING DESIALYZED, TRYPSINIZED CELL PLASMA MEMBRANE EXTERNAL SURFACE GLYCOPROTEINS AS EXOGENOUS ACCEPTORS. (E.) Bosman, H. B. (U. Rochester Sch. Med. Dent., N.Y.). *Biochem Biophys Res Commun* 49(5):1256-1262, 1972.

An acceptor fraction of 3T3, PY-3T3, MSV-3T3, or RSV-3T3 cells was prepared by incubation of the whole cells with neuraminidase followed by trypsin digestion. Using this dialyzed, trypsinized acceptor fraction and detergent homogenates of the cell lines, the virally transformed cells were found to have 1.5 to 6.1 times as much sialyl transferase activity with CMP-NANA- ^{14}C as substrate than the 3T3 cells. Up to 30% of the sialyl transferase activity was expressible on the external plasma membrane of the cells. The acceptor fractions of the transformed cells contained about 1.5 times as many sites for transfer of NANA on a mg protein basis as did the 3T3 cells. By use of a trypsin treated, but not neuraminidase treated, cell acceptor fraction, it was determined that the virally transformed cells had higher amounts of incomplete glycoproteins on their surfaces that would function as acceptors in the sialyl transferase reaction, possibly because of higher levels of degradative enzymes which represent a form of sub-lethal autolysis in the transformed cells.

- 5879 ISOLATION OF AGMK CELLS PARTIALLY RESISTANT TO SV40: IDENTIFICATION OF THE RESISTANT STEP. (E.) Reznikoff, C. (Children's Hosp., Med. Ctr. Boston, Mass.), P. Tegtmeyer, C. Dohan, Jr. and J. F. Enders. *Proc Soc Exp Biol Med* 141(2):740-746, 1972.

African green monkey kidney cell (AGMK) monolayer cultures were infected with SV40. While the usual result was eventual complete cell lysis, some colonies of SV40-resistant cells survived as chronically SV40-infected cultures. Three such chronically infected lines were maintained in a culture medium containing rabbit anti-SV40 serum. From one of these lines three clones were established in the presence of anti-SV40 serum and designated SV40 resistant clones 1, 2 and 3. The three resistant clones were free of SV40 T antigen and produced no infectious SV40. Cells from these clones were not tumorigenic in the hamster cheek pouch. All clones showed partial resistance to reinfection with SV40 at high or low multiplicities of infection. One resistant clone resisted infection with SV40 virus but was susceptible to infection with isolated SV40 DNA.

- 5880 REVERSIBLE SUPPRESSION OF ALKALINE PHOSPHATASE IN HUMAN THYROID MEDULLARY CARCINOMA CELLS TRANSFORMED BY SV40. (E.) Wivel, N. A. (Natl. Cancer Inst., Bethesda, Md.) and P. M. Grimley. *Proc Soc Exp Biol Med* 139(2):627-630, 1972.

Primary cultures were initiated with explants of fresh surgical specimens of thyroid medullary carcinomas from two kindred males (56 and 26 yr) with multiple endocrine neoplasia. Some of the primary cultures were infected with and transformed by SV40. At selected intervals, alkaline phosphatase activity was determined by *in vitro* assay of infected and uninfected cultures. Enzyme activity was consistently demonstrated in serial subcultures of the two uninfected carcinoma lines. Enzyme activity in the SV40-transformed thyroid carcinoma lines was negligible. However, alkaline phosphatase activity in the transformed lines could be restored to preinfection levels by incubation of the cells with hydrocortisone (2.5 µg/ml). Enzyme induction occurred over a period of ten days after which time levels remained constant. No steroid induction of alkaline phosphatase was observed in uninfected thyroid carcinoma cells. Returning infected cells to medium without hydrocortisone caused enzyme activity to fall to pretreatment levels within 96 hr. Experiments using permissive African green monkey kidney cells infected with SV40 indicated that the production of virus was not associated with an increase in alkaline phosphatase activity.

5881. USE OF THE MOLECULAR HYBRIDIZATION TECHNIQUE *IN SITU* TO OBTAIN ELECTRON MICROSCOPIC EVIDENCE FOR VEGETATIVE DNA REPLICATION IN SHOPE VIRUS-INDUCED PAPILLOMAS OF THE COTTONTAIL RABBIT. (Fr.) Croissant, O. (Gustave-Roussy Inst., Villejuif, France), C. Dauguet, P. Jeanteur and G. Orth. *CR Acad Sci (Paris)* 274(4):614-617, 1972.

Electron microscope studies have shown evidence of vegetative replication of viral DNA and of its localization in skin papillomas induced in cottontail rabbits by Shope virus after *in situ* hybridization of viral DNA with tritiated complementary RNA. The molecular hybridization technique *in situ* furnishes autoradiographic evidence of repetitive nucleotide sequences in cytological sections. Papilloma sections were fixed, incubated with tritiated RNA complementary to viral DNA, washed, incubated with an RNase solution, and fixed with glutaraldehyde and osmium tetroxide. Ultrathin sections were mounted between histological slides which were kept for three months at 4 C in darkness, after which latent images were brought out by a gold stain and a developer. The preparations were examined by electron microscope and the labeling rate measured after three months exposure. Neither the thickness of the sections nor glutaraldehyde fixation interfered with the formation of RNA-DNA hybrids. The induction of vegetative replication of viral DNA was detected in the nuclei of cells in the lower third and middle of the *stratum granulosum*. Small numbers of silver grains in the labeled cells were observed in condensed peripheral and nucleolar chromatin or, more frequently, were dispersed in the nucleoplasm. The labeling rate increased with the migration of cells to the surface, reaching 100-350 grains per 10 µ² in the nuclei of cells above the *stratum granulosum*. The observations did not show whether vegetative replication took place preferentially in the nuclear membrane or the chromatin. A long latent period was detected between viral DNA

replication and the appearance of the first virions. Large amounts of free viral DNA were found in imperfectly keratinized cells which suggest that an important fraction of viral DNA is destroyed in the last stage of keratinization.

5882 FATE OF VIRUS DNA IN THE ABORTIVE INFECTION OF HUMAN LYMPHOID CELL LINES BY EPSTEIN-BARR VIRUS. (E.) Jehn, U. (Karolinska Inst., Stockholm, Sweden), T. Lindahl and G. Klein. *J Gen Virol* 16(3):409-412, 1972.

The fate of ³H-prelabeled Epstein-Barr (EB) virus DNA was investigated after abortive superinfection of two different human lymphoid cell lines (Raji and NC37). At 40 hr after infection when "early antigen" was being expressed, the cells were lysed and the cellular distribution of radioactivity was determined. Approximately 50% of the total intracellular radioactivity was found in the nuclei. More than 50% of this ³H-labeled nuclear DNA was present in a DNase-sensitive form. Sucrose density and CsCl equilibrium density centrifugation studies showed that the labeled intranuclear DNA was undegraded, non-integrated EB virus DNA. These results therefore did not support the concept of covalent association between virus DNA and cellular DNA, and integration of virus DNA on a scale observed in other systems. It was also concluded that the observed expression of early virus functions 20 to 50 hr after superinfection of lymphoid cells may depend on transcription of the incoming EB virus DNA.

5883 DETECTION OF LEUKEMIA-LIKE VIRUSES A AND B IN HEp-2 CELL CULTURES OF A STABLE CELL LINE OF HUMAN LARYNGEAL CANCER. (Rus.) Il'in, K. V. (N. F. Gamaleya Inst. Epidemiol. Microbiol., Acad. Med. Sci. USSR, Moscow), A. F. Bykovskii and Zh. Zh. Spure. *Biull Eksp Biol Med* 73(2):86-89, 1972.

Viruses were detected in the cultures of transplantable HEp-2 cells from human laryngeal cancer. Trypsinized cultures of rabbit kidney tissue and human 4-month-old embryonal cells were incubated at 37 C for 7-10 days in a concentration of 50,000 cells/ml in a nutrient medium containing 10% Hank's solution, 0.5% lactalbumin hydrolysate, and 20% bovine serum. HEp-2 culture incubated in a similar medium was filtered and the cell-free filtrate inoculated on monolayers of rabbit kidney cells or human embryonal cells at 37 C for 4 hr, after which nutrient medium was added for culture growth. Twenty-five days post-infection the liquid phase of this culture, obtained by filtration through a G-4 glass plate, was subjected to centrifugation. Aliquots of the sediment in combination with Freund's adjuvant were inoculated to rabbits (intrapopliteal lymph node) for immunization. Rabbit serum obtained 16 days after inoculation was added to intact human embryo cells and the latter subjected to indirect fluorescence antibody studies 30 days later. Monolayer cultures were subjected to electron microscopy after 20 days of growth. Type A and B

viruses were detected in HE_p-2 cell cultures and in the infected rabbit kidney and human embryo cells. The viruses were capable of showing productive cycle in cultures of rabbit kidney cells and human embryonal cells, but did not cause cytopathological and transformational changes in the cells. Virus nucleoids of type A (diameter 500-550 Å) were localized in the cytoplasm of interphase and dividing cells. The external membrane of the virion type A (diameter 850-950 Å) was formed from elements of the cytoplasmic membrane. The membrane of the nucleoid of the virus type B (diameter 400-450 Å) is formed from the membrane of the endoplasmic reticulum. The external membrane of the virion of type B (diameter 900-950 Å) is formed from the cytoplasmic membrane. The cytoplasm of infected human embryonal cells showed antibodies in response to immune serum, indicating the presence of a virus.

- 5884 IMMUNOLOGICAL CROSS REACTIONS BETWEEN VIRUS PRODUCING AND NONVIRUS PRODUCING MAMMARY CARCINOMAS IN MICE. (Ger.) Zotter, St. (Med. Acad. Carl Gustav Carus, Dresden, East Germany), C. Kemmer, M. Müller and B. Micheel. *Arch Geschwulstforsch* 40(1):23-34, 1972.

Immunological cross reactions are described between mammary tumor virus (MTV)-producing mammary tumors (MT) and an apparently virus-free MT, which indicate the existence of a virus-coded cell antigen in these tumors. The studies were carried out with four MTs from syngeneic CBA/B1n mice immunized with a purified MTV preparation. Two carcinomas (MT 4814/24 and MT 8020/15) were virus-free, virus production could not be definitely demonstrated in a third carcinoma (MT 9915/5), and one which had been transformed since the sixth generation and originated from a virus-containing tumor (MT 7782/11) had become virus-free. The membrane immune fluorescence test was positive for tumors MT 4814 and 8020 and negative for MT 9915 and 7782. During the examination of the cell suspensions under the electron microscope, budding and mature MTV particles were seen in MT 4814 and 8020, following incubation with syngenic hyperimmune sera. In addition to virus labeling, deposits of ferritin complexes were seen in the virus-containing tumors; MT 9915 cell membrane was similarly marked. Normal CBA serum showed no

membrane deposits of this nature, the ferritin complexes occurring in random fashion with no relationship to the cell membrane. Ferritin labeling was not seen in the transformed MT 7782. Growth of MT 8020 and MT 9915 was significantly inhibited by mixtures with hyperimmunized spleen and peritoneal cells from CBA female mice, whereas growth of MT 7782 was not affected by these cells.

- 5885 TYPE C VIRUS PARTICLES IN CELL-FREE-INDUCED SARCOMAS OF SYRIAN HAMSTERS. (Ger.) Graffi, I. (Central Inst. Cancer Res., Berlin, East Germany), E. Bender, T. Schramm and A. Graffi. *Arch Geschwulstforsch* 39(4):281-292, 1972.

Electron microscopic investigations of virus particles in cell-free filtrate-induced hamster sarcomas are presented. Most of the sarcomas (fibrosarcomas or spindle cell sarcomas) induced by the cell-free filtrates from hamster skin epitheliomas developed at the inoculation site in the subcutis of the animal's back or side trunk. Virus particles at different stages of maturity were observed in various of these sarcomas. All virus particles exhibited a common basic structure featuring a well-defined envelope and a nucleoid with a sharply delineated membrane. Sometimes the particles appeared somewhat deformed indicating degenerative alterations. The total particle diameter averaged 80-100 nm and that of the nucleoid ranged between 55 and 60 nm. Particle maturity could be evaluated according to the electron optical density of the nucleoid. Virus particles occurred in both intercellular spaces and cytoplasm but were never detected in the nucleus of the sarcomatous cells. Their structural features corresponded to those of C-type viruses indicating that cell-free filtrate induction of sarcoma occurs through typical C-particle viruses.

- 5886 GAZDAR STRAIN OF MURINE SARCOMA VIRUS. BIOLOGIC AND ANTIGENIC INTERACTIONS WITH THE HETEROLOGOUS HAMSTER HOST. (E.) Sarma, P. S. (Nat'l. Cancer Inst., Bethesda, Md.), A. F. Gazdar, H. C. Turner and P. D. Kunchorn. *Proc Soc Exp Biol Med* 140(3):928-933, 1972.

Newborn hamsters were inoculated s.c. with Gazdar strain murine sarcoma virus (Gz-MSV). Undifferentiated, transplantable sarcomas developed at the site of inoculation by 21-45 days. Partially purified concentrates of primary and transplanted Gz-MSV hamster tumors were free of demonstrable infectious MSV or MuLV as tested by inoculation into newborn BALB/c and NIH Swiss mice and by a tissue culture complement-fixing antigen induction test, the COMUL test *in vitro* in cultures of NIH Swiss MEF and Syrian hamster embryo fibroblasts. Electron microscopic examination of primary and tissue culture cell lines derived from transplanted tumors showed mature and budding C-type virus particles. Gz-MSV-induced hamster tumors contained high titers of the MuLV species-specific group specific (gs) antigen. Hamsters with primary or transplanted Gz-MSV tumors developed complement fixing (CF) serum antibodies against the gs antigens of the mouse C-type viruses present in Moloney MSV rat tumors and in Rauscher leukemia virus preparations. These sera also reacted with hamster and mouse preparations of homologous Gz-MSV, but did not react against preparations of SV40 or polyoma virus-induced hamster tumors. The gs antisera from Gz-MSV tumor-bearing hamsters were as efficient as Moloney MSV tumor-bearing rat sera in detecting murine leukemia gs viral antigens and infectious virus in the COMUL test.

- 5887 PARTIALLY DOUBLE-STRANDED RNA IN MOUSE SPLEEN CELLS: THE EFFECT OF RAUSCHER

VIRUS INFECTION. (E.) Kissel'ov, F. L. (USSR Acad. Med. Sci., Moscow), L. A. Semjonova, I. S. Irlin and G. G. Shatalova. *Arch Gesamte Virusforsch* 36:265-274, 1972.

Rauscher leukemia virus (RLV)-containing plasma from leukemic BALB/c mice was injected i.v. into mice. RNA was isolated from spleens of recipients, fractionated in sucrose gradients and further fractionated on cellulose columns. A partially double-stranded RNA fraction (designated RNA-x) which eluted with STE (NaCl, Tris-HCl buffer, EDTA) was detected. RNA-x consisted of a population of heterogeneous molecules. It had a more ordered structure than typical single-stranded RNAs as indicated by its lower buoyant density. RNA-x appeared to be synthesized in infected cells. When mice were injected with RLV preparations on different multiplicities of infection, it was found that mice given high multiplicities produced large amounts of RNA-x. In C⁵⁷/BL mice insensitive to RLV, the amount of RNA-x after infection did not exceed the normal level. These results suggest that RNA-x synthesis is specific to mice undergoing RLV oncogenesis.

5888 THE LYMPHOCYTE RESPONSE TO A PRIMARY VIRAL NEOPLASM (MSV) THROUGH ITS ENTIRE COURSE IN BALB/c MICE. (E.) Lamon, E. W. (Dept. Tumor Biol., Karolinska Inst., Stockholm, Sweden), H. M. Skurzak and E. Klein. *Int J Cancer* 10(3):581-588, 1972.

BALB/c mice injected with Moloney sarcoma virus (MSV) developed tumors within 5-8 days which usually completely regressed by day 20-25. Maximal tumor size was around day 15. Lymphocytes from these animals were examined for activity against target cells bearing the Moloney leukemia virus (MLV) associated cell surface antigen at 2- to 5-day intervals for 30 days. Significantly cytotoxic lymphocytes were obtained from animals which had developed no palpable tumor as early as two days after infection and from animals in which tumors had completely regressed. The least active lymphocytes were from tumor-bearing animals. The cytotoxicity of the active lymphocytes was demonstrated to be antigen-specific by testing also against cells which were MLV-negative.

5889 INDUCTION OF MOUSE TUMOURS BY MEANS OF VIROGENIC RAT TUMOUR CELLS CONTAINING NON-INFECTIOUS ROUS SARCOMA VIRUS GENOME. (E.) Bubenik, J. (Inst. Exp. Biol. Genetics, Czechoslovak Acad. Sci., Prague), M. Baresova, V. Sovova, H. Sainerova and L. Donner. *Folia Biol (Praha)* 18(2):154-159, 1972.

The RSL rat tumor, induced by Schmidt-Ruppin Rous sarcoma virus, was established in tissue culture. Cultured RSL cells produced sarcomas on i.m. or s.c. injection into C57BL/10Sn mice, though neither cell-free material nor tissue culture fluid from RSL cultures produced tumors in mice. The sarcomas produced by RSL cells in mice were designated RSM.

RSM could be passaged in C57BL/10Sn mice but not in rats of the strain in which RSL was originally induced. *In vitro*, RSM grew more slowly than RSL; further, RSL contained a group-specific avian leukovirus antigen while RSM did not. RSM tumor cells were karyologically mouse cells. RSL cells, transplanted in chickens, gave rise to sarcomas which produced Rous sarcoma virus. RSM cells were not sarcomagenic chickens. Neither cell-free material nor culture fluid from RSL or RSM cells was sarcomagenic in chickens.

5890 ULTRASTRUCTURAL CHARACTERIZATION OF HAMSTER CELLS TRANSFORMED FOLLOWING EXPOSURE TO ULTRAVIOLET-IRRADIATED HERPES SIMPLEX VIRUS TYPE 2: (E.) Glaser, R. (M. S. Hershey Med. Ctr., Pennsylvania State U.), R. G. Duff and F. Rapp. *Cancer Res* 32(12):2803-2806, 1972.

Hamster embryo fibroblasts were transformed *in vitro* following exposure to UV-irradiated HSV-2. When cells from these cultures were inoculated into newborn hamsters, solid tumors developed. Continuous cell cultures of the tumor specimens were established. The virus-transformed cells, the solid tumors, and the tumor cell cultures were examined by electron microscopy. The transformed cultures and tumors contained cells with nuclei in which the chromatin had become condensed and marginated; this picture resembled the cytopathology induced during lytic infection by herpes simplex virus. These abnormalities were observed in some cell culture lines established from the tumors. Virus-like particles, similar in size and morphology to nonenveloped herpesvirus, were found in the nuclei of a small number of degenerating cells in some of the specimens examined.

5891 EXPERIMENTAL MALIGNANT TUMORS FROM RETINAL PIGMENT EPITHELIUM. (E.) Albert, D. M. (Yale U. Sch. Med., New Haven, Conn.), M. O. M. Tso and A. S. Rabson. *Arch Ophthalmol* 88(1):70-74, 1972.

Retinal pigment epithelium (RPE) from hamster eye was infected with simian vacuolating virus 40 and cultured. Transformed infected RPE tissue was injected s.c. into irradiated (400 roentgens) hamsters. Three wk later, all injected animals had developed malignant injection site tumors. The tumors metastasized to various sites, including lung, liver and brain, and killed their hosts by eight wk postinjection. The tumors were made up of spindle-shaped and epithelioid cells, and resembled human RPE tumors.

5892 DEGRADATION OF DNA RNA HYBRIDS BY RIBONUCLEASE H AND DNA POLYMERASES OF CELLULAR AND VIRAL ORIGIN. (E.) Keller, W. (Cold Spring Harbor Lab., N.Y.) and R. Crouch. *Proc Nat Acad Sci USA* 69(11):3360-3364, 1972.

Ribonuclease H (RNase H) from human KB cells and

from chick embryo cells, calf thymus cells, avian myeloblastosis virus (AMV) and Rous-associated virus was used to break down the synthetic DNA-RNA hybrid poly(dT)•((³²P)rA). In breaking down the hybrid, KB cell RNase H produced oligonucleotide and mononucleotide fragments. RNase H from KB cells and from AMV degraded only the RNA strand of the DNA-RNA hybrid, while exonuclease III and certain cellular DNA polymerases attacked both DNA and RNA. Oligonucleotides generated by cellular and viral RNase H terminated with a 5'-phosphate. Cellular RNase H was thought to be an endonuclease, while the viral enzyme acted as an exonuclease. Viral DNA polymerase and RNase H copurified through all separation steps. Therefore, RNase H activity is an intrinsic part of the viral DNA polymerase.

- 5893 INHIBITION BY α -AMANITIN OF SIMIAN VIRUS 40-SPECIFIC RIBONUCLEIC ACID SYNTHESIS IN NUCLEI OF INFECTED MONKEY CELLS. (E.) Jackson, A. H. (Cold Spring Harbor Lab., N.Y.) and B. Sugden. *J Virol* 10(5):1086-1089, 1972.

Experiments were conducted to determine which of the two major DNA-dependent RNA polymerases of mammalian cells is responsible for transcribing SV40 DNA. Nuclei isolated after 30 hr from lytically infected green monkey kidney cell cultures were assayed for RNA polymerase activity by determining the rate of ³H-UTP incorporation into acid insoluble material. Incorporation of radioactivity into SV40-specific RNA as determined by RNA-DNA hybridization studies was totally inhibited by α -amanitin. Since α -amanitin has been shown to have a selective inhibitory effect on mammalian RNA polymerase II, it was concluded that this enzyme probably is responsible for transcribing SV40-specific RNA in lytically infected cells. However, the possibility that RNA transcription was directed by an α -amanitin-sensitive viral-coded polymerase or by a viral modified host polymerase could not be excluded.

- 5894 MITOCHONDRIAL THYMIDINE-DEOXYURIDINE-PHOSPHORYLATING ACTIVITY AND THE REPLICATION OF MITOCHONDRIAL DNA. (E.) Kit, S. (Baylor Coll. Med., Houston, Texas) and Y. Minekawa. *Cancer Res* 32(11):2277-2288, 1972.

The replication of superhelical mitochondrial DNA was studied in SV40-transformed monkey, human and mouse cells, untransformed cells of these species; malignant cells and thymidine-kinase-deficient mouse cells. Superhelical mitochondrial DNA was extracted from ³H-thymidine-labeled cells by Hirt's procedure. ³H-thymidine incorporation by low-molecular wt Hirt supernatant DNA and by nuclear DNA was also studied. The different cell lines differed by no more than a factor of three in the amounts of ³H-thymidine their superhelical mitochondrial DNA incorporated. The radioactivity of this DNA varied only from 1,300-4,100 cpm/culture. However, the radioactivity of nuclear DNA varied from 21,000-6,200,000 cpm/culture, and the radioactivity of low-molecular wt DNA from 1,100

to 35,000 cpm/culture. Cycloheximide, an inhibitor of protein synthesis, markedly reduced labeling of nuclear and light-density Hirt supernatant DNA, but had little effect on labeling of mitochondrial DNA. Puromycin had a similar effect, while chlormaphenicol did not affect labeling of any DNA fractions. Thymidine-deoxyuridine-phosphorylating activity was detected in mitochondria of thymidine kinase-positive and thymidine kinase-deficient cell lines. Mitochondrial DNA apparently was not homologous in its sequence with SV40 DNA.

- 5895 BIOCHEMICAL METHOD FOR INSERTING NEW GENETIC INFORMATION INTO DNA OF SIMIAN VIRUS 40: CIRCULAR SV40 DNA MOLECULES CONTAINING LAMBDA PHAGE GENES AND THE GALACTOSE OPERON OF *ESCHERISCHIA COLI*. (E.) Jackson, D. A. (Stanford U. Med. Ctr., Calif.), R. H. Symons and P. Berg. *Proc Nat Acad Sci USA* 69(10):2904-2909, 1972.

Methods were developed for joining covalently any two DNA molecules. Using the method, circular dimers of SV40 DNA were constructed and a DNA segment containing λ phage genes and the galactose operon of *E. coli* was covalently integrated into the circular SV40 molecule. Circular SV40 DNA molecules were opened to linear duplexes by R₁ endonuclease cleaving. Oligo(dA) or -(dT) extensions were added to the 3'-hydroxyl termini of the DNA strands using the terminal deoxynucleotidyl transferase enzyme. Complementary homodeoxypolymeric extensions were added to the other DNA strand, and the two DNA molecules were annealed, forming a circular duplex. Finally, gaps in the molecular structure were filled with *E. coli* DNA polymerase and DNA ligase.

- 5896 STUDIES OF RETICULUM CELL SARCOMA IN HAMSTERS. (E.) Gerber, M. J. (Chicago Med. Sch., Ill.) and E. R. Brown. *Cancer Res* 32(10):2075-2081, 1972.

Tissue cultures were prepared from cells or ascites cells of a reticulum cell sarcoma of mice (RCS) by trypsinization of the tumor itself, by trypsinization of kidneys of tumor-bearing mice, or by suspension of ascites cells in culture medium. Cell-free filtrates from the RCS failed to induce tumors in X-irradiated or unirradiated hamsters. However, living cells from the three types of RCS tissue culture induced RCS in hamsters. No infectious murine leukemia virus (GC) was detected in these RCS tissue cultures. However, 36 of 60 mice injected with a mixed culture of tumor cells and mouse embryo cells demonstrated a leukemia comparable with the disease induced by GC virus. Thus RCS cells in culture are virogenic. Moreover, complement fixation tests with RCS cell and anti-GC sera showed that the former possessed murine leukemia virus soluble and membrane-associated antigens.

- 5897 HISTOCHEMICAL STUDY OF REDOX ENZYMES IN THE PROCESS OF VIRUS CARCINOGENESIS. (Rus.) Polukhina, M. A. (L. A. Tarasevich State Control Inst. Med. Biol. Prep., Moscow, USSR).

Biul Eksp Biol Med 73(3):78-80, 1972.

The state of redox enzymes related to glycolysis, Krebs cycle, and electron transport was studied histochemically, using tumors induced s.c. in hamsters by monkey adenovirus SA7(C8). Tumors were induced in all 158 newborn hamsters inoculated s.c. with 0.2 ml undiluted virus. The hamsters were killed 1-38 days after infection. NAD- and NADH diaphorases, succinate dehydrogenase, glucose 6 phosphate dehydrogenase, α -glycerophosphate, lactic, glutamic and isocitric acid dehydrogenases in the subcutaneous cellular tissues were studied. Tumor growth was accompanied by changes in the state of the redox enzymes in fibroblast cells as well as in tumor cells. These changes can be divided into three stages. The first stage (the first three days) is characterized by decreased enzyme activity in the fibroblast cells of the experimental hamsters. The second stage, corresponding to 5-20 days, is associated with increased activity of all enzymes except succinate dehydrogenase and isocitrate dehydrogenase and with changes in the form of "diphormasan" deposition in cells. These changes are probably due to the changes in the mitochondrial membranes. The third stage, corresponding to 19-21 days, is characterized by monomorphism of diphormasan deposition in the cells, increased glucose 6 phosphate dehydrogenase and lactate dehydrogenase and decreased NAD- and NADH-diaphorases. The changes in the enzyme activities in the second and third stages were characteristic of the biochemistry of tumor cells, irrespective of the type of carcinogenesis.

5898 MORPHOLOGICAL TRANSFORMATION OF HUMAN ASTROCYTES BY VISNA VIRUS WITH COMPLETE VIRUS PRODUCTION. (E.) Macintyre, E. H. (Dept. Biol. Sci., U. Denver, Colo.), C. J. Wintersgill and J. Thormar. *Nature New Biol* 237:111-113, 1972.

A comparative study was made of the effects of visna virus on sheep choroid plexus cells (SCP) and a permanent line of human astrocytes, 1181N1, derived from a highly malignant brain tumor. Visna-infected SCP cells were all dead by the tenth day postinfection. They produced virus at titers of $10^{6.5}$ TCID₅₀/0.1 ml cell-free supernatant and carried virus-specific cytoplasmic antigen. When grown in Eagle's minimal essential medium (MEM) supplemented with 10% lamb serum, visna-infected 1181N1 cells were morphologically transformed 12 days after infection. The cells produced virus at titers of $10^{2.7}$ TCID₅₀/0.1 ml cell-free supernatant and also carried the visna-specific antigen. Although the final morphological expression was the same for all 1181N1 cells, astrocytes grown in MEM supplemented with 10% fetal calf serum were not completely transformed until 29 days after infection. Transformed 1181N1 cells maintained the ability to produce virus even after 4.5 months *in vitro*.

5899 CYTOGENETIC CHARACTERISTICS OF TWO NEW TRANSPLANTABLE CELL LINES OF GRAY

HAMSTERS (*CRICETULUS MIGRATORIUS*) TRANSFORMED BY ROUS SARCOMA VIRUS. (Rus.) Markaryan, D. S. (Inst. Exp. Biol., Armenian SSR, Acad. Sci., Yerevan, USSR), D. M. Martirosyan and M. V. Avdzhian. *Biul Eksp Biol Med* 72(11):83-86, 1971.

A cytogenetic study was performed on two new Rous sarcoma virus-transformed transplantable hamster cell lines. XPO-1 culture was obtained from tumors induced by Rous sarcoma virus in 2-week-old gray hamsters after three s.c. inoculations of chick sarcoma cells. HET-Asa culture was obtained from the culture of gray hamster embryonal fibroblasts transformed by Rous sarcoma virus. Both cultures had undergone more than 100 passages prior to the time of study. Both cultures were characterized by the heteroploid karyotype, characteristic for transplantable cell cultures. There was a high incidence of dicentric chromosomes in both cultures: 30/100 cells in HET-Asa culture and 23/100 cells in XPO-1 culture. The dicentric chromosomes survived for as long as two months. There was also a high percentage of near- and pseudodiploid cells in both cultures: cells with 21-22-23 chromosomes were predominant and showed selective advantages in the given conditions over aneuploid cells with more chromosomes. Diploid, hypodiploid, and hyperdiploid cells often lacked the 8-10 chromosome group. The intense chromosomal aberrations in both cultures are perhaps related to metabolic anomalies or to the presence of some biologic agent in the cell cultures.

5900 AN OLIGONUCLEOTIDE AFFINITY COLUMN FOR RNA-DEPENDENT DNA POLYMERASE FROM RNA TUMOR VIRUSES. (E.) Gerwin, B. I. (Natl. Cancer Inst., Bethesda, Md.) and J. B. Milstien. *Proc Nat Acad Sci USA* 69(9):2599-2603, 1972.

Rauscher murine leukemia virus and human C-type virus from RD-114 cells were disrupted and the solubilized fractions containing polymerase activity were applied to (dT)₁₂₋₁₈-cellulose columns. RNA-dependent DNA polymerase of both viruses was recovered from the (dT)₁₂₋₁₈-cellulose columns. Uninfected 3T3FL cells showed no polymerase activity in (dT)₁₂₋₁₈-cellulose columns, while Moloney virus-infected 3T3FL cells demonstrated polymerase activity in the columns. This indicated the preference of viral as compared to cellular DNA polymerases for (dT)₁₂₋₁₈ as a primer.

5901 RNA TUMOR VIRUS DNA POLYMERASE: ACTIVITY WITH EXOGENOUS PRIMERS. (E.) Kiessling, A. A. (U. Washington Sch. Med., Seattle) and P. E. Neiman. *Biochim Biophys Acta* 272(2):147-155, 1972.

Studies were carried out *in vitro* to measure the primer preference of DNA polymerase activity released from detergent-treated virions of avian myeloblastosis virus (AMV) and Prague Rous sarcoma virus (PrRSV). Native DNA from avian leukemic myeloblasts had only a slight stimulatory effect on DNA synthesis by AMV or PrRSV DNA polymerase. Pretreatment with bovine pancreatic

deoxyribonuclease markedly enhanced the priming activity of myeloblast DNA. Maximally activated DNA, obtained following a 60 min incubation with bovine pancreatic ribonuclease, had a sedimentation velocity constant of 6S. Sonicated myeloblast DNA fragments did not stimulate DNA synthesis by virus polymerases, and pretreatment with micrococcal nuclease decreased the priming efficiency of myeloblast DNA. These findings suggest a specificity of the viral polymerases for 3'hydroxyl groups in the primer. The DNA product could not be separated from partially activated 15S DNA by sedimentation on velocity gradient even under alkaline conditions, indicating a covalent bond between primer and product. The maximum velocity of DNA synthesis was extrapolated from Lineweaver-Burke plots of the rate of DNA synthesis in the presence of increasing concentrations of maximally activated DNA primer. The values obtained were then compared with those for a variety of RNA and DNA primers as well as synthetic RNA-DNA hybrids. There appeared to be a preference for partially double stranded nucleic acids containing an excess of 3'hydroxyl groups.

RNA molecules synthesized late during productive infection in mouse cells was examined. The Py-specific RNA from whole cells, and from nuclear, cytoplasmic, and polyribosome fractions were compared with respect to sedimentation behavior (on sucrose gradients), electrophoretic mobility (on polyacrylamide gels), and base sequence homology (by competitive hybridization tests). Sedimentation and electrophoretic analysis revealed marked heterogeneity in PyRNA from all cell fractions. This heterogeneity and relative size distribution were essentially the same on dimethylsulfoxide- and on aqueous-sucrose gradients. The PyRNA from different regions of a sucrose gradient contained common sequences, as revealed by cross competition-hybridization experiments. However, the polyribosome-associated PyRNA was devoid of the >28 S species found in the other fractions. Thus, it appears that PyRNA, including RNA of apparent size in excess of one genome length, is synthesized in the nucleus and cleaved to smaller pieces in association with polyribosomes.

5902 INHIBITION OF HIPA PLASMACYTOMA CELL-FREE TRANSMISSION BY NORMAL SPLEEN OF BALB/c, DBA/2 AND C3H MICE. (E.) Pedio, G. (Inst. Path. Anat., U. Zurich, Switzerland) and J. R. Rüttner. *Int J Cancer* 8:497-502, 1971.

Cell-free extracts of the HIPA plasmacytoma were obtained by ultracentrifugation of tumor ascites from various strains of mouse; lethal doses of tumor cell ultracentrifugate were inoculated into ICR, C3H, BALB/c and DBA/2 mice one wk after i.p. inoculation of the mice with normal BALB/c mouse spleen homogenate. Seventy percent of mice given spleen homogenates survived the lethal dose of HIPA plasmacytoma ultracentrifugate. This protection was independent of the source of the HIPA tumor ultracentrifugate; ICR mice were equally protected by BALB/c spleen homogenates when HIPA ultracentrifugates came from ICR or BALB/c mice. Protection was maximal (75-100%) in ICR and C3H mice given spleen homogenates. DBA/2 mice and syngeneic BALB/c mice were protected, but the effect was weaker (50-57% protection) than in strains ICR and C3H. Spleen homogenates from DBA/2 and C3H mice had a protective effect comparable to that of BALB/c spleen homogenates. The factor responsible for protection was found in the sedimentable fraction of spleen homogenates centrifuged at 500 x g for 15 min and was destroyed by heat and freeze/thaw treatment. BALB/c spleen homogenate did not protect against cellular transplantation of HIPA plasmacytoma.

5903 THE PROCESSING OF POLYOMA VIRUS RNA SYNTHESIZED DURING PRODUCTIVE INFECTION IN MOUSE CELLS. (E.) Petric, M. (Dept. Microbiol., U. British Columbia, Vancouver, Canada) and J. B. Hudson. *Can J Biochem* 50(8):927-935, 1972.

The intracellular distribution of polyoma (Py) virus

5904 DIFFERENT NEOPLASTIC RESPONSE OF MICE AND RATS TO INFECTION BY MURINE SARCOMA VIRUS (MOLONEY). (E.) Kano-Tanaka, K. (Aichi Cancer Ctr. Res. Inst., Nagoya, Japan), T. O. Yoshida, T. Tanaka, K. Kojima and T. Hanaichi. *Gann* 63(4): 445-457, 1972.

The biologic activity of and the macroscopic, histologic and ultrastructural characteristics of the lesions induced by three lines of murine sarcoma virus (Moloney) (MSV-M) were compared. MSV-M was maintained by cell-free transmission of mouse tumors through newborn BALB/c mice (MSV-M stock line) and by cell transplants of an MSV-induced sarcoma through young BALB/c mice (MSV-sarcoma line). A third cell-free passage (MSV-rat line) was maintained in newborn WKA rats. All three virus lines were oncogenic in both BALB/c mice and WKA rats; however, the neoplastic response differed. MSV-M produced predominantly myosarcomas at the site of injection in mice but induced primarily osteosarcomas in rats. Occasionally, myosarcomas associated with bone tumors were observed in rats receiving mouse-derived virus. Mice and rats which survived for long periods rarely developed lymphoma. Mice which received rat-derived virus or received high passage mouse-derived virus frequently showed bone tissue hyperplasia adjacent to neoplastic lesions. In rats, cystic lesions were found in high incidence in lymph nodes. Rats were generally less sensitive to MSV-M tumor induction, requiring doses of inocula 10^4 times greater than those necessary to induce tumors in mice. Tumor incidence in rats receiving mouse-derived MSV increased with increasing passage, whereas that with rat-derived MSV showed little increase. Electron microscopic observation revealed C-type particles in tumor cells, spleen cells and megakaryocytes from spleen and bone marrow of both rats and mice. Rat bone tumor cells could be transplanted to WKA rats by cell-grafts only with difficulty, with successful transplants often regressing after

a short time. Tumors of other than bone origin were transplanted with somewhat more success.

5905 THE EFFECT OF NEURAMINIDASE ON THE AGGREGATION OF BHK 21 CELLS AND BHK21 CELLS TRANSFORMED BY POLYOMA VIRUS. (E.) Vicker, M. G. (Dept. Cell Biol., U. Glasgow, Scotland) and J. G. Edwards. *J Cell Sci* 10(3):759-768, 1972.

BHK21 clone 13 hamster cells were treated *in vitro* with *Clostridium perfringens* or *Vibrio cholerae* neuraminidase. The effect of neuraminidase on the aggregation of the cells was observed, both in cases in which neuraminidase was added to a pre-aggregated culture, and in cases in which BHK21 cells were pre-incubated with neuraminidase, suspended, and aggregated in the absence of neuraminidase. Neuraminidase increased cell aggregation in both cases, but the effect was more pronounced when neuraminidase was added to pre-aggregated cells. In such cases, the mean number of cells/aggregate was doubled by neuraminidase. In contrast, the aggregation of polyoma virus-transformed BHK21 clone 13 cells was only very slightly affected by neuraminidase.

5906 STIMULATED NORMAL HUMAN LYMPHOCYTES CONTAIN A RIBONUCLEASE-SENSITIVE DNA POLYMERASE DISTINCT FROM VIRAL RNA-DIRECTED DNA POLYMERASE. (E.) Bobrow, S. N. (Natl. Cancer Inst., Bethesda, Md.), R. G. Smith, M. S. Reitz and R. C. Gallo. *Proc Nat Acad Sci USA* 69(11):3228-3232, 1972.

Lymphocytes from normal human peripheral blood were incubated with phytohemagglutinin (PHA) and then subjected to repeated centrifugation. DNA polymerase was assayed in centrifuge pellets from PHA-stimulated lymphocytes. A ribonuclease-sensitive endogenous DNA polymerase was found in the cytoplasmic particulate fraction of PHA-stimulated lymphocytes; unstimulated lymphocytes did not show this enzyme. Heteropolymeric regions of 70S RNA from avian myeloblastosis virus were not transcribed by the DNA from PHA-stimulated lymphocytes. This distinguished this DNA polymerase from the RNA-dependent DNA polymerase of human leukemic cells and oncogenic RNA viruses.

5907 PROPERTIES OF A RIBONUCLEOPROTEIN PARTICLE ISOLATED FROM NONIDET P-40-TREATED ROUS SARCOMA VIRUS. (E.) Davis, N. L. (Biophys. Lab., U. Wisconsin, Madison) and R. R. Rueckert. *J Virol* 10(5):1010-1020, 1972.

Schmidt-Ruppin Rous sarcoma virus and Bratislava Rous virus (B77) were dissociated with Nonidet P-40 and sedimented in sucrose-D₂O density gradients. A rapidly sedimenting material was detected; it contained a ribonucleoprotein (RNP) complex, as determined by sedimentation and isopycnic centrifugation. The density of the RNP-containing matter was 1.34 g/ml and its sedimentation coefficient

was 130S. Phospholipids and glucosamine were absent from the RNP-containing matter. While the complete B77 virion contained 70 4S RNA molecules/10⁷ daltons of high molecular wt (HMN) RNA, the B77 RNP contained 30 4S RNA molecules/10⁷ daltons HMN RNA. SDS electrophoresis indicated that the RNP contained only five of the 11 polypeptides found in the complete virion; the major polypeptide in the RNP material had a molecular wt of 14,000 daltons.

5908 RE-EXPOSURE OF HUMAN LYMPHOBLASTOID CELL LINES TO EPSTEIN-BARR VIRUS. (E.) Diehl, V. (Inst. Virol., U. Würzburg, West Germany), H. Wolf, H. Schulte-Holthausen and H. zur Hausen. *Int J Cancer* 10(3):641-651, 1972.

Human lymphoblastoid lines of various origins which harbor Epstein-Barr virus (EBV)-specific nucleic acid were re-exposed to EBV. Following infection, cells of the non-virus-producing lines, Raji and S 95, predominantly synthesized EBV-specific early antigens (EA), whereas only a small percentage of cells revealed viral capsid antigens (VCA). In Raji cells, the number of VCA-producing cells was paralleled by the percentage of virus-specific DNA-synthesizing cells. In S 95 cells, however, viral DNA-synthesizing cells exceeded the number of VCA-producing cells by a factor of more than ten. Induction of EA in Raji cells was dose-dependent and inversely related to cell growth. Irradiation of the virus by ultraviolet light prior to infection led to reduced infectivity. This reduction seemed to follow single-hit kinetics. Raji cells, previously re-exposed to EBV, showed reduced EA induction after re-infection with EBV, as compared to Raji control cells not previously exposed. Of ten lines which spontaneously synthesize EBV-specific antigens, seven lines proved to be refractory to re-infection, whereas three were as susceptible as the Raji and S 95 controls. From three of the refractory lines infectious virus could be recovered from the culture medium prior to infection. These results permit the following interpretations: (1) the response of human lymphoblastoid cells after re-infection with EBV results from the infecting virus and not from stimulation of endogenous genomes; (2) cells demonstrating EA synthesis ultimately die; (3) re-exposure to EBV increases the resistance to re-infection of the surviving cells; and (4) cell lines producing infectious EBV are refractory to re-infection. It is suggested that the spontaneous synthesis of infectious virus favors the selection of resistant cells.

5909 ELECTRON MICROSCOPIC STUDIES ON REPLICATING FORM OF DEFECTIVE SV 40 VIRUS DNA. (E.) Yamamoto, S. (Okayama U. Med. Sch., Japan) and T. Oda. *Arch Gesamte Virusforsch* 38(1):29-32, 1972.

Replicating circular molecules of SV 40 DNA were isolated from SV 40 infected VERO cells. Preparations from dilute and undiluted passaged SV 40 virus stocks were shown to give different frequency distri-

butions of contour length of replicating DNA molecules. The mean length of RF-DNA was $1.26 \pm 0.21 \mu$ and $1.57 \pm 0.18 \mu$ for the undiluted and dilute passaged SV 40 stocks, resp. In undiluted passaged virus stocks, small replicating molecules with a contour length less than 1.0μ were noted, which were not detected in dilute passage stocks. The presence of shortened replicating forms of DNA in the undiluted passaged virus stocks would indicate that the DNA of defective SV 40 virus can replicate.

- 5910 CAPSID STRUCTURE IN POLYOMA VIRUS. (E.)
Lecatsas, G. (Royal Postgrad Med. Sch.,
London, England) and L. Mallucci. *Arch Gesamte
Virusforsch* 37(4):340-350, 1972.

Purified preparations of polyoma virus have been studied with the electron microscope employing the technique of negative staining which allows visualization of both sides of a virus particle. Use has been made of the aberrant tubular forms of the virus in order to determine the capsomere number in the normal particle. Scale geodesic models have shown that tubules corresponding in diameter to normal particles yield an apex which is based on a 32 subunit icosahedron. Tubules based on a 42 subunit icosahedron are significantly wider than the normal particle. Similarly, tubules based on a 72 subunit icosahedron are considerably wider than the normal spherical particle, and, in addition, possess pitch characteristics which are absent in tubules closely related in diameter to normal particles. It is concluded that a 32 subunit structure for polyoma virus cannot be ruled out.

- 5911 A SPECIFIC INHIBITOR OF POLYOMA VIRUS IN
INFECTED RAT AND HAMSTER CELLS AND
IN TRANSFORMED CLONES OF HAMSTER CELLS. (E.)
Cramer, R. (Inst. Radium-Biol., Orsay, France) and
G. Meyer. *J Gen Virol* 16(3):313-326, 1972.

Extracts of polyoma virus-infected non-permissive hamster cells made 8 to 10 hr after infection stimulated polyoma virus production in permissive mouse cells, whereas extracts made after 12 hr inhibited virus production. No such inhibitor was detected within 22 hr of infection in either permissive mouse embryo cells or different established mouse cell lines or HeLa cells. An inhibitor could be extracted from hamster cell clones either transformed by polyoma virus alone or doubly transformed by polyoma and Rous sarcoma virus, but not from cells transformed by SV40 or Rous sarcoma virus alone or from cells transformed spontaneously. Polyoma virus replication was inhibited only when inhibitor was added 1 to 2 hr after infection. The inhibitor, which was sensitive to trypsin and was heat labile (60 C, 60 min), had no effect on growth or DNA synthesis of non-infected permissive mouse cells. It did, however, reduce the number of infective centers and the yield of infectious virus, infectious DNA, and of the hypercoiled form I polyoma DNA. Studies made on a permissive hybrid mouse-hamster

cell line which did not produce inhibitor indicated that non-permissiveness was not dominant but rather it seemed to depend on the presence of inhibitor which could only be expressed in non-permissive cell lines.

- 5912 AUSTRALIA ANTIGEN IN HEPATOCELLULAR CAR-
CINOMA. (E.) Simons, M. J. (W.H.O.
Immunology Res Training Ctr., U. Singapore). *Lancet*
(7786):1089-1090, 1972.

Results obtained with counterimmunoelectrophoretic methods indicate that the frequency of Australia (Au) antigen in Hong Kong and Singapore Chinese patients with hepatocellular carcinoma (HCC) is no higher than in normal individuals. However, a high proportion of HCC patients probably have Au antigen in serum concentrations below the threshold of detectability by counterimmunoelectrophoresis. A study using the more sensitive immunoadherence hemagglutination method revealed the presence of Au antigen in 55 of 156 Chinese HCC patients in Singapore.

- 5913 THE ESTABLISHMENT OF LYMPHOBLASTOID LINES
FROM ADULT AND FETAL HUMAN LYMPHOID TISSUE
AND ITS DEPENDENCE ON EBV. (E.) Nilsson, K. (Wall-
enberg Lab., U. Uppsala, Sweden), G. Klein, W. Henle
and G. Henle. *Int J Cancer* 8:433-450, 1971.

Direct and indirect immunofluorescent methods were used to detect Epstein-Barr virus (EBV)-dependent cell membrane antigens, EBV viral capsid antigens (VCA), and anti-EBV VCA antibodies in 21 continuous human lymphoblastoid cell lines (LL). The LL were established by the Spongostan grid culture method; they derived from normal and malignant lymph nodes, bone marrow and spleen cells, and peripheral leukocytes. All lines except one were EBV carriers in initial tests, but the antigens disappeared in most lines in the course of the 4-month observation period. Only eight lines maintained the initial percentage of antigen-containing cells. Reactivity of antigens in VCA and membrane immunofluorescence tests was concordant in every case. Anti-VCA antibodies were found in sera of 15 of 16 donors. In contrast to the results obtained with adult lymphoid tissue, no LL lines were established from 20 fetal cultures initiated with the Spongostan technique. However, lymphoblastoid transformation was seen in three cultures of fetal lymphoid tissue exposed to a cell-free filtrate prepared from an EBV-carrying LL lymphoblastoid cell. Filtrate from an EBV-negative line inoculated into fetal cultures did not promote the establishment of LL. These results indicate that EBV infections are not usually transmitted vertically, and that EBV infection *in vivo* or *in vitro* may be a prerequisite for the indefinite growth of lymphoblastoid cells in culture.

- 5914 AGGLUTINATION OF CELLS TRANSFORMED BY ROUS
SARCOMA VIRUS BY WHEAT GERM AGGLUTININ AND
CONCAVALIN A. (E.) Burger, M. M. (Dept. Biochem.

Sci., Princeton U., N.J.) and G. S. Martin. *Nature New Biol* 237(70):9-12, 1972.

Cultured chick embryo fibroblasts transformed by the Schmidt-Ruppin strain of Rous sarcoma virus (SR-RSV) were tested for their ability to agglutinate in the presence of wheat germ agglutination (WGA) or concanavalin A (Con A). Transformed cells exhibited only a slight increase in agglutinability compared with untransformed controls. However, pretreatment of transformed cells with purified hyaluronidase (250 IU/ml, 15 min) led to a 10- to 20-fold enhancement of agglutination with WGA and to a 6-fold increase with Con A. Pretreatment of untransformed control cells with hyaluronidase had no effect. The patterns of inhibition of agglutination by various low molecular wt carbohydrates and by ovomucoid suggested that the binding sites affected by SR-RSV were qualitatively similar to those affected by transformation with SV40 or polyoma virus. Chick cells were infected with a temperature sensitive mutant of RSV (T5) and agglutinability was tested after hyaluronidase treatment. The expression of the surface alteration occurred only at the permissive temperature (36 C). T5-infected cells grown at 36 C and shifted to the nonpermissive temperature (41 C) lost their agglutinability by 12 to 18 hr. When cells were shifted back to 36 C, agglutinability was regained. These results suggest that agglutinability of the RSV-infected cells was associated with transformation, and not with virus release, which occurred at both temperatures.

5915 DETECTION AND QUANTITATION OF SIMIAN VIRUS 40 GENETIC MATERIAL IN ABORTIVE TRANSFORMED BALB/3T3 CLONES. (E.) Smith, H. S. (Bionetics Res. Labs., Bethesda, Md.), L. D. Gelb and M. A. Martin. *Proc Nat Acad Sci USA* 69(1):152-156, 1972.

The fate of viral DNA was studied in simian virus 40 (SV40) abortively transformed BALB/3T3 clones. Such clones were contact inhibited, did not yield virus after fusion with African green monkey cells, had no SV40 tumor antigen and would not grow in serum protein-free medium. Hybridization of ³²P-labeled SV40 DNA with DNA from abortively transformed cell lines showed that viral DNA was present in increased amounts (approximately five viral genome equivalents per diploid cell) in two of the three lines studied; the third line was indistinguishable from uninfected BALB/3T3 cells. Reassociation patterns suggested that the abortive lines contained the entire SV40 genome rather than multiple partial copies. Values for three independent reclones of one of the positive lines varied from 2.7 to 10 viral DNA equivalents per diploid cell, as compared to a value of two for a standard SV40 transformant.

5916 DETECTION OF CHICKEN SARCOMA VIRUS AFTER INFECTION OF CHICKEN FIBROBLASTS WITH DNA

ISOLATED FROM MAMMALIAN CELLS TRANSFORMED WITH ROUS VIRUS. (E.) Svoboda, J. (Czechoslovak Acad. Sci., Prague), I. Hloaznek and O. Mach. *Folia Biol (Praha)* 18(2):149-153, 1972.

DNA was extracted by the phenol method from XC cells, which carried the Prague Rous sarcoma virus (PR-RSV) genome, or from hamster RSCH cells, which carried the Schmidt-Ruppin RSV (SR-RSV) genome. These DNAs were used to treat BLEF chicken embryo fibroblasts. Three viruses capable of transforming BLEF were released by DNA-treated BLEF cells. One virus recovered from XC cells induced sarcoma growth when injected into chickens. All viruses produced typical pocks on the chicken chorioallantoic membrane.

5917 DETERMINATION OF PHOSPHOLIPID COMPOSITION OF RNA TUMOR VIRUSES BY ³²P LABELING OF INFECTED CELL CULTURES. (E.) Quigley, J. P. (Rockefeller U., New York, N.Y.), D. B. Rifkin and M. H. Einhorn. *Anal Biochem* 47(2):614-619, 1972.

The phospholipid composition of the viral envelope of a high-titer variant of the Schmidt-Ruppin strain of Rous sarcoma virus (RSV) was studied by thin-layer chromatography. RSV-infected chick embryo fibroblast (CEF) cultures were incubated with ³²P and at various times the cellular and viral phospholipids were extracted and the percentage of the total ³²P radioactivity of each phospholipid species was determined. After four days of labeling, the specific activity of phosphorus was the same in all species of cellular and viral phospholipids. The percentage distribution of radioactivity of the different classes of phospholipids differed between the CEF membrane and the virus envelope extracts. The major component of the CEF membrane was phosphatidyl choline (PC) which comprised about 50% of the total membrane phospholipids. Phosphatidyl ethanolamine (PE), phosphatidyl inositol (PI) + phosphatidyl serine (PS) and sphingomyelin (sph) comprised approximately 25%, 20% and 10%, resp. In contrast, the RSV envelope contained relatively more sph (30%) and relatively less PC (25%) and PI + PS (10%). Determinations of percentage composition based on ³²P incorporation agreed well with the percentage composition determined by chemical methods.

5918 IN VITRO CELL TRANSFORMATION BY HERPES-VIRUSES. (E.) Rapp, F. (M. S. Hershey Med. Ctr., Pennsylvania State U.) and R. Duff. *Fed Proc* 31(6):1660-1668, 1972.

Herpes simplex virus type 2 (HSV-2) previously exposed to ultraviolet radiation induced foci with altered morphology and loss of contact inhibition in cultures of hamster embryo fibroblasts (HEF). A total of four HSV-2 strains of the 12 tested transformed the HEF cells. Cell lines established from several clonal isolates of transformed foci induced fibrosarcomas when injected into newborn Syrian hamsters. These tumors were invasive and

induced metastatic tumors often seen in the lungs of the injected animals. The HSV-2 transformed hamster cells contained herpesvirus specific antigens in the cytoplasm of 1-5% of the cells. These virus antigens were detected by indirect immunofluorescence techniques. Tumor-bearing hamsters also developed antibodies in the serum capable of neutralizing HSV-2. The neutralizing titer of each serum was directly proportional to the length of time the host animal carried the tumor. Tests for the presence of C-type virus particles or C-type virus antigens were uniformly negative. However, electron-microscopy studies have detected herpeslike particles in a few of the transformed cells. The results are most compatible with the hypothesis that the inactivated herpesvirus transformed the cells and that expression of the virus genome is repressed in most cells in the culture. In this respect, the observations closely parallel those made with other suspected and known oncogenic herpesviruses.

- 5919 RESCUE OF THE MURINE SARCOMA VIRUS GENOME FROM NON-PRODUCER CELLS BY THE RD-114 TYPE C VIRUS. (E.) Gilden, R. V. (Flow Lab., Inc., Rockville, Md.), Y. K. Lee and C. Long. *Int J Cancer* 10(3):458-462, 1972.

A pseudotype focus-forming virus was rescued from non-producer murine sarcoma virus-transformed hamster HT-1 cells following their fusion with human RD cells freshly infected with RD-114 virus, a suspected human C-type virus. The rescued virus, MSV(RD-114), showed transforming activity against cultured skin, muscle, or whole human embryo fibroblasts and against WI-38 cells, but not against mouse, rat, or hamster embryo cells. Initial results suggested a one-hit titration pattern. The pseudotype MSV(RD-114) virus population contained both the envelope and gs antigens characteristic of RD-114, the rescuing helper virus. Anti-RD-114 reverse transcriptase antibody completely inhibited MSV(RD-114) reverse transcriptase. Human fibroblast cultures infected with RD-114 were completely resistant to focus formation by MSV(RD-114), whereas MSV(RD-114) could transform human fibroblast cultures replicating feline leukemia virus.

- 5920 CELL-MEDIATED REACTION AGAINST TUMORS INDUCED BY ONCORNAVIRUSES. I. KINETICS AND SPECIFICITY OF THE IMMUNE RESPONSE IN TUMORS AND TRANSPLANTED LYMPHOMAS (E.) Leclerc, J.C. (St. Louis Hosp., Paris, France), E. Gomard and J. P. Levy. *Int J Cancer* 10(3):589-601, 1972.

Cell-mediated anti-tumor immunity was studied by the ^{51}Cr release assay in C57Bl(B6) and BALB/c mice bearing autochthonous murine sarcoma virus (MSV)-induced sarcomas or bearing syngeneic transplants of lymphomas with various antigenic specificities. By 12 to 15 days after MSV injection or s.c. Moloney or Graffi lymphoma transplantation, spleen and lymph node cells from animals with both progressively growing ("progressors") and with regressing ("regressors")

tumors were clearly cytotoxic for isologous specific ^{51}Cr -labeled target cells. Thereafter, cytotoxic lymphoid cells disappeared rapidly in progressors, but more slowly in regressors. The level of cytolytic activity of lymphoid cells from the spleen of regressors did not, however, parallel the immune protection. No enhancement of existing cell-mediated anti-tumor activity was observed when mice which had rejected their initial tumor were re-inoculated with MSV or with lymphoma cells. No specific blocking activity was seen in sera from progressor or regressor mice. Since specific blocking by antisera could not be used to study the specificity of the immune cytotoxicity by lymphoid cells, it could not be determined whether the antigens detected by the ^{51}Cr release assay were identical to those identified by complement-dependent cytotoxicity or by immunofluorescence tests on living cells using sera from the same animals. The antigenic specificity of the immune reactions detected by the ^{51}Cr release assay was not identical to those revealed by the serological methods.

- 5921 POLY(rA) TRACTS OF TUMOR VIRUS 70S RNA ARE NOT TRANSCRIBED IN ENDOGENOUS OR RECONSTITUTED REACTIONS OF VIRAL REVERSE TRANSCRIPTASE. (E.) Reitz, M. (Bionetics Res. Lab., Bethesda, Md.), D. Gillespie, W. C. Saxinger, M. Robert and R. C. Gallo. *Biochem Biophys Res Commun* 49(5):1216-1224, 1972.

DNA transcripts prepared from reconstituted (purified DNA polymerase and exogenous 70S RNA) and endogenous reverse transcriptase reactions of avian myeloblastosis virus (AMV) were analyzed by two different molecular hybridization techniques. In addition, DNA from the reconstituted reaction was prepared both with and without oligo(dT) added as a synthetic primer. The DNA transcripts were then analyzed for poly(dT) content and for nucleotide sequences complementary to homologous and heterologous 70S RNA. The results showed that the poly(rA) region of AMV 70S RNA was not transcribed unless oligo(dT) was added as primer and that at least some of the poly(dT) synthesized in the oligo(dT)-stimulated reaction was covalently bound to heteropolymeric transcripts. These results indicated that 3'-OH groups of the resident primers did not reside within the poly(rA) regions and that poly(rA) was probably added post-transcriptionally to the viral RNA.

- 5922 RIBONUCLEASE H: A UBIQUITOUS ACTIVITY IN VIRIONS OF RIBONUCLEIC ACID TUMOR VIRUSES. (E.) Grandgenett, D. P. (St. Louis U. Sch. Med., Missouri), G. F. Gerard and M. Green. *J Virol* 10(6):1136-1142, 1972.

Ten ribonucleic acid (RNA) tumor viruses grown in five different host cell species and three non-oncogenic viruses from three different virus groups have been examined for ribonuclease H content. Three different substrates were used to assay ribonuclease H: calf thymus [^3H]RNA-deoxyribonucleic

id (DNA) hybrid prepared with denatured calf thymus DNA and *Escherichia coli* DNA-directed RNA polymerase, ^3H -polyadenylic acid [^3H -poly(a)] complexed to polydeoxythymidylic acid [poly(dT)], and ^3H -polyuridylic acid [^3H -poly(U)] complexed to polydeoxyadenylic acid [poly(dA)]. All ten RNA tumor viruses contained ribonuclease H activity which degraded the RNA of both the calf thymus hybrid and poly(a)-poly(dT), whereas only the ribonuclease H in the Moloney strain of murine sarcoma-leukemia virus and in RD-feline leukemia virus hydrolyzed the RNA strand of poly(U)-poly(dA). No appreciable ribonuclease H activity was detected in influenza, Sendai, or vesicular stomatitis virus. The ribonuclease H and RNA-directed DNA polymerase activities in Moloney murine sarcoma-leukemia virus were inseparable by phosphocellulose chromatography or glycerol gradient centrifugation, but appeared to be partially separated by diethylaminoethyl-cellulose chromatography.

923 CELL-MEDIATED DESTRUCTION OF ROUS SARCOMAS IN JAPANESE QUAILS. (E.) Hayami, M. (Washington Med. Sch., Seattle, Wash.), I. Hellström, K. E. Hellström and K. Yamanouchi. *Int J Cancer* 10(3):507-517, 1972.

A microcytotoxicity test was used to study the destruction of cultivated Rous sarcoma cells by thymus, spleen and bursa cells from Japanese quails whose Rous sarcomas had regressed ("regressors") and from quails with progressively growing tumors ("progressors"). Regressor spleen cells were slightly more cytotoxic than regressor thymus cells in showing a cytotoxic effect against cultured Rous sarcoma cells. Bursa cells from regressors showed no cytotoxic activity. Autochthonous and allogeneic lymphoid cells from regressors were equally cytotoxic. No cytotoxic effect was observed, however with lymphoid cells from progressors. Surgical bursectomy on the day of hatching, which depressed the production of antibodies against sheep red blood cells, slightly enhanced the ability of spleen cells from regressors to destroy cultivated Rous sarcoma cells. Spleen cells from thymectomized progressors which showed delayed skin graft rejection were not significantly cytotoxic. Progressor spleen cells could abolish the cytotoxic effect of regressor spleen cells from nonbursectomized quails but not those from bursectomized birds.

924 BIOCHEMICAL TRANSFORMATION OF L-CELLS WITH ULTRAVIOLET-IRRADIATED HERPES SIMPLEX VIRUS. (E.) Munyon, W. (Roswell Park Mem. Inst., Buffalo, N.Y.), E. Kraiselbund, D. Davis, R. Zeigel, A. Buchsbaum and E. Paoletti. *Fed Proc* 31(6):1669-1673, 1972.

Ltk minus cells can be stably converted to Ltk plus cells by infecting them with ultraviolet irradiated herpes simplex virus. This conversion consists of 1) acquiring the ability to use exogenous thymidine for the synthesis of cellular DNA and 2) an increase in the amount of thymidine kinase activity by a fac-

tor of 15-21 times relative to the low background level of thymidine kinase present in Ltk minus cells. Cell lines derived from clones of cells that have acquired these new characteristics have been called herpes simplex virus-transformed cells. The thymidine kinase activity present in the herpes simplex virus-transformed cells is different from the thymidine kinase present in normal L-cells with respect to migration during polyacrylamide gel electrophoresis and with respect to the kinetics of thermal inactivation. By these criteria, the thymidine kinase induced during the course of a lytic infection by herpes simplex virus is similar to the thymidine kinase found in the herpes simplex virus-transformed cells. These data support the notion that the herpes simplex virus-transformed cells have acquired the herpes simplex virus gene coding for thymidine kinase production.

5925 HERPESVIRUSES SAIMIRI AND ATELES--THEIR ROLE IN MALIGNANT LYMPHOMAS OF MONKEYS. (E.) Melendez, L. V. (Harvard Med. Sch., New England Regional Primate Res. Ctr., Southboro, Mass.), R. D. Hunt, M. D. Daniel, C. E. O. Fraser, H. H. Barahona, N. W. King and F. G. Garcia. *Fed Proc* 31(6):1643-1650, 1972.

This report indicates that *Herpesvirus saimiri* and *Herpesvirus ateles*, the first two oncogenic herpesvirus from primates, are unrelated viruses. They differ from each other in the following properties: cytopathogenicity (*H. ateles* has a wider *in vitro* host range than *H. saimiri*; plaquing capacity (*H. ateles* forms plaques in hamster cell cultures and *H. saimiri* does not); antibody development (*H. saimiri* produces good level of antibodies in goats and none in rabbits while *H. ateles* behaves inversely in the same species); antigenic relationship (no cross-neutralizing nor cross-fluorescing antibodies were detected); pathogenicity in rabbits (*H. saimiri* induces malignant lymphoma but this was not observed with *H. ateles*); oncogenic spectrum; in *in vivo* conditions *H. ateles* is more oncogenic than *H. saimiri* in cottontop marmosets (*Saguinus oedipus*). But *H. saimiri* so far has the widest oncogenic spectrum of known DNA oncogenic viruses.

5926 PARTICLES CONTAINING RNA-INSTRUCTED DNA POLYMERASE AND VIRUS-RELATED RNA IN HUMAN BREAST CANCERS. (E.) Axel, R. (Coll. Phys. Surg., Columbia U., New York, N.Y.), S. C. Gulati and S. Spiegelman. *Proc Nat Acad Sci USA* 69(11):3133-3137, 1972.

Tissues from 38 human breast adenocarcinomas were subjected to repeated centrifugation and added to a standard endogenous RNA-directed DNA polymerase reaction mixture. The mixtures were assayed for ability to synthesize a 70S RNA-DNA complex. Seventy-nine percent of adenocarcinoma tissues produced the 70S component, encapsulated with RNA-instructed DNA polymerase in a particle with the density characteristics of RNA tumor viruses. The complex was not

detected in normal breast tissue or in fibro-adenoma tissue. The DNA synthesized by the human RNA enzyme complex hybridized specifically with the RNA of mouse mammary tumor virus.

5927 ON MECHANISMS OF FORMATION AND PENETRATION INTO THE CELL OF MURINE LEUKEMIA VIRUSES.

(Rus.) Gogichadze, G. K. (Inst. Exp. Clin. Oncol., USSR Acad. Med. Sci., Moscow), A. S. Shubin and N. P. Mazurenko. *Vopr Virusol* 17(2):198-200, 1972.

5928 SPECIFICITY OF INTERACTION OF HUMAN ADENOVIRUS TYPES 3, 6 AND 12 WITH CELL CULTURES.

(Rus.) Ageyenko, A. I. (P. A. Gertsen Sci. Res. Inst. Oncol. Moscow, USSR), N. A. Chutkov and I. Ya. Kogan. *Vopr Virusol* 17(2):172-177, 1972.

5929 TERMINAL NUCLEOTIDES OF AVIAN MYELOBLASTOSIS VIRUS RNA AND OF RIBOSOMAL RNA FROM CHICKEN LEUKEMIC MYELOBLASTS.

(E.) Ahmad, M. S. (Sch. Med., U. California, Los Angeles), P. D. Markham and D. G. Glitz. *Biochim Biophys Acta* 281(4):554-563, 1972.

5930 ACTIVITY OF MONOAMINEOXIDASE AND DIAMINEOXIDASE IN CHICK FIBROBLASTS CULTURES INFECTED WITH ROUS SARCOMA VIRUS.

(Rus.) Soloimskaya, Ye. A. (N. N. Petrov Res. Inst. Oncology USSR Ministry Hlth., Leningrad) and O. K. Kuznetsov. *Biull Eksp Biol Med* 74(7):86-88, 1972.

5931 TYPE-C-VIRUS PARTICLES IN A TRANSPLANTABLE MESOTHELIOMA OF SYRIAN HAMSTER.

(Ger.) Graffi, I. (Central Inst. Cancer Res., German Acad. Sci., Berlin), E. Bender, T. Schramm and A. Graffi. *Arch Geschwulstforsch* 40(1):12-22, 1972.

5932 STUDIES ON INHIBITION OF VIRAL ONCOGENESIS. III. EFFECT OF CLAM EXTRACTS AND METHOTREXATE ON TUMOR FORMATION IN MALE AND FEMALE HAMSTERS INDUCED BY VIRULENT AND ATTENUATED ADENOVIRUS-12.

(E.) Li, C. P. (Natl. Inst. Hlth., Bethesda, Md.), N. M. Tauraso, B. Eddy, B. Prescott and E. C. Martino. *Arch Gesamte Virusforsch* 36:284-295, 1972.

5933 STRUCTURE OF THE LIPID PHASE OF RAUSCHER MURINE LEUKEMIA VIRUS.

(E.) Landsberger, F. R. (Sloan-Kettering Inst. Cancer Res., New York, N.Y.), R. W. Compans, J. Paxton and J. Lenard. *J Supramolec Structure* 1(1):50-54, 1972.

5934 CYTOGENETICS OF DNA AND RNA TRANSFORMATION BY ONCOGENIC VIRUSES.

(Cz.) Macek, M. (Dept. Pediat., Charles U., Prague, Czechoslovakia). *Cs Epidem* 21(2):93-98, 1972.

5935 ISOLATION OF TEMPERATURE-SENSITIVE MUTANTS

OF MURINE LEUKEMIA VIRUS. (E.) Stephenson,

J. R. (Natl. Cancer Inst., Bethesda, Md.), R. K. Reynolds and S. A. Aaronson. *Virology* 48(3):749-756, 1972.

5936 CAMPTOTHECIN: MECHANISM OF INHIBITION OF ADENOVIRUS FORMATION.

(E.) Horwitz, M. S. (Albert Einstein Coll. Med., New York, N.Y.) and C. Brayton. *Virology* 48(3):690-698, 1972.

5937 GROWTH OF SIMIAN ADENOVIRUS SA7 DURING ARGinine STARVATION.

(E.) Maentyjaervi, R. A. (Coll. Med., Pennsylvania St. U., Hershey). *Acta Pathol Microbiol Scand [A]* 80:117-122, 1972.

5938 INDUCTION OF TUMOURS IN STRIPED HAIRY-FOOTED HAMSTERS WITH SIMIAN ADENOVIRUS SA7(C8).

(Rus.) Bruyako, E. T. (Inst. Exp. Clin. Oncol. USSR Acad. Med. Sci., Moscow), E. E. Pogosyants and A. D. Altshtein. *Vopr Virusol* 16(6):679-681, 1971.

5939 CELL LINES FROM TUMORS INDUCED IN HAMSTERS BY THE BOVINE ADENOVIRUS, TYPE 3.

(Rus.) Grayevskaya, N. A. (Inst. Poliomyelitis Virus Encephalitis USSR Acad. Med. Sci. Moscow), N. M. Strizhachenko, V. Ya. Karmysheva, I. I. Gumina and A. V. Tyufanov. *Vop Onkol* 18(5):79-83, 1972.

5940 CONTRIBUTION TO THE ISOLATION OF AN RNA-DEPENDENT DNA-POLYMERASE FROM LYMPHOCYTES OF AN OX WITH LYMPHOID LEUKEMIA.

(Ger.) Kaaden, O. (Fed. Res. Inst. Vir. Dis. Vet. Med., Tübingen, Germany), B. Dietzschold and O. C. Straub. *Zbl Bakt (Orig)* 220:101-105, 1972.

5941 BITTNER VIRUS AND BREAST CANCER. POSSIBILITIES OF PROPAGATION THROUGH MALE CARRIERS IN HUMANS ALSO.

(It.) Greco, T. (S. Maria Nuova Hosp. Florence, Italy). *Osped Ital Chir* 24(1/3):89-91, 1971.

5942 TUMOR DEVELOPMENT BY NASAL INFECTION WITH ADENOVIRUS TYPE 12 IN C3Hf/Bi MICE.

(Jap.) Ohtsuki, Y. (Okayama U. Med. Sch., Japan). *J Karyopath Tumor Tumorigenesis* 13(3):145-148, 1971.

5943 MOUSE LEUKOSES, INDUCED WITH CELL-FREE FILTRATES FROM TRANSPLANTED RAT ERYTHROMYELOSIS.

(Uk.) Verkats'ky, P. P. (Sci. Res. Inst. Exp. Clin. Oncol. Kiev, USSR) and D. F. Gluzman. *Mikrobiol Zh* 34(1):58, 1972.

5944 COATING OF FRIEND LEUKEMIA VIRUS AFTER TREATMENT WITH SPECIFIC ANTISERUM.

(E.) Sato, T. (Sloan-Kettering Inst. Cancer Res., New York, N.Y.), C. Friend, C. Stackpole and E. de Harven. *Cancer Res* 32(12):2670-2678, 1972.

- 5945 SOME BIOLOGICAL PROPERTIES AND MORPHOLOGICAL CHARACTERISTICS OF THE TRANSPLANTABLE HAMSTER TUMOR INDUCED BY BOVINE ADENOVIRUS TYPE 3. (Rus.) Strizhachenko, N. M. (All-Union Inst. Exp. Vet., Moscow, USSR), N. A. Graevskaya and I. S. Levenbuk. *Biul Eksp Biol Med* 72(11):80-82, 1971.
- 5946 SELECTIVE INHIBITION OF ROUS SARCOMA VIRUS PRODUCTION IN TRANSFORMED CHICK FIBROBLASTS BY TWO RIFAMYCIN DERIVATIVES. (E.) Barlati, S. (Lab. Biochem. Genetics, Natl. Res. Council., Pavia, Italy) and P. Vigier. *FEBS Letters* 24(3):343-346, 1972.
- 5947 MITOCHONDRIAL AUTONOMY: DEPRESSED PROTEIN AND GLYCOPROTEIN SYNTHESIS IN MITOCHONDRIA OF SV-3T3 CELLS. (E.) Myers, M. W. (U. Rochester Sch. Med. and Dentistry, New York) and H. B. Bosmann. *FEBS Letters* 26(1):294-296, 1972.
- 5948 PERSISTENCE OF ROUS SARCOMA VIRUS GENOME IN AKR MOUSE SARCOMA CELLS RESISTANT TO CHROMOMYCIN A₃ AND ACTINOMYCIN D. (E.) Kuwata, T. (Sch. Med., Chiba U., Japan) and S. Sekiya. *Arch Gesamte Virusforsch* 37(4):386-390, 1972.
- 5949 THE PROCESSING OF POLYOMA VIRUS RNA SYNTHESIZED DURING PRODUCTIVE INFECTION IN MOUSE CELLS. (E.) Petric, M. (Dept. Microbiol., U. British Columbia, Vancouver, Canada) and J. B. Hudson. *Can J Biochem* 50(8):927-935, 1972.
- 5950 GLOBIN MESSENGER-RNA INDUCTION DURING ERYTHROID DIFFERENTIATION OF CULTURED LEUKEMIA CELLS. (E.) Ross, J. (Lab. Molecular Genetics, Bethesda, Md.), Y. Ikawa and P. Leder. *Proc Nat Acad Sci USA* 69(12):3620-3623, 1972.
- 5951 CHROMOSOMAL CHARACTERISTICS OF A LYMPHOBLASTOID LINE FROM BABOON *CHACMA PAPIO-PAPIO*: SIMILARITY TO HUMAN LYMPHOBLASTOID LINES. (E.) Macek, M. (Inst. Child Development Res., Prague, Czechoslovakia) and M. Benyesh-Melnick. *Neoplasma* 19(6):631-638, 1972.
- 5952 EFFECTS OF DIBUTYRYL CYCLIC ADENOSINE PHOSPHATE PLUS THEOPHYLLINE ON MURINE SARCOMA VIRUS TRANSFORMED NON-PRODUCER CELLS. (E.) Gazdar, A. (Natl. Cancer Inst., Bethesda, Md.), M. Hatanaka, R. Herberman, E. Russell and Y. Ikawa. *Proc Soc Exp Biol Med* 141(3):1044-1050, 1972.
- 5953 GEL ELECTROPHORESIS OF REVERSE TRANSCRIPTASE ACTIVITY OF MURINE MAMMARY TUMOUR VIRIONS. (E.) Dion, A. S. (Inst. Med. Res., Camden, N.J.) and D. H. Moore. *Nature New Biol* 240(96):17-19, 1972.
- 5954 TRANSPLANTATION OF BOVINE ADENOVIRUS-INDUCED TUMOR IN HAMSTER. (E.) Ohtsuki, Y. (Okayama U. Med. Sch., Japan), S. Kobayashi and M. Ohmori. *Acta Med Okayama* 25(5):573-576, 1971.
- 5955 PROLIFERATION KINETICS OF POLYOMA VIRUS-INDUCED KIDNEY SARCOMAS. (Ger.) Lang, W. (Hannover, W. Germany), H. Zobl, G. Siegismund and A. Geogii. *11th Meeting German Cancer Assoc Hannover (Sept):*85-86, 1971.
- 5956 TUMOR SIZE AS AFFECTED BY THYMECTOMY AND VIRUS ANTIBODIES. (Ger.) Ostertag, H. (Hannover, W. Germany), H. Zobl, W. Desselberger and A. Geogii. *11th Meeting German Cancer Assoc Hannover (Sept):*13, 1971.

See also:

- * (Rev): 5713, 5714, 5715, 5717, 5724, 5736, 5737, 5738, 5739, 5743, 5746, 5748, 5749, 5753, 5757
- * (Chem): 5808, 5810, 5819, 5860
- * (Immun): 5963, 5964, 5969, 5970, 5980, 5986, 5996, 5997, 6002, 6018, 6025
- * (Epid-Biom): 6081

- 5957 INHIBITION BY LYMPHOCYTE NUCLEI OF DNA AND RNA SYNTHESIS IN STIMULATED LYMPHOCYTES AND LEUKAEMIC CELLS. (E.) Pegrum, G. D. (Charing Cross Hosp. Med Sch. London, England) and E. Thompson. *Brit J Exp Path* 52(2):560-564, 1971.

Lymphocyte preparations were obtained and cultured from 33 healthy donors, 15 patients with acute leukemia, 12 patients with chronic lymphatic leukemia and ten patients with chronic myeloid leukemia. Normal lymphocytes were stimulated with phytohemagglutinin (PHA) 24 hr before the start of the experiment. On the day of the experiment, preparations of lymphocytic nuclei free of cytoplasmic contamination and taken from fresh blood samples from normal donors were placed in the PHA-stimulated and the leukemic cultures. After three or six days of growth, samples of each culture were labeled with ^3H -thymidine or ^3H -uridine so that the rate of DNA or RNA synthesis could be determined. Cultures of leukemic cells, lymphocytes and nuclei incubated alone were used as controls. DNA and RNA synthesis was inhibited in seven of 16 treated PHA-stimulated cultures on day three and in 15 of 16 cultures after six days. Where there was depression of DNA synthesis, the number of transformed cells was also clearly reduced. Normal lymphocyte nuclei free of cytoplasmic contamination also inhibited DNA and RNA synthesis in acute leukemic cells, the chronic lymphatic leukemic cells and the chronic myeloid leukemic cells. No inhibition of ^3H -thymidine incorporation was seen in five control cultures using PHA stimulated nuclei alone.

- 5958 THE LYMPHOCYTES OF CHRONIC LYMPHOCYTIC LEUKEMIA: THEIR PROLIFERATION AND CELL CYCLE KINETICS. (E.) Johnson, L. I. (Mt. Sinai Sch. Med., New York, N.Y.), J. LoBue and A. D. Rubin. *Cell Tissue Kinet* 5:27-34, 1972.

Lymphocytes cultured in diffusion chambers and implanted, i.p., in rats were double labeled using tritiated thymidine (^3H -TdR) and ^{14}C thymidine, and double-emulsion autographs were tabulated according to whether overlying grains were present only in the ^3H -labeled layer or in both ^3H - and ^{14}C -labeled layers. When treated with phytohemagglutinin (PHA) CLL cultures showed a maximum percentage of blast cells occurring at 5-7 days, compared to the usual 2-3 days of normal lymphocyte transformation. Kinetics of proliferation in the late-developing CLL blasts was compared with results obtained with blasts developing in normal lymphocyte cultures. Following ^3H -TdR pulse labeling of PHA-treated CLL cultures, blasts appeared to enter mitosis at a slower rate, possibly due to a T_{G2} (post-DNA synthesis, pre-mitotic time) more variable than in normal blasts. Estimated $T_{G2}+T_m$ (mitotic time) for CLL blasts was 3.5 hr compared to 2.5 hr for normal blasts. Labeling index (LI) was used to estimate T_c (cell cycle time). A lower mitotic index in CLL blasts was observed. DNA synthesis was calculated to be 8-10 hr, consistent with normal and CLL blast cells. In both the double label procedure and the labeled mitosis technique cell cycle estimates for CLL lymphocytes were within

the normal range of values found for normal blast cells.

- 5959 OBSERVATIONS ON THE ULTRASTRUCTURE OF TWO HAMSTER LYMPHOMAS WITH PARTICULAR REFERENCE TO INFILTRATING MACROPHAGES. (E.) Birbeck, M. S. C. (Chester Beatty Res. Inst., London, England) and R. L. Carter. *Int J Cancer* 9(2):249-257, 1972.

Two transplantable hamster lymphomas, one of which (ML) metastasizes, while the other (NML) only grows at the site of implantation, were examined in the electron microscope. The tumor cells of the two lymphomas were found to be identical except for a slightly greater amount of endoplasmic reticulum on ML; both contain the typical ultrastructural features of experimental tumor cells, including viral particles. The difference between the two tumors was found to be in the invading host macrophages. The macrophages in NML are large cells containing phagosomes filled with tumor cells in varying stages of digestion. ML also contains macrophages but these are small cells without phagosomes, which accounts for their not being found in earlier light microscope studies. That these latter cells are macrophages is evident from their membrane processes and the presence of primary lysosomes. The failure to find any basic ultrastructural differences between ML and NML cells strengthens the argument that the fundamental differences between these two tumors lie primarily in the host response that they evoke.

- 5960 CHANGES IN TOTAL GAMMA GLOBULIN CONTENT AND IN IMMUNOGLOBULINS G, A AND M IN THE SERUM OF CHILDREN WITH LEUKEMIA: COMMUNICATION II. QUANTITATIVE CHANGES OF IMMUNOGLOBULINS G, A AND M IN THE SERUM OF CHILDREN WITH LEUKEMIA. (Ger.) Blau, H.-J. (U. Pediat. Clin., Rostock, East Germany). *Folia Haematol* 97(3):146-156, 1972.

The immunoglobulin picture in relation to the different stages of leukemia in children is described. The results were obtained in 222 serum tests in 32 children with leukemia (25 with paraneoplastic leucosis, three with acute and four with chronic myeloid leukemia), and in 21 healthy children, by means of simple radial immunodiffusion and the Mancini test. Sera of children in remission had a lower IgG value than sera of those with a relapsed form, although no statistical significance could be demonstrated. Mean IgM values revealed a statistical decrease in the remission stage compared with the onset of paraneoplastic leucosis. The IgA values in the various stages of the disease were quite constant. During stable remission, despite cytostatic treatment at various intervals, children with paraneoplastic leucosis have serum gamma globulins within the normal range; although the IgG is decreased, the IgM and IgA values bring the total gamma globulins up to the normal value. With a relapse, there is a decrease in IgG which is more marked than that of IgM. Thus, in paraneoplastic leucosis, the IgG changes are foremost, IgM changes are slighter and IgA changes are rare. In children with acute or the juvenile form of a

chronic myeloid leukemia, the various fractions of the gamma globulins are analogous to the values in paraneoplastic leucosis or higher. In chronic myeloid leukemia, similar to the adult type, the IgG and IgM values, particularly in the progressive phases, are high; in the less progressive phases these values are within normal limits.

5961 BLASTIC STIMULATION BY PHYTOHEMAGGLUTININ (PHA) AND NATURAL ROSETTE TEST IN CANCEROLOGY. (Fr.) Serrou, B. (Dept. Immunol. C.R.L.C., Montpellier, France), C. Girard and C. Romieu. *Travaux Soc Pharmacie Montpellier* 32(1):27-34, 1972.

Cellular and humoral immunity factors were investigated in 100 patients with various neoplasias (Hodgkin's, otorhinolaryngological areas, reticulosarcoma, solid tumors). Serum complement, C'3 reaction, and the immunoglobulins IgA, IgG, and IgM were determined for humoral immunity. For the cellular immunity, a series of skin tests were conducted. These were *in vitro* lymphoblastic transformation in the presence of phytohemagglutinin (PHA) and the formation of natural rosettes. The normal hemolytic value, used for the determination of the complement, was determined as 50% (H₅₀); this result was increased in the patient population up to 80 or 100 hemolytic units. No marked variations in immunoglobulins were seen except in patients treated by immunotherapy. The test for lymphoblastic stimulation by PHA indicated a lower degree of transformation in the patients (compared with normals). In normal subjects, PHA stimulation caused an increase in the degree of transformation from 0-7% to 77%; in Hodgkin's disease, the stimulation showed a mean of 9%. The rosette test used consists of an agglutination of sheep red blood cells on the lymphocyte membrane at the sites of immunoglobulins. Isolation of lymphocytes by gradient concentration is effected with the aid of the Ficoll-Triosil method. The number of natural rosettes varied from 50 to 80/1000 in normal subjects, was below 10/1000 in patients with Hodgkin's disease and could rise to 40/1000 upon immunotherapy. Patients with tumors involving otorhinolaryngological organs had natural rosette numbers comparable or higher than normal subjects.

5962 DELAYED HYPERSENSITIVITY REACTIONS IN PATIENTS WITH MALIGNANT BRAIN TUMORS TO HUMAN TUMOR CELL LINES GROWN *IN VITRO*. (Fr.) Febvre, H. (Cellular Biol. Unit, I.N.S.E.R.M., Paris, France), J. Maunoury, J. P. Constans and P. Trouillas. *Int J Cancer* 10:221-232, 1972.

The detection of immunity in patients with malignant brain tumors by means of human neoplastic cells grown *in vitro* is described. Most of the antigenic material in the study was taken from cells that had been isolated in the laboratory from surgical specimens; the origin of the cells and the date when culture was begun are tabulated. Controls were obtained by direct lyophilization of normal and pathological tissues. Hypersensitivity reactions were tested before two to three wk after surgical intervention,

with some patients followed for longer periods. These tests were conducted under blind control. Patients operated on for cerebral tumors and hyperimmunized with their own tumors had strongly positive intradermal reactions. Intradermal inoculation of 2 mg protein, in distilled water, from the antigenic material also produced strong reactions in these patients. Reactions elicited from patients with benign or malignant tumors before surgery were all negative. Patients with autologous or recidivous grafts showed positive reactions to the antigens; this was also the case with patients who had extra-cerebral, terminal cerebral, or infiltrated and necrosed tumors. In patients with malignant tumors in general, a non-specific antigenic histologic type stimulation exists which is associated with the existence of tumor cells in the organism. This antigenic stimulation is revealed by so-called "strong" antigens generated by *in vitro*-cultivated malignant brain tumor cells.

5963 DEMONSTRATION OF GRAFFI VIRUS-INDUCED AND SPECIES-SPECIFIC SURFACE ANTIGENS IN RAT GRAFFI LEUKEMIA CELLS, USING IMMUNOELECTROMICROSCOPIC TECHNIQUES. (Ger.) Micheel, B. (Cancer Res. Inst. German Acad. Sci., Berlin, Germany), D. Bierwolf, A. Randt, H. Franz, J. Mohr and G. Pasternak. *Acta Biol Med Germ* 27(3):639-649, 1971.

The use of ferrocene as an antibody marker for differentiating antigen specificity of leukemia cells by electron microscopy is described. Since ferrocene-marked antibodies are observed as amorphous, in distinction to the ferritin-marker granular forms, immunoelectron microscopic techniques were employed to establish whether normal cellular antigens are formed in the extracellular envelopes of the virus particles and if the virus-free membrane areas, in which virus-induced antigens are located, contain normal cellular antigens. The results revealed that antisera against normal (rat-specific) membrane antigens do not react with the extracellular Graffi-virus particle envelopes, and that on the surfaces of leukemia cells, there are discrete areas which do not contain antigens. These areas possibly contain only Graffi-virus-induced antigens. In this test, ferritin is used as the marker for the antigens (species-specific) and ferrocene marks the Graffi-virus-induced antigens. When leukemia cells are incubated with normal mouse serum and antimouse globulin marked with ferritin and ferrocene, there is no marking of viral or cellular structures. The results support the presumption of a correlation between the presence of viral antigens in the cell membrane and the formation of virus particles.

5964 SURFACE ANTIGEN AND POLYPSEUDOPODIA IN ABORTIVE TRANSFORMATION OF BHK 21 CELLS BY POLYOMA VIRUS. (E.) Stoker, M. G. P. (Imperial Cancer Res. Fund Lab., London, England), M. Thornton, P. Riddle, F. Birg and G. Meyer. *Int J Cancer* 10(3):613-618, 1972.

BHK 21 cells were exposed to high multiplicities of

polyoma virus. A change in surface antigen was detected by immunofluorescence, beginning at 18 hr and affecting up to 88% of cells 24 hr after infection. Time-lapse cinematography showed that there was a concurrent change in movement and shape (polypseudopodia) of the cells in the confluent layer, involving about the same proportion of cells. Both these changes appeared before the virus-induced stimulation of the thymidine incorporation and mitosis, and before the increase in lectin agglutinability. The S antigen disappeared more rapidly than the polyspseudopodia in these abortively transformed cells, but both persisted in stably transformed cells. The antigenic change and polyspseudopodia were not the result of the virus-induced stimulation of cell DNA synthesis and mitosis.

- 5965 ALTERATION OF ONCOGENIC PROPERTIES OF RAT RETICULOSARCOMAS UNDER THE EFFECT OF COMPLETE FREUND'S ADJUVANT. (Rus.) Gordienko, S. P. (P. A. Gertsen Moscow Res. Inst. Oncol., USSR) and A. I. Ageenko. *Biul Eksp Biol Med* 72(10):88-92, 1971.

The effects of complete Freund's adjuvant (CFA), prepared from tuberculous mycobacteria, on the growth of tumor transplants and oncogenicity of cell-free extracts of rat reticulosarcoma 321-KPC were studied. A cellular suspension of reticulosarcoma 321-KPC (3.5×10^5) was inoculated into the dorsal skin of 30 Wistar rats 10 days after the i.m. injection of 0.04 ml CFA into the hind paw. Tumors occurred in all rats, 26 of which had intraperitoneal tumors. The average tumor latent period was 90 days. In contrast, local tumors but no intraperitoneal tumors were observed in four of 30 control rats not pretreated with CFA. The average latent period was 17 days. Of 20 rats given CFA prior to inoculation of 3.5×10^6 reticulosarcoma cells into spinal skin, 13 had intraperitoneal reticulosarcoma, the latent period being 160 days. The cell-free extract of rat reticulosarcoma 321-KPC alone did not induce tumors in any newborn Wistar rats, but tumors occurred in 44/95 (45%) of newborn rats simultaneously inoculated with CFA and the extracellular extract. The latent period was 136 days.

- 5966 ANTIGEN SOLUBILIZED FROM HUMAN LEUKEMIA: LYMPHOCYTE STIMULATION. (E.) Gutterman, J. U. (M. D. Anderson Hosp. Tumor Inst., Houston, Texas), G. Mavligit, K. B. McCredie, G. P. Bodey, Sr., E. J. Freireich and E. M. Herish. *Science* 177(4054):1114-1115, 1972.

Tumor antigen was extracted from blast cells of seven leukemia patients by treatment with hypertonic (3 molar) KCl. Normal allogeneic lymphocytes and lymphocytes from blast cell donors (autologous lymphocytes) were exposed to soluble tumor antigen or to stimulator leukemia cells and the blastogenic response of lymphocytes was noted. Six of the seven autologous lymphocyte pools showed a significant

blastogenic response to soluble antigen and five of these seven pools responded to stimulator leukemic lymphocytes. Normal allogeneic lymphocytes showed a blastogenic response to only one of the seven soluble tumor antigen preparations, but responded to six of seven stimulator leukemic cell preparations. The use of soluble antigen should facilitate the study of specific tumor immunity in human leukemia.

- 5967 DETECTION OF TUMOUR-ASSOCIATED TRANSPLANTATION ANTIGEN OF BO-IV CARCINOMA ON SOMATIC CELLS OF TUMOUR-FREE SYNGENEIC MICE. I. DEMONSTRATION OF THIS ANTIGEN ON SPLEEN CELLS. (E.) Rejthar, A. (Fac. Med., Purkyne U., Brno, Czechoslovakia). *Folia Biol* 18(2):132-138, 1972.

The genetic homogeneity of CBA/j mice was verified by isotransplantation of skin grafts. Fifteen CBA/j mice were then immunized against transplantable BO-IV round-cell carcinoma by s.c. injection of irradiated tumor cells. This regimen increased resistance to BO-IV challenge; immunized mice survived 4.9 days longer than unimmunized mice. Mice challenged with BO-IV and concomitantly given spleen cells from immunized mice survived five days longer than mice given the challenge and spleen cells from untreated donors. Mice immunized with syngeneic spleen cells a week before BO-IV challenge showed a highly significant increase in resistance to tumor growth; their mean survival time was 6.5 days longer than that of controls. Serum from immunized mice, injected into mice challenged with constant doses of BO-IV cells, produced a passive immunological enhancement of tumor growth. It was concluded that BO-IV cells carried a true tumor-associated transplantation antigen, and that spleen cells of tumor-free mice carried an identical antigenic structure.

- 5968 THE EFFECT OF SOME ALKYLATING AGENTS AND THE WHOLE-BODY IONIZING IRRADIATION ON THE FORMATION AND REALIZATION OF THE IMMUNOLOGICAL MEMORY. (Rus.) Kazaryan, K. A. (N. F. Gamaleya Inst. Epidemiol. Microbiol., Acad. Med. Sci. USSR, Moscow), L. N. Fontalin, L. A. Pevnitskii and V. V. Solov'ev. *Biul Eksp Biol Med* 72(11):58-61, 1971.

The effects of alkylating agents on the formation of the immunologic memory and secondary immune response were studied in mice. Adult hybrid white mice were immunized with a small dose of sheep erythrocytes (1×10^6) injected i.v. twice at intervals of 27-44 days. The alkylating agents--sarcosyl, 8 mg/kg/day for four days; thio-TEPA, 8 mg/kg/day for four days, degranol, 25 mg/kg/day for two days and cyclophosphamide 200 mg/kg (single dose)--were administered i.p. to the mice at the time of first or second immunizations, or in the interval between them. The animals were irradiated with 500 r Co once before or after immunization. The number of antibody-forming cells in the spleen were determined by Jerne's method four days after the second immunization. All the agents sharply suppressed

realization of the immunologic memory, measured by the IgM antibody production in the secondary response: Sarcolysin, degranol, cyclophosphamide, and radiation suppressed the secondary response, and thio-TEPA significantly weakened it. Another series of experiments revealed that the formation of the immunologic memory was radioresistant but sensitive to cyclophosphamide, whereas the cell carriers of the already-formed memory were radiosensitive but stable to the agents.

- 5969 EPSTEIN-BARR VIRUS (HERPES-TYPE VIRUS) ANTIBODIES IN CONNECTIVE TISSUE DISEASES. (E.) Stevens, D. A. (Natl. Cancer Inst., Bethesda, Md.), M. B. Stevens, G. R. Newell, P. H. Levine and D. F. Waggoner. *Arch Intern Med* 130(1):23-28, 1972.

Serum specimens from female patients with connective tissue diseases were tested for anti-Epstein-Barr virus (EBV) antibody by immunofluorescence and immunodiffusion. The patients included 34 with systemic lupus erythematosus (SLE) with or without nephritis, 11 with rheumatoid arthritis, six with polymyositis and 12 with systemic sclerosis. No significant differences were seen in percentages of sera with positive immunofluorescence patterns between patients and normal controls. A particular pattern of nuclear fluorescence was noted in 75-85% of cells; areas of fluorescence were arranged in crossing strands to form a web. In immunodiffusion tests against EBV antigens, sera from SLE patients with or without nephritis had a greater mean number of reaction bands than controls, though not more than other patient groups.

- 5970 REVERSE TRANSCRIPTASES OF PRIMATE VIRUSES AS IMMUNOLOGICAL MARKERS. (E.) Scolnick, E. M. (Natl. Cancer Inst., Bethesda, Md.), W. P. Parks and G. J. Todaro. *Science* 177(4054):1119-1121, 1972.

Studies were undertaken to determine the immunological relations between the DNA polymerases ("reverse transcriptases") of type C viruses isolated from a woolly monkey fibrosarcoma and from a gibbon ape lymphosarcoma, the Mason-Pfizer monkey virus (MP-MV) isolated from a mammary adenocarcinoma of a rhesus monkey, and foamy viruses isolated from several primate species. Antiserum prepared against the woolly monkey tumor virus RNA polymerase could also inhibit the gibbon-type polymerase but not the polymerases from the MP-MV and the foamy viruses. Antiserum prepared against the MP-MV polymerase did not inhibit the activity of any of the other primate viral polymerases. Antiserum prepared against a type C virus (RD-114) isolated from a human rhabdomyosarcoma grown in fetal cat brain did not affect woolly monkey, gibbon ape, avian, or feline type C virus polymerase. Antisera against woolly monkey and gibbon ape tumor virus polymerases did not comparably inhibit RD-114 polymerase activity. These results indicated that the polymerases from the woolly monkey and gibbon ape tumors are immunologically related to

each other and are distinct from the C-type viruses isolated from other mammals.

- 5971 A HETERO-ORGANIC ANTIGEN OF A RAT ASCITES HEPATOMA. (E.) Satoh, S. (Sch. Med., Hokkaido U., Sapporo, Japan). *Gann* 63:579-590, 1972.

Rat ascites hepatoma (AH-272) ascites were centrifuged and the antigen-containing soluble extract was reacted in agar gel precipitation tests with anti-AH-272 rabbit antisera. Absorbed antisera which failed to react with extracts from normal rat tissue formed a clear precipitation line with the AH-272 antigen-containing solution. In immunoelectrophoresis, AH-272 antigen solution formed a precipitation arc against the absorbed antiserum at the position of the serum α_2 -globulin. AH-272 antigen was quantitated in normal rat tissues; it was present in the largest amounts in placenta. Immunofluorescence and cellular fractionation of AH-272 cells indicated that the antigen was present in the soluble structure of the cytoplasm. Purified, the AH-272 antigen was characterized physicochemically as a protein of molecular wt 40,000-50,000.

- 5972 RADIOIMMUNOASSAY FOR α_1 -FETOPROTEIN IN THE SERUM OF RATS. (E.) Oaks, D. D. (Montreal Gen. Hosp., Quebec, Canada), J. Shuster and P. Gold. *Cancer Res* 32(12):2753-2760, 1972.

A radioimmunoassay for the detection of α_1 -fetoprotein (AFP) in the sera of rats is described. The procedure is based on the preparation of purified and radiolabeled AFP, monospecific anti-AFP antiserum, and a modification of the coprecipitation-inhibition technique in 50% saturated ammonium sulfate. A detailed description is given of the combination of immunochemical and physicochemical methods used in the purification of the rat AFP. The purified rat AFP is virtually identical to the native, circulating AFP by immunological criteria and contains, at most, trace contamination with other materials. The radioimmunoassay has a sensitivity that allows 25 ng AFP per ml of serum to be detected with reproducibility. The assay requires 20 μ l of serum for analysis and can be completed within a few hours.

- 5973 INCREASED ANTIBODY TO HERPES SIMPLEX VIRUS IN PATIENTS WITH NASOPHARYNGEAL CANCER. (E.) Palmer, E. L. (Ctr. Dis. Control, Atlanta, Ga.), P. M. Feorino and M. L. Martin. *J Infect Dis* 126(2):186-188, 1972.

Sera from patients with nasopharyngeal cancer, Burkitt's lymphoma, and primary infection with herpes simplex virus, and sera from controls were tested for antibodies to herpes simplex virus by the complement-fixation test and for antibodies to Epstein-Barr virus by fluorescent-antibody test. Sera from patients with nasopharyngeal cancer contained elevated levels of antibody to both herpes simplex and Epstein-Barr viruses, whereas sera from

patients with Burkitt's lymphoma contained elevated levels of antibody to Epstein-Barr virus only. Titers of antibodies to subunits of herpes simplex virus in the sera of patients with nasopharyngeal cancer were higher than those in control sera. The levels of antibody were markedly similar to those in convalescent-phase sera of individuals with recent primary infection with herpes simplex virus. The antibody profiles of some patients with nasopharyngeal cancer were consistent with reactivated, latent infection with herpes simplex virus.

- 5974 MACROPHAGE MIGRATION INHIBITION WITH MOUSE TUMOR ANTIGENS: PROPERTIES OF SERUM AND PERITONEAL CELLS DURING TUMOR GROWTH AND AFTER TUMOR LOSS. (E.) Halliday, W. J. (U. Washington Med. Sch., Seattle). *Cell Immunol* 3:113-112, 1972.

Sera and peritoneal cells (PC) were obtained from mice bearing primary Moloney virus-induced tumors or transplanted chemically induced tumors ("progressor" mice) and from mice in which these tumors had spontaneously regressed or had been surgically removed ("regressor" mice). No stimulus was given to produce peritoneal exudates. PC from the two types of tumor-treated animals were distinguishable. "Regressor" cells had their migration in culture inhibited by the corresponding soluble tumor antigen, whereas "progressor" cells did not. Mixtures of the two kinds of PC were not inhibited. "Progressor" PC produced a soluble substance *in vitro* which could block the normal inhibition of "regressor" cells. Sera from the two types of mice were also different. "Progressor" serum blocked the migration inhibition usually found with "regressor" PC. "Regressor" serum not only lacked this property but was able to unblock "progressor" PC, so that mixtures of the latter cells with this serum were inhibited by tumor antigen. Macrophage migration inhibition thus revealed cellular immunity and humoral factors analogous to those found by other techniques in animals and human subjects exposed to tumor antigens.

- 5975 METABOLIC ASPECTS OF LEUKEMIC LYMPHOCYTE IMMUNE REACTIVITY. (E.) Brody, J. I. (U. Pennsylvania Sch. Med., Philadelphia). *Acta Haematol* 47(3):129-133, 1972.

Leukemic lymphocytes cultured from seven patients with chronic lymphocytic leukemia were compared with lymphocytes from healthy donors to determine whether or not differences existed in their abilities to utilize glucose and to synthesize nucleic acid following exposure to phytohemagglutinin (PHA) and/or methylene blue (MB), two substances which stimulate glucose utilization via the Embden-Meyerhof (EM) pathway and hexose monophosphate (HMP) shunt, resp. As determined by the extent of formation of $^{14}\text{CO}_2$ and ^{14}C -labeled glycolytic intermediates by cells grown in ^{14}C -glucose-containing medium, leukemic lymphocytes showed a limited ability, compared with normal lymphocytes, to increase glucose metabolism when stimulated by PHA or MB alone or by PHA + MB. This limited

ability to enhance glucose metabolism by both the HMP shunt and the EM pathway was associated with a similar limitation in the ability to increase the incorporation of ^3H -thymidine into DNA following PHA and/or MB stimulation. These two phenomena appeared to be interdependent. These results suggest that the leukemic lymphocyte may react immunologically *in vivo* in a limited fashion which is determined by its inherent cellular metabolic deficiencies.

- 5976 STRUCTURAL STUDIES OF THE MAJOR GLYCOPROTEIN IN PREPARATIONS WITH CARCINOEMBRYONIC ANTIGEN ACTIVITY. (E.) Terry, W. D. (Natl. Cancer Inst., Bethesda, Md.), P. A. Henkart, J. E. Coligan and C. W. Todd. *J Exp Med* 136(1):200-204, 1972.

Amino acid sequence studies have been carried out on the only protein with an unblocked amino-terminal amino acid found in a carcinoembryonic antigen (CEA) fraction purified from colonic cancer metastases obtained from the livers of two patients. The amino acid compositions of the proteins from the two CEA fractions were very similar, with methionine being absent in both, and were very similar to the compositions obtained for CEA preparations from five other tumors. Sixteen of the first 19 residues of the one preparation and the first 24 residues of the second were determined and found to be identical. The finding of identical sequences in the CEA preparations from the two different tumors suggests that this polypeptide is probably the same in all fractions with CEA activity.

- 5977 EPSTEIN-BARR VIRUS-SPECIFIC IgM IN INFECTIOUS MONONUCLEOSIS, BURKITT LYMPHOMA, AND NASOPHARYNGEAL CARCINOMA. (E.) Banatvala, J. E. (St. Thomas Hosp. Med. Sch., London, England), J. M. Best and D. K. Waller. *Lancet* (7762):1205-1208, 1972.

Whole and fractionated sera from patients with infectious mononucleosis (IM), Burkitt lymphoma, and nasopharyngeal carcinoma were tested by the indirect immunofluorescence method for the presence of Epstein-Barr virus-specific antibody. A virus-specific IgM response could be detected in serum fractions from 7 of 8 IM patients from 7 to 70 days after the onset of symptoms. In the eighth patient virus-specific IgM could be detected for six months corresponding to the duration of her symptoms. In all patients, total whole serum IgM titers were highest between 5 and 20 days after the onset of symptoms. No detectable virus-specific antibody could be detected in sera from patients who had had heterophile-antibody-positive IM between 3 and 9 yr previously. EB virus-specific IgM could also not be detected in sera from six patients with nasopharyngeal carcinoma, in sera from three patients with differing stages of Hodgkin's disease, or in sera from nine patients (two untreated, seven treated) with Burkitt lymphoma. Total serum IgM concentrations were raised in patients with acute IM, but were

generally normal during convalescence. Patients with Burkitt lymphoma and nasopharyngeal carcinoma had slightly lower IgM levels than did healthy donors. Serum IgG levels were normal in all groups of patients.

- 978 CARCINOEMBRYONIC ANTIGEN IN WHOLE SERUM. (E.) MacSween, J. M. (Hall Inst. Med. Res., Victoria, Australia), N. L. Warner, A. D. Ankhurst and I. R. Mackay. *Br J Cancer* 26(5):356-60, 1972.

Sera from 51 healthy donors and 326 patients with various neoplastic and nonneoplastic diseases were tested for the presence of carcinoembryonic antigen (CEA) using a modified microradioimmunoassay technique. The new technique differs from those previously described in that it is performed on 0.025 ml of whole serum instead of 5 ml of perchloric acid-extracted serum. Using whole serum, blood CEA levels as little as 5 ng/ml could be detected as compared to 3 ng/ml for perchloric acid-extracted serum. Whole sera from 20 of 23 patients with localized colonic cancer and from all 21 with disseminated colonic cancer were positive for the presence of CEA. In addition, CEA was detected in sera from patients with other types of cancer especially breast and lung) and with diseases other than cancer (particularly liver cirrhosis and pancreatitis). Sera from 5 of 51 healthy donors contained CEA levels greater than 5 ng/ml.

- 979 SUPPRESSION OF ESTABLISHED FRIEND VIRUS LEUKEMIA BY STATOLON. IV. ROLE OF HUMORAL ANTIBODY IN THE DEVELOPMENT OF A DORMANT INFECTION. (E.) Wheelock, E. F. (Jefferson Med. Coll., Philadelphia, Pa.), S. T. Toy, N. L. Caroline, J. R. Sibal, M. A. Fink, P. C. L. Beverley and J. C. Allison. *J Nat Cancer Inst* 48(3):665-673, 1972.

BA/2 mice were inoculated with Friend leukemia virus (FV); postinoculation, infected mice were injected i.v. with 4 mg statolon, a double-stranded RNA-containing mycophag. The progression of virus-induced leukemia symptoms in statolon-treated and untreated FV-infected mice was observed. The splenomegaly response to FV leukemia was abolished by statolon; grossly enlarged spleen in statolon-treated infected mice regressed to normal size. Antibody responses of mice in which FV infection had been suppressed by statolon (FV carriers) were compared with antibody responses in mice in which overt leukemia developed in spite of statolon treatment (statolon-FV-leukemic mice). FV-carriers' sera and statolon-FV-leukemic sera produced equal amounts of hemagglutinating antibody. Isotopic antiglobulin tests, however, showed that only FV-carriers produced significant amounts of antibody which bound to FV-leukemic cells. FV-carrier serum contained FV-neutralizing antibody activity at a 1:40 dilution, while statolon-FV-leukemic sera possessed neutralizing activity at only a 1:10 dilution. In *in vitro*

tests for anti-FV-leukemia activity of sera, sera from FV-carriers completely inhibited leukemogenesis in mice inoculated with FV and FV-leukemic spleen cells; no antileukemic activity was seen in statolon-FV-leukemic sera. Antibody levels declined as FV-carrier mice aged and FV emerged from its dormant state to produce overt leukemia.

- 5980 STUDIES ON THE IMMUNOLOGICAL ANALYSIS OF BOTH TYPES OF HERPES SIMPLEX VIRUS. (Ger.) Schneweis, K. E. (Inst. Med. Microbiol., U. Bonn, Germany). *Zbl Bakt (Orig)* 220:95-97, 1972.

- 5981 THE ACTION OF SERA FROM PATIENTS WITH DIFFERENT ONCOLOGIC HISTORIES ON CELL MULTIPLICATION *IN VITRO*. I. COMMUNICATION. MULTIPLICATION OF TRANSPLANTABLE HUMAN CELLS IN THE PRESENCE OF SERA FROM PATIENTS WITH DIFFERENT ONCOLOGIC ANAMNESIS. (Rus.) Golubev, D. B. (Central Sci. Res. Inst. Radiol., USSR Pub. Hlth. Min., Leningrad), E. A. L'vovskiy and P. N. Kiselev. *Lab Delo* (5):282-285, 1972.

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- 5984 ANTIBODIES AGAINST ATPC⁺ ASCITES TUMOR CELLS, STUDIED BY IMMUNOFLUORESCENCE. (It.) Marconi, P. (Inst. Microbiol. Hyg., U. Perugia, Italy), M. Pitzurra and F. Bistoni. *Boll Soc Ital Biol Sper* 48(3/4):63-66, 1972.

- 5985 CELLULAR PROLIFERATION DEPENDENT GLOBULIN SYNTHESIS. (E.) Tokita, N. (Sch. Med., Showa U., Japan). *J Showa Med Assoc* 31(6):315-324, 1972.

- 5986 THE RELATIONSHIP BETWEEN THE SOLUBLE ANTIGENS AND THE VIRION OF ADENOVIRUS TYPE 3. VI. FURTHER CHARACTERIZATION OF ANTIGENIC SITES AVAILABLE AT THE SURFACE OF VIRIONS. (E.) Norrby, E. (Karolinska Inst., Sch. Med., Stockholm, Sweden) and G. Wadell. *Virology* 48(3):757-765, 1972.

- 5987 INCREASED IMMUNOGENICITY OF EHRlich ASCITES CELLS AFTER HEAT TREATMENT. (E.) Mondovi, B. (Inst. Biol. Chem., U. Rome, Italy), A. S. Santoro, R. Strom, R. Faiola and A. R. Fanelli. *Cancer* 30(4):885-888, 1972.

- 5988 ATP-ASE ACTIVITY OF LYMPHOCYTES FROM NORMAL INDIVIDUALS AND PATIENTS WITH CANCER. (E.) Ellegaard, J. (Hahnemann Med. Coll., Philadelphia, Pa.) and N. V. Dimitrov. *Cancer* 30(4):881-884, 1972.
- 5989 ALTERED HOST-ALLOGRAFT RELATIONSHIPS FOR MOUSE TUMORS MODIFIED BY PRIOR PASSAGE *IN VITRO* AND *IN VIVO*. II. REACTIVITY OF LYMPHOID CELLS. (E.) Jacobs, B. B. (American Med. Ctr. Denver, Colo.). *J Nat Cancer Inst* 49(4):1085-1091, 1972.
- 5990 ANTITUMOR EFFECTS OF ANTIBODY-DIPHThERIA TOXIN CONJUGATES: USE OF HAPTEN-COATED TUMOR CELLS AS AN ANTIGENIC TARGET. (E.) Moolten, F. L. (Boston U. Sch. Med., Mass.), N. J. Capparell and S. R. Cooperband. *J Nat Cancer Inst* 49(4):1057-1062, 1972.
- 5991 ATYPICAL IMMUNOGLOBULINS ASSOCIATED WITH SPONTANEOUS LYMPHOMAS IN AN INBRED STRAIN OF MICE. (E.) Schrohenloher, R. E. (Dept. Med., U. Alabama, Birmingham) and P. C. Bailey. *J Nat Cancer Inst* 49(4):1027-1037, 1972.
- 5992 CARCINOEMBRYONIC ANTIGEN (CEA) IN PATIENTS WITH CARCINOMA OF THE DIGESTIVE TRACT. (E.) Holyoke, D. (Roswell Park Mem. Inst., Buffalo, N.Y.), G. Reynoso and T. M. Chu. *Ann Surg* 176(4):559-564, 1972.
- 5993 IMMUNOSPECIFIC REGRESSION OF METHYLCHOLANTHRENE FIBROSARCOMA USING NEURAMINIDASE: III. SYNERGISTIC EFFECT OF BCG AND NEURAMINIDASE TREATED TUMOR CELLS. (E.) Simmons, R. L. (Dept. Surg., U. Minnesota, Minneapolis) and A. Rios. *Ann Surg* 176(2):188-194, 1972.
- 5994 THE APPEARANCE OF FORSSMAN HAPTEN IN HUMAN TUMOR. (E.) Kawanami, J. (Shionogi Res. Lab., Shionogi & Co., Osaka, Japan). *J Biochem* 72(3):783-785, 1972.
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- 5996 HETEROGENIC TISSUE ANTIGENS OF THE ADENOVIRUS SARCOMA IN HAMSTERS. (Rus.) Bashkayev, I. S. (P. A. Gertsen Res. Inst. Oncol., Moscow, USSR), A. I. Ageyenko and I. Ya. Kogan. *Vop Onkol* 18(7):73-77, 1972.
- 5997 THE EFFECT OF IMMUNOLOGICAL REACTIVITY OF RABBIT LEUKOCYTES AND MACROPHAGES ON INTERFERON PRODUCTION BY HERPES VIRUS. (Rus.) Bocharov, A. F. (Central Inst. Postgrad. Med., Moscow, USSR), S. A. Moysiadi, A. M. Amchenkova, F. V. Voronina and Ya. Ye. Khesin. *Vop Virusol* 16(6):725-731, 1971.
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- 6000 FREQUENCY OF AUSTRALIA ANTIGEN OCCURRING IN THE HOSPITALIZED POPULATION, IN LIVER CIRRHOSIS AND CANCER AMONG THE AFRICANS OF DAKAR. (Fr.) Sankale, M. (Dept. Med. Phar. Sci., U. Dakar, Africa) and I. Seck. *Bull Soc Path Exot* 64(6):821-827, 1971.
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H. Hörtnagl, H. Winkler, H. Asamer, H. J. Födisch and J. Klima. *Lab Invest* 27(6):613-619, 1972.

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- 047 IMMUNOLOGICAL TESTS PERFORMED WITH SERUM AND URINE FROM PATIENTS WITH HYPERNEPHROID CARCINOMA. (Ger.) Bichler, K. H. (Marburg, W. Germany), F. Porzsolt, C. Kirchner and C. Hirschhäuser. *11th Meeting German Cancer Assoc Hannover (Sept):17-18, 1971.*
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See also:

- * (Rev): 5710, 5711, 5712, 5726, 5727, 5728, 5739, 5742, 5745, 5759, 5760, 5761
- * (Chem): 5785, 5788, 5802, 5805, 5831, 5860
- * (Phys): 5864
- * (Viral): 5879, 5886, 5888, 5896, 5911, 5920, 5944, 5954, 5956

- 6051 RELATIONSHIPS BETWEEN ULTRASTRUCTURE AND BIOLOGIC FEATURES OF PIGMENTARY TUMORS (NEVUS CELL NEVI, MELANOSIS PROBLASTOMATOSA, MALIGNANT MELANOMA). (Ger.) Klug, H. (Humboldt U., Berlin, Germany) and Th. Thormann. *Arch Geschwulstforsch* 37(4):368-386, 1971.

Electron microscopic studies were performed on cells of junctional nevi (JN), lentigo malignant melanomas (MP), and malignant melanomas (MM) to elucidate the relationship between the ultrastructure of these cells and their degree of malignancy. Distinct structural differences were observed between JN and MP cells. Both tumor forms can be easily distinguished. Differences lie in the structure of melanosomes, the different number of melanosomes and the mitochondria in the cytoplasm and in the nucleoli. The melanosomes of JN cells, however, are morphologically identical with the melanosomes of normal epidermal melanocytes. The chromatin structure of the JN cell nuclei does not differ markedly from MP cells and manifests small membrane invaginations sporadically. The large number of melanosomes in MP cells and their spherical form is conspicuous. No distinct lamellar inner structure has been observed as yet in premelanosomes. The most obvious morphologic difference between JN and MM cells is the fine structure and size of the nucleoli, independent of their pigment-forming ability. The structures observed on MM cells clearly point to increased or disturbed RNA or protein synthesis in the tumor cells. Therefore, structure and size of nucleoli are reliable morphologic criteria of the degree of malignancy. The considerable difference in the number of mitochondria in JN and MM cells is another indicator of the different metabolic activity of both cell forms.

- 6052 MEMBRANE PROLIFERATION AND PHOSPHATIDYLCHOLINE SYNTHESIS IN NORMAL, PRENEOPLASTIC, AND NEOPLASTIC MAMMARY GLAND TISSUES IN C3H MICE. (E.) Hillyard, L. A. (Children's Hosp. Med. Ctr. Northern California, Oakland) and S. Abraham. *Cancer Res.* 32(12):2834-2841, 1972.

The rates of incorporation of uniformly labeled L-leucine- ^{14}C into protein and of choline-methyl- ^{14}C and L-methionine-methyl- ^{14}C into the phosphatidylcholine of the organelle membranes was determined for tissue slices prepared from normal mammary glands, preneoplastic hyperplastic alveolar nodule outgrowths, and mammary adenocarcinomas of C3H mice. The relative incorporation rates of uniformly labeled leucine- ^{14}C and of choline-methyl- ^{14}C were compared with the rate of incorporation of thymidine-methyl- ^3H into the DNA of each tissue. The rate of membrane protein synthesis as indicated by the leucine incorporation rate did not correlate with cell growth, since synthesis in the rapidly growing mammary glands in pregnant mice was not significantly greater than that in the slower growing mammary glands in lactating mice. The observations were made that methylation of phosphatidylethanolamine did not contribute to phosphatidylcholine synthesis and that the correlation between choline-methyl- ^{14}C and thymidine-methyl- ^3H incorporation in the various

mammary gland tissues was good. These findings suggest that choline incorporation into phosphatidylcholine has general applicability to studies on membrane proliferation in mammary glands. Subcellular fractions from each mammary tissue were assayed for activities of phosphodiesterase I and NADPH-cytochrome *c* reductase enzymes localized in the endoplasmic reticulum. NADPH-cytochrome *c* activity in the hyperplastic alveolar nodule outgrowth was similar to that in normal lactating gland rather than that in the histologically identical normal gland of pregnancy. The intracellular distribution of NADPH-cytochrome *c* activity in the mammary adenocarcinoma suggests that homogenization of this tumor produces particles, derived from the endoplasmic reticulum, with a density distribution different than that produced from normal tissue.

- 6053 THE IMPORTANCE OF HYPOXIA IN PATHOGENESIS OF NEOPLASMS. (Rus.) Belousov, A. P. (P. A. Gertsen Res. Inst. Oncol., Moscow, USSR), S. D. Pletnev, M. K. Kochetkov, L. D. Ostrovtshev and E. B. Mairanovskaya. *Vopr Onkol* 18(5):12-16, 1972.

The intensity of hypoxia in neoplastic and normal tissues of the mammary gland was studied in 177 patients with cancer and mastopathy of the mammary gland (including 68 with breast cancer) and 15 healthy women. The oxygen flow in tissues was determined by means of a polarographic method using an open electrode introduced into the tested tissue and connected with a recording device; another electrode was applied to the skin surface. Oxygen flow data were expressed in mg of O_2 passed through a one cm^2 section per second, referred to as oxygen index. Two groups were distinguished according to the intensity of the oxygen flow data. The first group, with a low oxygen flow index consisted of 132 persons with a median oxygen index of 0.78-0.92 mg/ cm^2 sec (patients) and 1.12 mg/ cm^2 sec (normal subjects). The second group, with a high oxygen flow index of 1.65-2.39 in patients and 2.32 mg/ cm^2 sec in healthy subjects included 60 people. Thirty percent of the first group and 46% of the second group were cancer patients. The intensity of oxygen flow was significantly decreased in the (normal) intact tissue of 68% of the patients with mastopathy, cyst, fibroadenoma, and cancer of the mammary gland. The oxygen flow was relatively high and no hypoxia was seen in normal tissue of 32% of the patients. Hypoxia was ascertained in all neoplastic tissues indicating that neoplasia of the mammary gland develops in a background of local tissue hypoxia.

- 6054 THE ALTERATION OF CELL SURFACE IN TUMOURS. (Hun.) Sugar, J. (Res. Inst. Oncol. Path., Budapest, Hungary) and O. Csuka. *Magyar Onkol* 16:21-23, 1972.

- 6055 PATHOGENETIC VARIETIES OF CANCER OF THE UTERINE BODY. (Rus.) Bokhman, Ya. Y. (N. N. Petrov Res. Inst. Oncol., USSR Min. Public Hlth., Leningrad) and L. I. Kostina. *Vopr Onkol* 18(2):18-24, 1972.

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057 MORPHOGENESIS AND HISTOLOGICAL STRUCTURE OF BLUE NEVUSES. (Rus.) Gordeladze, A. S. Sanitary Hyg. Med. Inst., Leningrad, USSR). *Vop Onkol* 18(7):12-19, 1972.

058 ON MALIGNANCY OF GRANULAR CELL OVARIAN TUMORS. (Rus.) Gubareva, A. V. (Central Res. Roentgeno-Radiological Inst., USSR Ministry Public Hlth., Leningrad). *Vop Onkol* 18(7):48-54, 1972.

059 THE RELATIONSHIP BETWEEN INDIRECT METAPLASIA AND CARCINOMA *IN SITU* IN THE ORIGIN OF ECTOCERVICAL CANCER. VALUE OF THE BASAL PLATE AS AN INDICATION OF CARCINOMATOUS INVASION. ELECTRON MICROSCOPY STUDIES. (Sp.) Bonilla-Musoles, F. (Dept. Obst. Gyn. Valencia, Spain). *Toko-Ginecol* 31(308):411-434, 1972.

060 ON THE HISTOPATHOLOGY AND HISTOGENESIS OF ORCHIOBLASTOMA. (It.) Tosi, P. (Inst. Anat. Path. Histol., U. Siena, Italy), G. Tota and L. Accavelli. *Arch De Vecchi Anat Pat* 56(3):479-488, 1970.

061 HISTOPATHOLOGICAL AND HISTOCHEMICAL STUDY OF THE SUPPORTING CONNECTIVE TISSUE IN EPI-THELIAL LESIONS OF THE UTERINE CERVIX. (It.) Gentini, G. P. (Inst. Anat. Path. Histol., U. Modena, Italy), A. Botticelli, C. F. De Gaetani and Barbanti Silva. *Arch De Vecchi Anat Pat* 56(3):429-461, 1970.

062 DIFFERENCES IN THE SERUM AMINOACID COMPOSITION OCCURRING BETWEEN MALE AND FEMALE ACUTE LEUKEMIA PATIENTS. (Rus.) Abramovich, A. B. (Central Inst. Hematol. Blood Transf. Moscow, USSR) and L. G. Valeva. *Lab Delo* (3):169-171, 1972.

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064 ELECTRON MICROSCOPY STUDIES PERFORMED ON EXPERIMENTAL BRAIN TUMORS OF THE RAT. (Ger.) Geman, A. (Med. Acad. Erfurt, Germany), W. Jähnisch and W. Dietz. *Zbl Allg Path* 115:13-21, 1972.

065 ONCOGENIC INFECTIOUS NUCLEOPROTEIN FROM "STATU-NASCENDI-MEDIA" OF UTERINE CERVIX CARCINOMA INOCULATED ON EMBRYONATED CHICKEN EGG CHORIOALLANTOIS MEMBRANE. (Ger.) Eschbach, W. (Central Cancer Res. Inst. German Acad. Sci. Berlin),

H. Glathe and B. Nöbel. *Arch Geschwulstforsch* 39(2):95-98, 1972.

6066 THE EARLY STAGES OF ENDOMETRIAL CARCINOMA. (Ger.) Abad, L. (Women's Clin. U. Valencia, Spain) and E. Barbera. *Schweiz Z Gynaek* 2(4-6):363-371, 1971.

6067 THE SPREAD OF SQUAMOUS CELL CARCINOMA OF THE UTERINE CERVIX INTO THE BLOOD-VESSELS. (E.) Kindermann, G. (U. Erlangen Women Clin., Germany) and H. P. Jabusch. *Arch Gynaekol* 212:1-8, 1972.

6068 MENINGEAL MELANOCYTOMA (MELANOTIC MENINGIOMA) ITS MELANOCYTIC ORIGIN AS REVEALED BY ELECTRON MICROSCOPY. (E.) Limas, C. (Georgetown U. Med. Ctr., Washington, D.C.) and F. O. Tio. *Cancer* 30(5):1286-1294, 1972.

6069 THE HISTOLOGICAL STRUCTURE AND HISTOGENESIS OF CARCINOID TUMOURS OF DIFFERENT LOCALIZATION. (Rus.) Derizhanova, I. S. (Rostov-on-Don Med. Inst., USSR). *Arkhl Patol* 34(3):25-32, 1972.

6070 THE IMPORTANCE OF THE MICROBIAL FACTOR IN THE PATHOGENESIS OF LEUKEMIA. (Rus.) Fedorov, N. A. (Central Inst. Hematol. Blood Transf., Moscow, USSR), T. V. Golosova, N. M. Nemenova, G. Ya. Kagan, E. M. Kipervasser, V. A. Martynova, N. V. Chubarova and F. Guseinova. *Arkhl Patol* 34(3):14-19, 1972.

6071 HEMANGIO-ENDOTHELIOMA OF THE SPLEEN WITH ERYTHROPHAGOCYTOSIS AND CONSUMPTION COAGULOPATHY. MORPHOLOGICAL, OPTICAL AND ULTRA-STRUCTURAL STUDY. (Fr.) Hopfner, C. (Fac. Med., Lab. Anatomy Path., Reims, France), M. Dufour, M. Pluot and T. Caulet. *Virchows Arch A* 356:66-75, 1972.

6072 THE PRENEOPLASTIC STAGES AND BIOLOGICAL FEATURES OF URINARY BLADDER TUMORS IN THE RAT. (Ger.) Schauer, A. (Munich, W. Germany), E. Kunze, J. Spielmann and G. Krüsmann. *11th Meeting German Cancer Assoc Hannover (Sept):*83-84, 1971.

See also:

- * (Rev): 5705, 5719, 5733, 5744
- * (Chem): 5763, 5764, 5772, 5776, 5797, 5813
- * (Phys): 5868
- * (Viral): 5897

6073 LEUKEMIA INCIDENCE IN SAMARKAND AND THE SAMARKAND REGION IN 1966-1969. (Rus.)

Bogdanov, I. S. (Uzbek Inst. Hematol. Blood Transfusion, Tashkent, USSR) and Kh. A. Khakimov. *Probl Gemat Pereliv Krovi* 17(2):33-34, 1972.

The incidence of leukemia in the Samarkand region, the center of agriculture and industry of Uzbekistan USSR, was studied. A total of 264 patients with various forms of leukemias and hemoblastoses was recorded in this region in 1966-1969. The incidence of leukemias and hemoblastoses to the total incidence of diseases was 0.048% and that to total oncological diseases was 7.84%, being fourth among malignancies after carcinoma of the stomach, skin, and esophagus. The mean annual incidence of leukemias and hemoblastoses in cities and rural areas for 1966-1969 was 4.81 per 100,000 population. The mean annual index of incidence of leukemias and hemoblastoses was 8.94 in the cities and 3.73 in the rural areas. The mean annual incidence index was different according to the types of leukemias. Of 18 cases of chronic lympholeukemia in the Samarkand region in 1966-1969, only one case was seen in the rural area, while 17 cases were seen in cities. The mean annual index of incidence of chronic lympholeukemia for the period 1966-1969 was 0.33/100,000 residents (1.22 in cities). The male/female ratio was 1.3:1. There were 94 cases of acute forms of leukemia (1.71/100,000 population). Of these, 49 cases were lymphogranulematoses (0.87/100,000 population). The mean annual index for the total incidence of leukemia and hemoblastoses was 8.54/100,000 population. Chronic forms of leukemia were most prevalent, being 3.32/100,000, followed by acute forms (3.06/100,000).

6074 HODGKIN'S DISEASE: CASES WITH FEATURES OF A COMMUNITY OUTBREAK. (E.) Vianna, N. J.

(New York State Dept. Hlth., Albany), P. Greenwald, J. Brady, A. K. Polan, A. Dwork, J. Mauro and J. N. P. Davies. *Ann Intern Med* 77(2):169-180, 1972.

A study of the incidence of Hodgkin's disease in Albany County, N.Y., from 1950 through 1970, showed a period of high incidence followed by an apparently reciprocal period, when the incidence of the disease was below average. The increased incidence closely paralleled temporally the occurrence of cases in a specific group of students, their friends, and household relatives. Thirty-four lymphoma cases, of which 31 were Hodgkin's disease, have been interlinked to date. These observations and the occurrence of similar Hodgkin's disease groupings in two different areas suggest that the pattern of disease occurrence was similar to that of an infectious disease.

6075 CANCER MORTALITY AMONG U.S. JEWS. (E.) Haenszel, W. (Nat'l. Cancer Inst., Bethesda, Md.). *Israel J Med Sci* 7(12):1437-1450, 1971.

Cancer Registry data from the U.S. were reviewed to determine the relative position of the risks for Jews when contrasted with non-Jewish populations.

Sex differences were found for the incidence of tumors of all sites except the G.I. tract. Males generally had low risks for cancers of the buccal cavity, pharynx and prostate whereas Jewish female risks were similar to those of the general non-Jewish population. Females showed a decreased incidence of carcinomas of the cervix and bladder and an increased incidence of cancers of the esophagus (foreign born only), pancreas, lung, breast (U.S. born), ovary and excess leukemia and lymphomas compared with other U.S. white populations. In general, however, the pattern of site-specific risk of U.S. Jews was similar to that of other white U.S. populations. The male:female sex ratios of site-specific risks among U.S. Jews were generally lower than for other U.S. white populations. Comparisons of the U.S. data with those from Israel's Cancer Registry suggest that these lower sex ratios of risk were characteristic of Jews in both countries.

6076 CANCER MORTALITY IN THE DISTRICT OF SKOPJE FROM 1961 TO 1969. (E.) Gjorgov, A.

(Municipal Public Hlth. Inst., Skopje, Yugoslavia). *Lijec Vjesn* 93(5):517-532, 1971.

A retrospective study of the incidence of all types of cancer was conducted in the district of Skopje, Yugoslavia, for the years 1961 to 1969. Data were obtained from death certificates, card indices and from official reports of the Central Statistics Office of Skopje. From 1961 to 1969, 1093 men and 838 women died of cancer in Skopje (population about 370,000). Although the overall morbidity rates in rural and urban areas were approximately the same, nearly three times as many urban dwellers as rural inhabitants died of their disease. The annual rate of increase in the incidence of cancer was much higher (9.8%) for immigrants to the area than for either urban natives (3.5%) or the rural population (2.3%). Deaths due to cancer were also much higher in the immigrant population. The large annual increases could be attributed both to improved records and to an actual increase in the number of cases. The annual rate of increase in fatal cancer cases was greatest (7.7%) for people older than 65 yr, followed by the 25 to 44-yr-old age group (6.6%) and by people under 25 yr of age (2.8%). The principal cause of death for both sexes was gastric carcinoma. Pulmonary cancer was the second leading cause of death in men and cancer of the reproductive tract was the second leading cause in women. The highest annual rate of increase (16.5%) was in female gastric cancer followed by cancer of the female reproductive organs (9.5%) and pulmonary cancer in men (8.7%).

6077 THE KINETICS OF CELLULAR PROLIFERATION IN NORMAL AND MALIGNANT TISSUES. NUCLEIC ACID METABOLISM IN RELATION TO THE CELL CYCLE IN HUMAN TISSUES. (E.) Fabrikant, J. I. (Dept. Radiological Sci., Johns Hopkins U., Baltimore, Md.), M. J. Vitak and C. L. Wissemann, III. *Growth* 36(3):173-183, 1972.

The kinetics of tumor cell proliferation in normal and diseased tissues of the human larynx have been examined in patients using nucleic acid precursor labeling techniques combined with high resolution autoradiography. The potential tissue doubling times based on cell phase distribution models have been determined in normal, inflammatory, and neoplastic lesions in 58 patients with diseases of the larynx and hypopharynx. The data are based on analyses of cell kinetic parameters, including pulse-labeling, and on tritium-, carbon-14-thymidine double-labeling techniques, on cell age models, and are corrected for the growth fraction and cell loss factor. They indicate that (1) the range of tissue doubling times for the normal epithelial mucosa of the human larynx is ~ 6 to 10 days; (2) values for carcinoma of the larynx are slightly longer than normal values; (3) inflammatory lesions have the fastest turnover rates; (4) the growth rates of benign tumors vary widely; and (5) the duration of DNA synthesis in human cells ranges from ~ 10 to 25 hours. Analysis of cell and tissue kinetics suggests that proliferation rates in neoplastic cells may not necessarily be greater than the normal cell populations from which they arise. The *in vitro* techniques have also been adapted to examine the incorporation of tritiated uridine to study RNA synthesis in human tissues. The relationships of nucleic acid metabolism and cell population kinetics are discussed in terms of cellular control mechanisms and growth characteristics of neoplastic tissues in man, and the observations are related to the implications of tumor cell proliferation in the clinical situation.

6078 EPIDEMIOLOGY OF HODGKIN'S DISEASE. (E.)
Cole, P. (Harvard Sch. Public Hlth.,
Boston, Mass.). *JAMA* 222(13):1636-1639, 1972.

The two major current issues in the epidemiology of Hodgkin's disease are 1) the nature of the disease and 2) the specific etiology of the disease. The age-incidence curve of Hodgkin's disease is bimodal. In younger patients, the incidence is only slightly higher in males than females, there is no association with any religious group, and at diagnosis the disease is usually localized. The histologic patterns are those associated with a more favorable prognosis. In patients over 50 yrs of age, Jewish males predominate, the disease is usually disseminated, and the histologic patterns are those associated with a poor prognosis. Current evidence, which is often contradictory, tends to favor the concept that Hodgkin's disease is two processes, each with a distinct etiology. However, the possibility that the heterogeneous nature of the disease is due to variations in host response to a single etiologic factor cannot be eliminated. With respect to young people, a moderate amount of circumstantial evidence supports a specific viral etiology for Hodgkin's disease. It has also been suggested that tonsillectomy places young people into a higher risk group with respect to Hodgkin's disease. However, results have indicated that some uncontrolled variable, rather than tonsillectomy itself, may account for the association.

6079 CANCER OF THE ESOPHAGUS IN CENTRAL AFRICA.
(E.) Wapnick, S. (Ichilov Hosp., Tel Aviv, Israel), L. N. D. Zanamwe, M. Chitiyo and J. M. Mynors. *Chest* 61(7):649-654, 1972.

Data on Africans with esophageal cancer admitted to Harari Hospital, Salisbury, Rhodesia, between 1958-1970 were reviewed. Out of a total of 404 cases of cancer of the esophagus 333 cases were squamous carcinomas and four were adenocarcinomas. Forty-two percent of patients were from Malawi, 20% were from Mozambique and 38% were from Rhodesia. The relatively high percentages of hospital admissions from other African states may explain the unusually high esophageal cancer rate recorded in Rhodesia. Ninety-eight percent of patients were males, and a slight excess of blood group A persons was seen in the patient group. African patients with esophageal cancer presented at a younger age than that reported for white patients. Various etiological factors for esophageal cancer in Africans are discussed, including the drinking of liquors made in pots which contain carcinogens.

6080 RACIAL AND SOCIOECONOMIC FACTORS IN COLONIC CANCER SURVIVAL. (E.) Krain, L. S. (U. California Los Angeles Med. Ctr.). *Ann Surg* 175(4):601-606, 1972.

Data on incidence and mortality from colonic cancer compiled by the California Tumor Registry were analyzed for socioeconomic and racial patterns in colonic cancer survival. Socioeconomic level was ranked from high to low, on a four-point scale, according to criteria of income, education and employment. Nonwhites had higher incidence and poorer survival rates for colonic cancer than whites. Colonic cancers in nonwhites were more apt to be in an advanced stage at diagnosis than colonic cancers in whites. The incidence of colonic cancer in California was found to be rising, and to be significantly higher in the two higher socioeconomic counties. However, there were no significant differences in the localization of colonic cancers (i.e., cecum, appendix, ascending or transverse colon, or sigmoid colon) between different socioeconomic or racial groups.

6081 A COMPARATIVE MORPHOLOGIC STUDY OF ROUS RAT SARCOMA WITH NORMAL AND ABNORMAL CHROMOSOMAL PATTERN. (E.) Lindberg, L. G. (Inst. Path., U. Lund, Sweden), F. Mitelman and P. Vorwerk. *Lab Invest* 27(4):387-392, 1972.

Morphologic and volumetric data of Rous rat sarcoma cells with normal diploid karyotype are compared with the same data obtained from a Rous rat sarcoma with cells containing four extra chromosomes. Primary Rous rat sarcoma (RR sarcoma) was transplanted to succeeding generations of rats and chromosomes were studied intermittently, usually every other passage. Preparations for electron microscopic studies were selected from passages 1 and 14, resp. In passage 1, as in the primary sarcoma, 100% of

the tumor cells analyzed had a normal diploid karyotype whereas in passage 14 no cells with a normal karyotype were observed; the stemline number was 46 and differed from the normal by gains of $2t$, $1st_3$ and $1st_5$ chromosome. RR sarcomas were composed of two morphologically different types of cells: a large cell with much cytoplasm and a nucleus containing scanty granular chromatin and a large nucleolus (A cells); and a small cell with a proportionally large nucleus and dense chromatin pattern (C cells). Karyologically normal RR A cells were 60% larger than karyologically abnormal A cells, while aneuploid C cells were twice as large as diploid C cells. Other parameters common to RR cells did not differ between the diploid and non-diploid cells.

- 6082 THE DISTRIBUTION OF CANCER WITHIN THE LARGE BOWEL. (E.) De Jong, U. W. (Epidemiol. Biostatistics U., IARC, Lyons, France), N. E. Day, C. S. Muir, T. H. C. Barclay, G. Bras, F. H. Foster, D. J. Jussawalla, M. Kurihara, G. Linden, I. Martinez, P. M. Payne, E. Pedersen, N. Ringertz and T. Shammugaratnam. *Int J Cancer* 10(3):463-477, 1972.

The incidence of large-bowel cancer by subsites of the colon and rectum was determined for 13 populations: Alameda County (California), Bombay, Denmark, Kingston and St. Andrew (Jamaica), Miyagi Prefecture (Japan), New Zealand, Norway, Puerto Rico, Saskatchewan (Canada), Singapore, Southern Metropolitan Cancer Registry (England) and Sweden. In this series, the highest rates for large-bowel cancer are found in North America and New Zealand and the lowest in the East (Japan, Bombay and Singapore) and the Caribbean. Intermediate rates prevail in Scandinavia and England. In areas of high and intermediate risk, the incidence of large-bowel cancer decreases from ascending colon toward the descending colon with a sharp increase in incidence at the sigmoid colon, the rates for the rectum being in turn higher than those for the sigmoid. In low-incidence areas, the general pattern is the same, but there may be a deficit of sigmoid cancers. Denmark has a significant excess of low rectum cancer, particularly in males, although the rates for other parts of the large intestine in this registry are in the intermediate range. Under age 65 yr the sex ratio for each registry is fairly uniform throughout the colon. At age 65 and over, the incidence of descending and sigmoid colon cancer increases more steeply in males than in females, as does the incidence of rectal cancer. The sex ratios for ascending and transverse colon cancer do not change with advancing age. The results are consistent with subsite risk being related to the transportation rate of colonic content. Rates in a variety of risk situations need to be investigated, with particular attention to the sigmoid in low-risk areas.

- 6083 INCIDENCE OF NEOPLASMS IN CHILDREN BORN AFTER INFLUENZA EPIDEMICS. (E.) Leck, I. (Dept. Social Preventive Med., U. Manchester, England) and J. K. Steward. *Brit Med J* 4(5841): 631-634, 1972.

The hypothesis that children whose mothers have had influenza during pregnancy are especially susceptible to lymphatic and hematopoietic tumors was tested. The incidence of such tumors among children registered at the Manchester (England) Children's Tumor Registry between 1954-1968 was studied. Six influenza epidemics had occurred in the Manchester area during the study period. The incidence of lymphatic and hematopoietic tissue neoplasms was no higher among children born after these epidemics than among children born at other times.

- 6084 PETS AND ADULT LEUKEMIA. (E.) Bross, I. D. J. (Roswell Park Mem. Inst., Buffalo, N.Y.), Sister R. Bertell and R. Gibson. *Am J Pub Health* 62(11):1520-1531, 1972.

Data on leukemia incidence in adults in the Tri-State Survey (New York, Maryland and Minnesota) were compiled and correlated with exposure to pet animals. A total of 1413 leukemia cases (with appropriate controls) was studied between 1959 and 1962. When correlations were sought between leukemia incidence and exposure to animals without regard to the health of the animals in question, results were negative. However, exposure to sick cats increased the leukemia risk from 1.09 for all cats to 1.75, and exposure to sick birds increased the risk from 1.26 with all birds to 1.99. Evidence for a correlation between leukemia and exposure to sick dogs was equivocal. The effect of sick pets showed more strongly in patients with acute as opposed to chronic leukemia. The largest risk for exposure to sick birds and cats was seen for acute lymphatic leukemia.

- 6085 EPIDEMIOLOGIC STUDIES ON UTERINE CANCER AT CANCER INSTITUTE HOSPITAL, TOKYO, JAPAN. (E.) Masubuchi, K. (Cancer Inst. Hosp., Tokyo, Japan) and H. Nemoto. *Cancer* 30(1):268-275, 1972.

Five hundred seventy-two female patients with uterine carcinoma and 200 randomly chosen noncancer patients seen at the Cancer Institute Hospital, Tokyo, Japan, were interviewed in an epidemiological study. In addition, the hospital records of 2,923 patients with uterine carcinoma treated in the clinic from 1954-1963 were examined and compared with the records of 100 randomly chosen noncancer patients seen during the same period. Patients with carcinoma of the corpus or cervix were married at a younger age than the women from the control groups. Women with cervical carcinoma had more pregnancies and deliveries, were younger at the time of their first delivery and were older at the time of their last delivery than were the women of the control groups. Significantly more women with corpus carcinoma were nulliparous than were women of the control groups. The percentage of carcinoma patients who had first intercourse before the age of 19 was higher than that of the control groups. The proportion of patients with either a history of syphilis or a positive Wassermann test at the time of admission was higher in the carcinoma groups than

in the controls. The proportion of carcinoma patients whose spouses had a history of phimosis or paraphimosis was greater than that of the control group. The data also suggested a familial tendency for uterine and extra-uterine carcinoma; however, these results were not statistically different from the controls.

- 6086 SOME OBSERVATIONS ON THE EPIDEMIOLOGY OF CANCER OF THE BREAST IN WOMEN OF WESTERN INDIA. (E.) Paymaster, J. C. (Tata Mem. Hosp., Bombay, India) and P. Gangadharan. *Int J Cancer* 10(3):443-450, 1972.

Cancer of the cervix is the most common cancer in Indian women followed by cancer of the breast. Between 1941-1970, 65% of the women cancer patients at Tata Memorial Hospital, Bombay, had cancer of the cervix (28,865 cases) and 30% had breast cancer (7409 cases). The incidence of breast cancer varied widely among females of different religious communities and was highest among Parsis (49.4%) and Sindhis (30.5%). A comparison of 746 cancer cases with 746 controls suggested that factors such as age at marriage, age at first pregnancy, and number of children are high-risk factors in the etiology of cancer in patients between 40-54 yr of age. Almost 80% of the Parsi women with breast cancer were age 45 or above. Compared with other communities, the proportion of never married women is high among Parsis. A trend to late age at first marriage has resulted in increased age at first pregnancy and low total parity.

- 6087 CANCER MORTALITY IN NEW ZEALAND: 4. OTHER PRIMARY SITES. (E.) Donovan, J. W. (Dept. Math. Stat., U. Sydney, Australia). *NZ Med J* 75(478):144-148, 1972.

New Zealand cancer statistics from 1941 to 1968 were reviewed to determine mortality trends for cancers of the lung, kidney, bladder; leukemias; and some less common cancers. Increases in lung cancer mortality were found to have declined among younger male cohorts, though Maori males and females continued to show very high lung cancer death rates, the rate for Maori females being three times the highest national rate given in a recent report. Kidney cancer mortality did not change over the study period. Bladder cancer deaths increased in males over 65, and leukemia deaths increased among both males and females for persons over 75. The latter increase may have been due to increased diagnosis of leukemia, though a real increase in stem cell leukemia was indicated. Laryngeal cancer mortality was on the decline in New Zealand. Malignant melanoma mortality and brain tumor mortality were on the rise. Bone cancer deaths were decreasing, perhaps because of fewer false diagnoses.

- 6088 ULTRASTRUCTURE OF TRANSPLANTABLE MOUSE HEPATOMAS WITH DIFFERENT GROWTH RATES. (E.)

Malick, L. E. (Div. Biol. Med. Sci., Brown U., Providence, R.I.). *J Nat Cancer Inst* 49(4):1039-1055, 1972.

- 6089 RETINOBLASTOMA: PRESENTATION AND SURVIVAL IN NEGRO CHILDREN COMPARED WITH WHITES. (E.) Newell, G. R. (Dept. Epidemiol. Biostatistics, Tulane U., New Orleans, La.), J. D. Roberts and A. Baranovsky. *J Nat Cancer Inst* 49(4):989-991, 1972.

- 6090 MULTIPLE MYELOMA INCIDENCE IN METROPOLITAN ATLANTA, GEORGIA: RACIAL AND SEASONAL VARIATIONS. (E.) McPhedran, P. (U.S. Dept. H.E.W., Atlanta, Ga.), C. W. Heath, Jr. and J. Garcia. *Blood* 39(6):866-873, 1972.

- 6091 URBANIZATION AND CARCINOMA OF THE UTERINE CERVIX. (Hung.) Kadar, T. (Postgrad. Med. Inst. Budapest, Hungary), A. Nagy and A. Papolczy. *Magyar Noorv L* 34:415-421, 1971.

- 6092 MORTALITY FROM LEUKEMIA IN THE GERMAN FEDERAL ARMY. (Ger.) Mairose, U. B. (Fed. Army Inst. Gen. Exp. Path. Mainz, Germany) and J. Altwein. *Med Welt* 23(20):755-757, 1972.

- 6093 THE FREQUENCY OF UTERINE CERVIX CARCINOMA. (Ger.) Neumann, G. (City Hlth. Ser. Stuttgart Germany). *Lebensversicherungsmedizin* 24(4):87-90, 1972.

- 6094 MORTALITY FROM MELANOMA IN SWITZERLAND AS RECORDED BETWEEN 1951 AND 1968. (Ger.) Ott, F. (Dermatol. Clin. U. Zürich, Switzerland), H. Werder and H. Storck. *Praxis* 61(22):747-749, 1972.

- 6095 EPIDEMIOLOGY OF LEUKEMIA AMONG CHILDREN IN BULGARIA. (Rus.) Bratanov, Br. Ts. (Sofia, Bulgaria), N. Doncheva, Yem. Lozanov and G. Stankov. *Pediatrics* (5):80-81, 1972.

- 6096 THE WOMAN AND THE SMOKING-INDUCED LUNG CANCER PROBLEM. (Dut.) Drogendijk, A. C. (Free U. Amsterdam, Netherlands). *Nederl T Geneesk* 116(23):957-960, 1972.

- 6097 UTERINE CERVIX CANCER EPIDEMIOLOGY IN WARSAW BETWEEN 1963-1967. (Sp.) Gadowska, H. (U. Warsaw, Poland). *Folia Clin Int (Bare)* 22(4):274-280, 1972.

- 6098 IS MOTORIZATION THE MAIN CANCER-CAUSING FACTOR? (Ger.) Blumer, W. (Radiation Ther. Nucl. Med. Clin. U. Zürich, Switzerland), R. Jaumann and T. Reich. *Praxis* 61(16):514-518, 1972.

- 6099 THE CANCER MORTALITY RATE AMONG ASBESTOS INDUSTRY WORKERS IN THE URALS. (Rus.) Kogan, F. M. (Sverdlovsk Inst. Occup. Hyg. Dis., USSR), N. A. Gusel'nikova and M. R. Gulevskaya. *Gig Sanit* (7):29-32, 1972.
- 6100 CONTRIBUTION TO THE EPIDEMIOLOGY, DETECTION, DIAGNOSIS, AND THERAPY OF PENILE CARCINOMA. (Ger.) Kuchenbuch, H.-S. (Natl. Army Hosp. Ueckermünde, Germany) and H.-D. Jung. *Arch Geschwulstforsch* 39(2):128-136, 1972.
- 6101 AN EPIDEMIOLOGIC STUDY OF LUNG CANCER IN MALES AGED 40-64 YEARS LIVING IN THE KOLIN DISTRICT (RESULTS FOR A 4-YEAR PERIOD). (Cz.) Kubik, A. (Res. Inst. Tuberc. Resp. Dis. Prague, Czechoslovakia), R. Krivinka, V. Stasek, J. Krivanek and V. Neumann. *Stud Pneum Phtis Cechoslov* 32(3/4):119-125, 1972.
- 6102 A STUDY OF EPIDEMIOLOGIC FACTORS IN CARCINOMA OF THE UTERINE CERVIX. (Kor.) Kwak, H. M. (Yonsei U. Coll. Med., Seoul, Korea), I.-S. Kim, S. O. Chung and H. Hwang Dong. *J Korean Med Ass* 15(3):242-248, 1972.
- 6103 REPORT ON THE MALE CARCINOMA OF THE BREAST IN THE GDR IN THE PERIOD FROM 1.7.1968 TO 30.6.1969. (Ger.) Pinnow, W. (Charité Tumor Clin. Humboldt U. Berlin, Germany), H. Rehde, W. Reichel, K. Baldauf and S. Möpert. *Radiobiol Radiother* 13(1):15-21, 1972.
- 6104 THYMIDINE LABELLING STUDIES IN A TRANSMISSIBLE VENEREAL TUMOUR OF THE DOG. (E.) Cohen, D. (Sch. Vet. Med., Cambridge, England) and G. G. Steel. *Br J Cancer* 26(5):413-419, 1972.
- 6105 MALIGNANT MELANOMA IN GIPPSLAND, VICTORIA: INCIDENCE AND A STUDY OF 65 CASES. (E.) Mitchell, J. H. (Monash U., Melbourne, Australia) and J. A. Hayman. *Med J Aust* (26):1352-1357, 1972.
- 6106 MALIGNANT MELANOMA. SOME CASES IN GENERAL PRACTICE AND A COMPUTER-ASSISTED INVESTIGATION OF INCIDENCE AND SURVIVAL. (E.) Clout, I. (Crawley, Sussex, England). *J R Coll Gen Pract* 22(121):508-520, 1972.
- 6107 SOME INTERFERENCE MICROSCOPIC OBSERVATIONS DURING THE GROWTH OF EHRlich ASCITES TUMOUR. (E.) Svejda, J. (Med. Fac. U. J. E. Purkyne, Brno, Czechoslovakia), A. Rejthar and R. Wotke. *Neoplasma* 19(5):477-481, 1972.
- See also:
* (Rev): 5706, 5732, 5746
* (Chem): 5768, 5797, 5816, 5817
* (Viral): 5955, 5956

MISCELLANEOUS

6108 COMPARATIVE CYTOGENETIC AND QUANTITATIVE
CYTOCHEMICAL DNA STUDIES IN ACUTE LEUKEMIAS.
(Ger.) Müller, D. (Med. Clin., Inst. Anthropol.
Human Genetics, U. Tübingen, West Germany), D. Orywall
and N. Hübner. *Blut* 23(5):287-301, 1971.

A comparative study of cytogenetic and cytochemical
findings in 15 cases of acute leukemia was conducted.
The overwhelming number of metaphases appearing in all
the well growing preparations indicated the presence
of diploid chromosomes. In 13 of these patients, a
cell frequency of 32-36 arbitrary units could be de-
tected by Feulgen photometry which corresponded to
previously determined figures on normal bone marrow
granulocytes. One patient with myeloblastic leu-
kemia exhibited a hyperdiploidy with 53 chromosomes,
together with a Feulgen photometric increased
DNA value, which was proportional to the increase
in chromosomes. Another patient with myeloblastic
leukemia showed numerous tetraploid metaphases in
the chromosome analysis. In four leukemia patients
increased blasts were demonstrated with a twofold
increase in DNA. No correlation could be detected
between DNA values of a blast population and
the aberrations in chromosome counts. Other factors
may be involved in determining the DNA content of
leukemia blasts, besides chromosome quantities.

6109 REGULATION OF THE NUCLEOLAR DNA-DEPENDENT
RNA POLYMERASE BY AMINO ACIDS IN EHRlich
ASCITES TUMOR CELLS. (E.) Franze-Fernandez, M. T.
New York Blood Ctr., New York) and A. O. Pogo.
Proc Nat Acad Sci USA 68(12):3040-3044, 1971.

Amino acids in incubation media are thought to be
regulatory factors controlling nucleolar RNA polymer-
ase activity. RNA polymerase was assayed by measur-
ing the incorporation of [³H]GMP and [³H]UMP into
RNA. Ehrlich ascites tumor cells of mice were in-
cubated with and without added amino acids in Eagle's
medium. [³H]uridine incorporation into 45S rRNA
showed more labeled 45S rRNA in amino acid-enriched
cells than in cells from low amino acid media. Cells
incubated with or without amino acids had similar
amounts of [³H]uridine incorporated into RNA species
other than the 45S rRNA. RNA polymerase assay was
inhibited by actinomycin D, thereby showing its DNA
dependence. In nuclei of cells from amino acid-
enriched media, GMP incorporation into RNA was
consistently high. Kinetics of GMP incorporation
show a similar time course in both high and low
amino acid media, yet the rate of GMP incorporation
and final plateau level were less in cells from low
amino acid media. Cells exposed to a medium of high
amino acid concentration show a rapid rise in enzyme
activity leveling off at 20 min; a second burst of
activity was detected after 60 min. The non-linear
enzyme activity elevations suggest that more than
one metabolic process may be involved in controlling
the activity of nucleolar RNA polymerase.

6110 MULTIPLE CHROMOSOME ABERRATIONS IN A LYMPHO-
SARCOMATOUS TUMOR. (E.) Fleischmann, T.

(Inst. Genetics, U. Lund, Sweden), C. H. Hakansson,
A. Levan and T. Möller. *Hereditas* 70(2):243-258,
1972.

Karyotype studies were performed on material from
two biopsies taken from a fatal lymphoblastic sar-
coma developed on a 61-yr-old man. The chromosome
number 48 predominated in chromosome fixations from
both biopsies. The stemline appeared to have changed
in the proportions of the normal chromosome types.
The most striking change observed, however, was the
appearance of five medium-sized marker chromosomes
with a completely median centromere. These chromo-
somes showed up on orcein slides and fluorescence
analysis of chromosomes. Though two of these
marker chromosomes appeared to be fragments of other
chromosomes, three remained unexplained. These three
markers fluoresced brightly and evenly in both arms.
They resembled markers recently found in four other
malignant lymphomas.

6111 ENDOCRINE STUDIES IN POST-MENOPAUSAL WOMEN
WITH OVARIAN TUMOURS. (E.) Edwards, R. L.
(Birmingham Midland Hosp. Women, England), H. O.
Nicholson, T. Zoidis, W. R. Butt and C. W. Taylor.
J Obstet Gynaecol Br Commow 78:467-477, 1971.

An endocrine assessment was made in 78 post-menopau-
sal women. The urinary excretion of estriol was
greater than 10 µg per 24 hours in 14 out of 31
cases with malignant ovarian tumors, in 2 out of 24
cases with benign ovarian tumors, and in 6 out of 23
cases without ovarian tumors. Although the urinary
estriol excretion was increased in all eight cases with
mucinous carcinoma it was raised in only 4 out of 18
cases with serous carcinoma. Some of the greatest
amounts of urinary estriol were found in cases with-
out ovarian tumors. The urinary excretion of
pregnanediol was increased in 6 out of 18 cases.
These six patients also had increased estriol excre-
tion. The excretion of steroids was normal after
oophorectomy. Tests of adrenal cortical activity and
ovarian vein blood analysis also point to the
diseased ovary as the site of increased steroid
synthesis. The correlation of increased urinary
estriol with vaginal cornification index was fair,
but with vaginal bleeding and endometrial activity
was poor.

6112 STUDIES ON PLASMA MEMBRANES. XVII. ON
THE CHEMICAL COMPOSITION OF PLASMA MEM-
BRANES PREPARED FROM RAT AND MOUSE LIVER AND HEPA-
TOMAS. (E.) Emmelot, P. (Netherlands Cancer Inst.,
Amsterdam) and C. J. Bos. *J Membrane Biol* 9(1):83-
104, 1972.

Plasma membranes were isolated under hypotonic
conditions from rat and mouse livers and five hepato-
mas, i.e. one rather anaplastic rat hepatoma (and
its subline) and three well-differentiated mouse
hepatomas. All these membranes contained some 25%
protein soluble in 0.15 M NaCl. Evidence is pre-
sented that this protein is mainly, if not exclusively

of nonmembranous origin. Protein/phospholipid P (P=phosphorus) ratios did not differ significantly for the various plasma membrane species except the rat-hepatoma subline, which showed a markedly lower ratio and was thus identified. Hepatoma membranes contained more P of a nonphospholipid nature than did liver membranes and to this increase contributed in all instances an increased RNA content and in some cases also an increased DNA content. RNA may be present in isolated plasma membranes in two forms: one type that cannot be removed and another that is removable by physiological saline. The saline-soluble type of membrane RNA results from the presence of Ca^{2+} during homogenization and is a low molecular wt RNA species that could be transfer RNA of the cytoplasm. Whether the RNA of the saline-insoluble membranes, which corresponds in amount to about 1% of the clean-membrane protein on a weight basis, is a genuine constituent of the plasma membranes, remains to be established. The increase in hepatoma-membrane RNA is attributed to the ribosomal RNA of the few microsomal vesicles which are structurally connected with these plasma membranes. The sialic acid content and the percentage of neuraminidase-resistant sialic acid of hepatoma as compared with liver membranes was either similar or changed, depending on the hepatoma strain. Gel-filtration of trypsin-released peptides of liver plasma membranes showed hexosamine and hexose to be confined to the sialic acid-containing fractions. In spite of quantitative differences among fractions, the relative contents of the three carbohydrates in the combined fractions were (about) similar to those in intact liver membranes. Similar experiments with the rat-hepatoma membranes showed a changed carbohydrate expression.

- 6113 RENAL CARCINOMA (HYPERNEPHROMA) OCCURRING IN 5 SIBLINGS. (E.) Franksson, C. (Serafimer Hosp., Caroline Inst., Stockholm, Sweden), A. Bergstrand, I. Ljungdahl, G. Magnusson and H. Nordenstam. *J Urol* 108:58-61, 1972.

Primary renal carcinoma has been demonstrated in five siblings. The tumors were multiple and bilateral in four of the patients and located in the right kidney of the other. The clinical picture and histologic patterns were consistent in all five cases. Symptoms first appeared when the patients were between 37 and 53 yr old and included fever, hematuria, backache, and a palpable tumor. All tumors were well demarcated from the renal tissue and from the perirenal and hilar fatty connective tissue. Both the primary tumors and the metastases consisted histologically of tubular or papillary structures with a poorly developed connective tissue matrix. One patient with bilateral tumors had a history of polycystic kidneys.

- 6114 CYCLIC 3',5'-NUCLEOTIDE MONOPHOSPHATE PHOSPHODIESTERASE ACTIVITY IN HEPATOMAS OF DIFFERENT GROWTH RATES. (E.) Rhoads, A. R. (Howard U. Coll. Med., Washington, D.C.), H. P. Morris and W. L. West. *Cancer Res* 32(12):2651-2655, 1972.

Cyclic 3',5'-nucleotide monophosphate phosphodiesterase activity was determined for seven hepatomas of different growth rates and host livers. Activity was measured in the soluble fraction of the cell ($78,000 \times g$) in the presence and absence of 4 mM imidazole. The activity of phosphodiesterase in all hepatomas examined was significantly below the level found in normal liver of non tumor-bearing rats. This decrease level of phosphodiesterase activity was observed in both the presence and absence of imidazole and ranged from 30 to 60% of levels found in respective controls. The enzyme from neoplastic tissue showed a decreased response to imidazole stimulation. At 40 mM, imidazole caused an average stimulation of 28% for normal and host liver tissue compared to 16% for the enzyme from hepatomas. Decreased phosphodiesterase activity was also observed in the host livers of animals bearing hepatoma 7800 and 7777. In contrast to decreased activity in hepatomas, fetal liver and regenerating liver showed a significant increase in the imidazole-stimulated activity. In the presence of imidazole, phosphodiesterase activity in all tissues was stimulated 110 and 135% of basal levels. Differences in the pH-activity profiles were observed between phosphodiesterase from normal and neoplastic liver. Phosphodiesterase of normal liver had a well-defined pH optimum at 7.4, whereas the activity from hepatoma had a broader optimum ranging from 6.2 to 7.4. Kinetic plots of the hydrolysis of cyclic adenosine 3',5'-monophosphate exhibited anomalous behavior suggesting that both normal and neoplastic tissue contain at least two different phosphodiesterase activities. Apparent Michaelis constants for the high- and low-affinity enzymes ranged from 2.5 to 7.6 μM and from 39 to 54 μM , respectively.

- 6115 STUDIES ON PLASMA MEMBRANES. XVIII. LIPID CLASS COMPOSITION OF PLASMA MEMBRANES ISOLATED FROM RAT AND MOUSE LIVER AND HEPATOMAS. (E.) Hoeven, R. R. van (Netherlands Cancer Inst., Amsterdam) and P. Emmelot. *J Membrane Biol* 9(2):105-126, 1972.

Plasma membranes were isolated from homogenates of normal mouse and rat livers, of two slowly growing and well-differentiated mouse hepatomas and of one anaplastic and rapidly growing rat hepatomas (and its subline), and their lipid class compositions were chemically determined and compared. Total lipids accounted for 30-35% of the dry wt of the membranes of normal rat and mouse livers and of the mouse hepatomas, and for 45% in the rat hepatoma subline. Phospholipids accounted for 60, 55, and 50% of the total lipid fraction of normal rat liver, normal mouse liver and rat hepatoma, and of mouse hepatoma membranes, resp. In all plasma cell membranes studied, cholesterol was the major neutral lipid. Both rat and mouse hepatoma membranes contained 25-50% more cholesterol than did normal liver membranes. Although cholesterol esters of hepatoma membranes were increased, the differences in the cholesterol contents were probably due to increases in the free cholesterol fraction. Increases were also observed in the free fatty acid content of the

mouse and rat hepatoma membranes. The major phospholipid components of all plasma membranes studied were phosphatidyl choline, sphingomyelin, phosphatidyl ethanolamine and phosphatidyl serine. Their relative proportions differed appreciably, with normal mouse and rat liver membranes showing the closest resemblance. Cardiolipin was absent from normal rat and mouse liver membranes, but could be detected in hepatoma membranes due to mitochondrial contamination. No consistent phospholipid profile characterized the hepatomas as opposed to normal liver plasma membranes, nor did the profiles (including plasmalogens) resemble those previously reported for other hepatomas. The only distinguishing feature appeared to be the increased cholesterol levels of the hepatoma plasma membranes.

- 6116 SPECIFIC ESTROGEN-RECEPTORS IN THE NEOPLASTIC AND LACTATING MAMMARY GLAND OF THE RAT. (E.) Wittcliff, J. L. (U. Rochester Sch. Med. Dentistry, N.Y.), D. G. Gardner, W. L. Battema and P. J. Gilbert. *Biochem Biophys Res Commun* 48(1):119-125, 1972.

Specific ^3H -estradiol- 17β receptors were studied by a sucrose gradient assay of cytosol fractions from homogenates of normal lactating mammary gland and the estrogen-responsive R3230AC rat mammary adenocarcinoma. Specific estrogen-binding substances, sedimenting as 8S particles, were detected in both normal lactating breast and mammary adenocarcinoma. Preincubation of the cytosol fractions with the antiuterotropic substance CN-55, 945-27 prevented binding of ^3H -estradiol. The 8S receptors of both tissues were saturated at estradiol concentrations of 1-2 nM. The estrogen receptors in the hyperplastic and neoplastic tissues exhibited similar dissociation constants of approximately 1×10^{-9} M. Lactating mammary gland contained about three times as many receptors per mg protein as the mammary adenocarcinoma. Ovariectomy of the host had no apparent effect on the number of binding sites per mg protein in the R3230AC tumor. Progesterone, hydrocortisone, testosterone and dihydrotestosterone did not bind to the estrogen receptors of either lactating mammary gland or R3230AC tumor.

- 6117 FAMILIAL ACUTE MYELOID LEUKAEMIA WITH ACQUIRED PELGER-HUET ANOMALY AND ANEUPLOIDY OF C GROUP. (E.) Kaur, J. (Royal Postgrad. Med. Sch., London, England), D. Catovsky, H. Valdimarsson, J. Jansson and A. S. D. Spiers. *Brit Med J* (5836):327-331, 1972.

An Icelandic family is described in which all five members of a sibship had leukemia; two members had acute myeloid leukemia, one had myelofibrosis and leukemic change, and two had evidence of preleukemia. The acquired form of the Pelger-Huët and anomaly was seen in neutrophils of all siblings. Also, bone marrow cells showing aneuploidy of the C group chromosomes (chromosome number = 47) were seen in two sibs. Immunological deficiencies and increased

susceptibility to virus infection were also present in the family.

- 6118 INDUCTION OF MELANOTIC PSEUDOTUMORS IN *DROSOPHILA MELANOGASTER* BY JUVENILE HORMONE. (E.) Madhavan, K. (Lab. Develop. Biol., Swiss Federal Inst. Technol., Zürich). *Wilhelm Roux Arch* 169(4):345-349, 1972.

Larva, prepupae and pharate adults of *Drosophila melanogaster*, strains *aldehyde oxidase negative* (*Aldoxⁿ*), *bw*, *yv* and *yvf*, were given topical applications of Cecropia C_{18} juvenile hormone (JH) dissolved in N,N-dimethylformamide (DMFM). DMFM alone induced melanotic masses in 13% of *Aldoxⁿ* and *bw* third instar larva, but failed to induce masses in third instar *yv* or *yvf* larvae. JH induced melanotic masses in all strains tested, and produced masses in 100 and 79% of third instar *Aldoxⁿ* and *bw* larva, resp. Melanotic masses became macroscopically visible 26-32 hr after JH treatment. *Aldoxⁿ* and *yvf* larva, injured cutically before JH and/or DMFM, developed melanotic masses similar to those induced in uninjured larva by these agents. DMFM induced melanotic masses in 15% of late second instar *Aldoxⁿ* and *bw* larva; JH induced melanotic masses in 85% of late second instar *Aldoxⁿ* larva and in 91% of late second instar *bw* larva. Possible mechanisms of pseudotumor formation by JH are discussed.

- 6119 ADENYLATE CYCLASE ACTIVITY IN ADRENOCORTICOTROPIC HORMONE-SENSITIVE AND MUTANT ADRENOCORTICAL TUMOR CELL LINES. (E.) Schimmer, B. P. (Banting Best Dept. Med. Res., U. Toronto, Canada). *J Biol Chem* 247(10):3134-3138, 1972.

Adrenocorticotrophic hormone (ACTH) was added to cultures of three populations of adrenal tumors: Y-1 cells, which respond to ACTH with increased steroidogenesis, and two mutant cell lines, Y-6 and OS3, which are insensitive to ACTH. Adenylate cyclase activity in the three lines treated with ACTH was measured by observing the conversion of $(8\text{-}^{14}\text{C})\text{ATP}$ or $(2\text{-}^3\text{H})\text{ATP}$ to adenosine $3',5'$ -monophosphate (cAMP). Adenylate cyclase activity is stimulated by ACTH in Y-1 cells and Y-1 cell homogenates but not in Y-6 or OS3 cells. Homogenates of all three cell lines were stimulated by sodium fluoride. These observations demonstrate that Y-6 and OS3 cells are defective in the ability to accumulate cAMP in response to added ACTH and that this defect is the result of an adenylate cyclase which is insensitive to ACTH. Adenylate cyclase activity in Y-1, Y-6 and OS3 cells is not distinguishable in terms of requirements for fluoride ion, pH optima, stability at 37 C, optimum ATP:Mg^{2+} ratio and apparent K_m values. The findings that ATP, at concentrations in excess of Mg^{2+} , inhibit fluoride-stimulated adenylate cyclase in the three cell types, and that the inhibition is overcome by increased Mg^{2+} concentration, suggest that $\text{ATP}\cdot\text{Mg}$ is the substrate for adenylate cyclase.

- 6120 MOUSE-MYELOMA RNA POLYMERASE B. TEMPLATE-SPECIFICITIES AND THE ROLE OF A TRANSCRIPTION-STIMULATING FACTOR. (E.) Lentfer, D. (Max-Planck Inst. Exp. Med., Göttingen, West Germany) and A. G. Lezius. *Eur J Biochem* 30(2):278-284, 1972.

A DNA-dependent RNA polymerase was purified from homogenates of the mouse myeloma tumor, MOPC 70 E. A stimulating factor (heat-labile protein of 20,000-30,000 mol wt that restores double strand specificity) was also purified from the same system. The purified enzyme showed an absolute requirement for DNA, required Mn^{++} and medium ionic strength for maximum activity, and was totally inhibited by α -amanitin and phosphate ion, thus establishing it as RNA polymerase B. The template specificities were studied using native and heat-denatured DNA as well as synthetic double and single-stranded polydeoxynucleotides. Alternating polydeoxynucleotides (e.g., poly-[d(A-T-d(A-T))] and poly[d(I-C-d(I-C))] were the most efficient templates. The latter stimulated the incorporation of 3H -UTP into RNA by two orders of magnitude in the absence of stimulating factor when compared with the template activity of native DNA. The addition of factor resulted in only a two-fold increase in 3H -UTP incorporation with the alternating polydeoxynucleotide templates. Templates with a base composition similar to calf thymus DNA (e.g. poly[d(A-C-d(T-G))] and poly[d(A-G-d(T-C))] were intermediate in activity; however with these templates, factor stimulated 3H -UTP incorporation by five-fold. The homoduplexes (poly-(dA)·poly(dT), poly(dG)·poly(dC), and poly(dI)·poly(dC) were very poor templates both in the presence and absence of stimulating factor. Among the single-stranded templates assayed, poly(dI) and poly[d(T-G)] were completely inactive, whereas poly(dC) and poly(dT) were readily transcribed. The stimulating factor was probably not involved in transcription initiation since the rate of incorporation of γ - ^{32}P -ATP into RNA was unaltered in its presence.

- 6121 PHOSPHORYLASE AND GLYCOGEN IN THE SQUAMOUS CELL CARCINOMA OF THE LUNG AND BENIGN GROWTHS OF THE SQUAMOUS EPITHELIUM OF THE BRONCHI. (Rus.) Badmaeva, V. V. (P. A. Gertsen Moscow Res. Inst. Oncol., USSR). *Arkh Patol* 33(12):58-62, 1971.

The metabolism of glycogen and phosphorylase was studied histochemically in 20 lung cancer tumors, two bronchial papillomas and three cases of metaplastic bronchial mucosa. High phosphorylase activity was observed in the metaplastic bronchial epithelium and the squamous epithelium of the papillomas without signs of cell anaplasia. Phosphorylase activity in benign growths of the squamous epithelium in the lung was seen in areas of glycogen accumulation in mature epithelial cells. Differentiated forms of squamous cell carcinoma were characterized by loss of phosphorylase and the presence of free glycogen in tumor cells. Nondifferentiated squamous cell cancer differed from the more mature forms in the complete absence of glycogen and phosphorylase detected histochemically.

- 6122 GLUCURONIC ACID IN THE BLOOD AND URINE OF PATIENTS WITH CANCER AND PRECANCER OF THE MAMMARY GLAND. (Rus.) Al'pert, A. E. (Saratov Med. Inst., USSR) and A. M. Lunts. *Vopr Onkol* 17(11):28-31, 1971.

Blood and urine glucuronic acid levels were determined by the Marrog and Dische methods, resp., in 65 women (29-77 yr old) with mammary gland cancer and 15 women with precancerous fibrocystic mastopathy. The average level of blood glucuronic acid was similar in mammary cancer patients (7.2 mg%) and 54 healthy controls (6.9 mg%). Protein-containing serum fractions in which glucuronic acid may be combined with estrogens were less than 2.0 mg% in 3% of healthy subjects compared with 25% of cancer patients. Seventy-seven percent of healthy women but only 34% of tumor patients had total glucuronic acid levels between 5.0-8.9 mg%. Two groups of cancer patients were distinguished: those with very low (20%) and those with very high (22%) content of total glucuronic acid in blood. Analogous results were obtained in patients with precancerous conditions of the mammary gland, indicating early disturbances in glucuronic acid metabolism in the malignant process. There was a direct correlation between the stage of cancer and the total content of glucuronic acid in blood: the number of patients with hypoglucuronemia increased with the advance of cancer. It is suggested that blood glucuronic acid level and glucuronidase activity are related to the metabolism of estrogen and other steroid hormones.

- 6123 CHROMOSOME ABNORMALITIES IN AKR/TIALD LEUKAEMIAS. (E.) Legrand, E. (Curie Fdn., Paris, France) and J. F. Duplan. *Eur J Cancer* 7(6):485-490, 1971.

Chromosomal abnormalities of leukemic cells of X-irradiated AKR/TIALD mice were investigated. Mice 60-70 days old were exposed to 900 rads whole body radiation, while mice 30-37 days old received four weekly exposures of 175 rads each. All mice exposed to 900 rads were restored with AKR or TIALD bone marrow cells. Mice receiving four weekly irradiations were divided into three groups: mice restored with AKR bone marrow cells; mice restored with TIALD bone marrow cells; and mice remaining unrestored. All leukemias occurring in 900 rads irradiated mice developed from unirradiated donor cells, but in fractionally irradiated animals thymic lymphosarcomas developed from both host and donor thymic cells. Test animals showing obvious leukemia symptoms were sacrificed and cells from the thymus and marrow of the femur were prepared for chromosome study. Karyotype of cells showed the most frequent chromosome abnormality was a trisomy of the metacentric, probably originating from a nondisjunction. Since this trisomy has never been found in normal mice, it is considered a characteristic of leukemic cells.

- 6124 NONHISTONE CHROMOSOMAL PROTEINS IN SYNCHRONIZED HeLa CELLS. (E.) Bhorjee, J. S. (Worcester Fdn. Exp. Biol., Shrewsbury, Mass.)

and T. Pederson. *Proc Nat Acad Sci USA* 69(11): 3345-3349, 1972.

Synchronized HeLa cells in culture were fractionated and chromatin was isolated from their nuclei at different points in the cell cycle. Chromatin was separated into DNA, histones and nonhistone proteins. Nonhistone proteins, subjected to polyacrylamide gel electrophoresis, produced 22 distinct bands, corresponding to molecular wts of 5,000-180,000 daltons. Eighty-five percent of the material had molecular wts exceeding 40,000. The amounts of some nonhistone proteins remained the same at different stages in the cell cycle, while others changed by as much as 50%. Band 11, for instance, (75,000 molecular wt) decreased markedly in the early S phase, recovering in mid-S. Band 11 was reduced by 50% in mid-S and G₂.

6125 THE INFLUENCE OF PROTEOLYTIC ENZYMES INHIBITOR ON THE COURSE OF LYMPHOCYTE TRANSFORMATION *IN VITRO*. (E.) Tchorzewski, H. Dept. Gen. Exp. Path., Lodz, Poland) and A. Denys. *Experientia* 28(4):462-463, 1972.

It had previously been shown that the content of acid hydrolases in stimulated lymphocytes was increased. To study the possible role of proteolytic enzymes in stimulation, the effects of a proteolytic enzyme inhibitor were determined on *in vitro* PHA- and antigen-stimulated spleen and lymph node lymphocytes cultured from guinea-pigs preimmunized with human serum albumin. The protease inhibitor (200 µg/ml) significantly decreased (7- to 16-fold) the transformation rate of both spleen and lymph node lymphocytes *in vitro*, either after PHA or antigen stimulation, and slightly lowered ¹⁴C-leucine incorporation into cellular protein. The inhibitor had no significant effect on cell survival and did not affect oxygen consumption of transformed lymphocytes. It was concluded that the protease inhibitor prevented *in vitro* lymphocyte transformation by inhibiting protein synthesis.

6126 A FACTOR RESPONSIBLE FOR THE METABOLIC DEVIATIONS IN LIVER OF TUMOR-BEARING ANIMALS. (E.) Tanaka, T. (Inst. Protein Res., Osaka U., Japan), S. Yanagi, M. Miyahara, R. Kaku, H. Imamura, K. Taniuchi and M. Suda. *Gann* 63(5): 555-562, 1972.

The increase in type M₂ pyruvate kinase and in low K_m hexokinase activity was observed in the liver of 129 strains of mice following the i.p. transplantation of Ehrlich ascites tumor cells. Although there were great differences in enzyme activities among the different strains, both M₂ pyruvate kinase and low K_m hexokinase activities were consistently elevated in liver cell homogenates from tumor-bearing mice. The relative increases in the activities of both enzymes were greatest in those strains which showed lower activities in the control animals (e.g., 129, ICR and CF1 mice). The factor responsible for the stimulation in enzyme activity

could be recovered in the supernatant fraction of centrifuged ascites tumor cell sonicates (6,000 g for 15-25 min). The factor was heat stable but could not be acetone extracted. Intraperitoneal injection of bovine serum albumin into nontumor-bearing mice did not cause an increase in M₂ pyruvate kinase or low K_m hexokinase activity. The stimulating activity was present in an ultrafiltrate prepared from tumor cell sonicates, indicating that its molecular wt was less than 50,000.

6127 MECHANISM OF RESISTANCE TO STEROIDS: GLUCOCORTICOID RECEPTOR DEFECT IN LYMPHOMA CELLS. (E.) Rosenau, W. (Dept. Biochem., U. California, San Francisco), J. D. Baxter, G. G. Rousseau and G. M. Tomkins. *Nature New Biol* 237(70):20-24, 1972.

Mouse lymphoma cells, sensitive or resistant to the cytolytic effect of glucocorticoids, were treated with dexamethasone. Dexamethasone in concentrations of 2 x 10⁻⁸ M caused 99% cell lysis of sensitive lymphoma cells, while no cytolysis occurred in resistant cells, even at concentrations of 10⁻⁵ M. Cytosol of sensitive cells contained specific receptors which became saturated with dexamethasone at concentrations above 8 x 10⁻⁸ M; the capacity of cytosol from resistant cells to bind dexamethasone was 10% of the capacity of sensitive cells. Progesterone and 17α-hydroxyprogesterone decreased the lytic response of cells to dexamethasone and inhibited the binding of dexamethasone to cell cytosol. However, progesterone inhibited lysis and cytosol binding more effectively than 17α-hydroxyprogesterone. 17α-Methyltestosterone and testosterone did not cause lysis by themselves, but inhibited lysis by dexamethasone. Androstenedione inhibited neither the dexamethasone lytic effect nor the cytosol binding effect.

6128 SIMILARITIES OF THE ERYTHROCYTES IN JUVENILE CHRONIC MYELOGENOUS LEUKEMIA TO FETAL ERYTHROCYTES. (E.) Maurer, H. S. (Lincoln Sch. Med., U. Illinois, Chicago), L. N. Vida and G. R. Honig. *Blood* 39(6):778-784, 1972.

Erythrocytes from a four yr old boy with fatal juvenile chronic myelogenous leukemia were observed. The patient showed an enlarged spleen, myeloid hyperplasia, thrombocytopenia and low leukocyte alkaline phosphatase. The patient's blood cells had no Philadelphia chromosome. The erythrocytes had many features of erythrocytes of newborns. Fetal hemoglobin comprised 70-73% of the patient's blood hemoglobin, and the oxygen dissociation curve of whole blood was displaced to the left of that of normal adult blood. In addition, hemoglobin A₂ and the erythrocyte I antigen titer were reduced. The glycine:alanine ratio of the 136 position of the γ chain of the patient's fetal hemoglobin was similar to that seen in hemoglobin from newborns. These findings indicate that juvenile chronic myelogenous leukemia is accompanied by a reversion to fetal-type erythropoiesis.

- 6129 THE LIFE SPAN OF CELLULAR CULTURES FROM LEUKEMIC HUMAN BLOOD. (Fr.) Belpomme, D. (Hosp. Paul Brousse, Villejuif, France), P. Blondel and D. Grandjon. *C R Acad Sci [D](Paris)* 274(25):3480-3483, 1972.

The kinetic and morphological analysis of the cultures of 82 samples of human leukemic blood is presented. Blood samples of 20 cm³ were taken from patients with acute or chronic leukemias, either during the first perceptible stage or during a recurrent attack. Death of cultures was determined by nonacidification of the culture medium; absence of viable cells; and complete disappearance of cells from the monolayer adhering to the flasks. The establishment of a permanent line of cultures was determined by their growth curve. Of the 82 samples, 10 could be used to establish 16 permanent lymphoblastoid lines in 12-122 days. Of these, seven derived from acute lymphoid leukemia (LAL), two from acute myelogenous leukemia (LAM), and one from chronic myelogenous leukemia (LMC) bloods; it was not possible to obtain a line from chronic lymphoid leukemia (LLC) blood. The remaining 72 samples produced cultures of a limited life span, the peaks on a distribution curve showing life spans on days 26, 59, and 85. Specimens showing at least one viable culture at different times following culture initiation were divided into four groups based on survival time: 28 specimens with a life span of 10-33 days; 28 with a life span of 35-65 days; 16 with a survival of 66-122 days; and 10 with permanent lines. Of these groups, the second was associated with large monocytoid cells, the third with small monocytoid or microcells, and the fourth with lymphoblasts.

- 6130 RETINOBLASTOMA AND D-CHROMOSOME DELETIONS (E.) Orye, E. (Pediatric Clin., St. U. Ghent, Belgium), M. J. Delbeke and B. Vandenabeele. *Lancet* 2:1376, 1971.

Additional evidence is given consistent with the hypothesis that a locus on the long arm of a D chromosome is concerned in the development of retinoblastoma. All mitoses of PHA-stimulated lymphocytes and directly processed bone-marrow cells from a patient with retinoblastoma had a deletion of the long arm of a D chromosome. The chromosome was identified as number 13 by autoradiography, quinacrine fluorescence, and analysis of the DNA d-r Giemsa banding pattern. The missing section was the broadest of the three bands normally present in that arm. The chromosomes of the parents were normal. The patient had no mental retardation, and only congenital anomalies were bilateral clinodactyly and cleft uvula.

- 6131 ULTRASTRUCTURE OF EXOCRINE SPIRADENOMA. (Rus.) Yavelov, V. A. (Milit. Med. Managt., USSR Min. Defense, Moscow) and V. N. Vinogradov. *Arkiv Pat* 34(5):46-52, 1972.

- 6132 KARYOLOGIC CHARACTERISTICS AND CYTOLOGIC FEATURES OF TUMOR CELLS IN VARIOUS HISTO-

LOGICAL FORMS OF CANCER OF THE PANCREAS. (Rus.) Perzadayev, R. O. (I.P. Pavlov Med. Inst., Leningrad, USSR). *Arkiv Pat* 34(5):28-35, 1972.

- 6133 UNUSUAL LEUKOERYTHROBLASTIC BLOOD COUNT OF AN IMMATURE-CELL LEUKEMIA WITH HETEROTOPIC RENAL HEMOPOIESIS. (Ger.) Meister, H. (Med. Acad., Erfurt, Germany) and A. Lagemann. *Schweiz Med Wochr* 102:617-619, 1972.

- 6134 FUNCTIONAL AND ELECTRONMICROSCOPIC STUDIES OF THE RETICULOENDOTHELIAL SYSTEM IN TUMOR-BEARING RATS. (Jap.) Gocho, Y. (Sapporo Med. Coll., Japan). *Sapporo Med J* 39(3/4):120-138, 1971.

- 6135 AN UNUSUAL CARTILAGINOUS TUMOUR OF THE FINGER. (Ger.) Lenart, G. (Orthopedical Clin., Semmelweis-U., Budapest, Hungary) and K. Szepesi. *Arch Orthop Unfallchir* 73(1):7-10, 1972.

- 6136 CONTRIBUTION TO THE KNOWLEDGE OF SIDERO-PHILOUS TUMORS OF THE KIDNEY. (Ger.) Remmele, W. (Dist. Cap. Clin. Wiesbaden, Germany) and H. Abtahi. *Virchows Arch (Pathol Anat)* 356(3):275-280, 1972.

- 6137 TINKTORIAL AND HISTOCHEMICAL FEATURES OF THE CONNECTIVE TISSUE IN THE ASSESSMENT OF THE CONDITION OF SOME HISTOLOGICAL FORMS OF MAMMARY GLAND CANCER. (Rus.) Mel'nikov, D. N. (Reg. Oncol. Disp., Chelyabinsk, USSR). *Arkiv Pat* 34(5):35-40, 1972.

- 6138 NODULAR (PSEUDOSARCOMATOUS) FASCIITIS. (Rus.) Vikhert, A. M. (A.L. Myasnikov Inst. Cardiol., USSR Acad. Med. Sci., Moscow), K. K. Poroshin and G. A. Galil-Ogly. *Vop Onkol* 18(7):20-25, 1972.

- 6139 ELECTRON MICROSCOPY AND CYTOCHEMISTRY OF THE GAUCHER CELLS IN MYELOID LEUKEMIA. (Ger.) Keyserlingk, D. G. (Anat. Inst. Free U. Berlin), I. Boll and M. Albrecht. *Klin Wschr* 50:510-516, 1972.

- 6140 CLINICO-MORPHOLOGICAL CHARACTERISTICS OF THE THYROID TUMORS FROM ASHKINASI CELLS. (Rus.) Propp, R. M. (Inst. Exp. Clin. Oncol., USSR Acad. Med. Sci., Moscow) and Ye. A. Smirnova. *Vop Onkol* 18(7):8-12, 1972.

- 6141 GENETIC EXPRESSION REGULATION STUDIES FOR THE DETECTION AND QUANTITATIVE DETERMINATION OF CANCER CELLS. (Sp.) Weber, G. (Indiana U. Sch. Med., Indianapolis). *Folia Clin Int* 22(4):231-252, 1972.

- 6142 LEUKEMIA IN CHILDREN AND RECKLINGHAUSEN'S DISEASE (WITH REFERENCE TO FIVE CASES, TWO

WHOM WERE FAMILIAL LEUKEMIAS). (Fr.) Germain, D. (Hosp. Louis-Boulevard-Herriot, Lyon, France), P. Trouillas and M. Robert. *Nouv Rev Franc Hemat* 12(4):555-560, 1972.

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44 CELL CLONES, CYTOCHEMISTRY, AND CONVERSION OF CHRONIC MYELOID LEUKEMIAS INTO ACUTE FORMS (WITH REFERENCE TO 7 CASES). (Fr.) Kessous, A. (Purpan Hosp., Toulouse, France), J. Pris, J. Grozdea, J. Corberand, Monnier, R. Bierme and P. Colombies. *Nouv Rev Franc Hemat* 12(4):519-525, 1972.

45 LYMPHOGRAPHIC EVALUATION OF 116 CASES OF MALIGNANT MELANOMA. (It.) Musumeci, R. (Inst. Study & Cure Tumors, Milan, Italy), Acerbi, G. P. Balzarini, S. Orefice, F. Preda and Uslenghi. *Tumori* 88(1):1-11, 1972.

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48 TUMOR CELLS OCCURRING IN BLOOD IN OPERATIONS FOR CANCER OF THE RECTUM. (Rus.) Gofman, A. M. (Res. Lab. Proctology, RSFSR Ministry Public Hlth. Clin., Moscow USSR), S. N. Fayn, G. N. Stovskaya and V. N. Drozdova. *Vop Onkol* 18(6):25-31, 1972.

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6152 TRYPTOPHAN METABOLISM ALTERATIONS IN CANCER OF THE URINARY BLADDER. (Rus.) Martynenko, A. G. (Inst. Oncol. Probl. Ukr. SSR Acad. Sci., Kiev, USSR), L. A. Kartasheva, M. I. Goykhberg and I. A. Klimenko. *Vop Onkol* 18(5):23-26, 1972.

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AARONSON, S.A.
5935*
ABAD, L.
6066*
ABLIN, R.J.
6011*
ABRAHAM, S.
6052
ABRAMOVICH, A.B.
6062*
ABTAHI, H.
6136*
ACERBI, L.
6145*
ADAMEK, M.
5866
ADAMENKO, G.P.
5995*
ADENIS, L.
6187*, 6285*
AGEENKO, A.I.
5874*, 5965
AGEYENKO, A.I.
5928*, 5996*
AGOSTON, I.
6359*
AGUILAR-PARADA, E.
6273*
AGUREEV, A.I.
6189*
AHERNE, W.
6233*
AHLQUIST, J.
5872*
AHMAD, M.S.
5929*
AITIO, A.
5832*
ALBERT, D.M.
5891
ALBRECHT, M.
6139*
ALEKSANDROV, S.N.
5703
ALKEN, P.
6240*
ALLEN, M.
5729*
ALLISON, A.C.
5979
ALPERT, A.E.
6122
ALTERNBURG, L.C.
6375*
ALTSHEIN, A.D.
5938*
ALTSHULER, B.
5844*
ALTWEIN, J.
6092*
AMANDZHOLOV, B.S.
6250*

AMCHENKOVA, A.M.
5997*
AMER, S.M.
5859*
AMES, B.N.
5787
ANDERSON, K.M.
5829*
ANDONOV, P.
6159*
ANDRIANOVA, M.M.
5831*
ANISIMOV, V.N.
5822*
ANSELL, J.S.
6321*
AOKI, T.
6022*
APATENKO, A.K.
5730*
ARAO, T.
6368*
ARDITO, G.
6261*
ARENDT, A.
6180*, 6220*
ARIANO, M.
6211*
ARKHIPOV, G.N.
5820*
ARNOULT, J.
6216*
ASAMER, H.
6035*
AURELIAN, L.
5715
AUSLANDER, M.O.
5839*
AVDZHIAN, M.V.
5899
AXEL, R.
5810, 5926
BABAI, F.
6281*
BABASHAYEV, B.S.
6374*
BADMAEVA, V.V.
6121
BAIKIE, A.G.
6354*
BAILEY, P.C.
5991*
BALA, YU.M.
5873*
BALARAMANNAIR, M.
6200*
BALDA, B.R.
6390*, 6391*
BALDAUF, K.
6103*
BALZARINI, G.P.
6145*

BANATVALA, J.E.
5977
BANKHURST, A.D.
5978
BANNASCH, P.
5855*, 5856*
BARAHONA, H.H.
5925
BARANOVSKY, A.
6089*
BARBANTI SILVA, C.
6061*
BARBERA, E.
6066*
BARCAT, J.A.
6360*
BARCLAY, T.H.C.
6082
BARESOVA, M.
5889
BARICALLA, R.
6056*
BARKER, A.D.
6308*
BARKER, C.R.
5811
BARLATI, S.
5946*
BARTSCH, H.
5787
BASERGA, R.
6319*
BASHKAYEV, I.S.
5996*
BASTOS, A.L.
6341*
BATKA, H.
5765
BATTEMA, W.L.
6116
BAUM, M.
6280*
BAUZ, R.
6049*
BAXTER, J.D.
6127
BAZIN, H.
6010*, 6012*
BECKER, G.
6384*
BECKERS, A.
6010*, 6012*
BELISARIO, J.C.
5702
BELOUSOV, A.P.
6053
BELPOMME, D.
6129
BELTRAN, G.
6346*
BELUGINA, Z.T.
6149*

BELYAEVA, M.I.	BISTONI, F.	BRADLEY, M.N.
6351*	5984*	6283*
BENDER, E.	BLACKLEDGE, A.	BRADSHAW, R.A.
5885, 5931*	6293*	6329*
BENIASHVILI, D.SH.	BLAIR, D.G.R.	BRADVAROVA, I.
6248*, 6270*	6289*	6159*
BENNETT, R.C.	BLAKE, W.D.	BRADY, J.
6342*	5729*	6074
BENSO, L.	BLAU, H.J.	BRAS, G.
5998*	5960, 5999*	6082
BENYESH-MELNICK, M.	BLONDEL, P.	BRATANGV, BR.TS.
5951*	6129	6095*
BERG, P.	BLUMER, W.	BRATLID, D.
5895	6098*	6334*
BERGELSON, L.D.	BOBROW, S.N.	BRAUNSBURG, H.
6373*	5906	6339*
BERGSTRAND, A.	BOCHAROV, A.F.	BRAYTON, C.
6113	5997*	5936*
BERNHEIM, N.J.	BOCKMAN, D.E.	BREBOROWICZ, J.
5871*	6283*	6274*
BERRY, C.G.	BODEY, G.P., SR.	BREHM, K.
5755*	5966	6246*
BERTALANFFY, F.D.	BOGDANOV, I.S.	BRENK, H.A.S. VAN DEN
5797	6073	6336*
BERTELL, SISTER R.	BOGOVSKII, S.P.	BRITTINGER, G.
6084	5850*	6005*
BERTOGLIO, J.	BOHN, E.W.	BRITTON, S.
6036*	6288*	5726*
BERTOLOTTI, A.	BOHUNICKA, E.	BRODSKY, I.
6259*	6019*, 6371*	6338*
BERTRAMS, J.	BOKHMAN, YA.Y.	BRODY, J.I.
5760*, 6040*	6055*	5975
BESSER, G.M.	BOLDEN, A.	BROSS, I.D.J.
6365*	6286*	6084
BEST, J.M.	BOLIS, G.B.	BROWN, E.R.
5977	6158*	5896
BEVERLEY, P.C.L.	BOLL, I.	BROWN, J.S.
5979	6139*	6320*
BHAGWANDEEN, S.B.	BONILLA-MUSOLES, F.	BRUGERE, J.
6302*	6059*	6228*
BHORJEE, J.S.	BORDIN, G.M.	BRUNET, M.R.
6124	6296*	5998*
BICHLER, K.H.	BORGAONKAR, D.S.	BRUYAKO, E.T.
6047*	6362*	5938*
BIENTZ, M.	BOROS, B.	BUBENIK, J.
5817*	6359*	5889
BIERME, R.	BOS, C.J.	BUCHSBAUM, R.
6144*	6112	5924
BIERWOLF, D.	BOSMAN, H.B.	BUCKLE, R.M.
5963	5878	6366*
BILSKI-PASQUIER, G.	BOSMANN, H.B.	BUERKLE, G.
6163*	5947*	5851*
BIRBECK, M.S.C.	BOTTICELLI, A.	BUETTNER, H.H.
5959	6061*	6197*
BIRD, C.	BOURGON, J.J.	BUKHNY, A.F.
5762	6036*	6239*
BIRD, C.C.	BOUSSER, J.	BUKHTOYAROVA, Z.M.
5799	6143*, 6163*	5865
BIRG, F.	BOUTSELIS, J.G.	BUKHVALOV, I.B.
5964	6325*	6236*
BIRKMAYER, G.D.	BOYES, D.A.	BULAN, M.B.
6390*, 6391*	5794	6306*

BULLOUGH, W.S.
5707
BURGER, M.M.
5914
BURNS, J.
6316*
BUSCH, H.
6379*
BUTT, W.R.
6111
BUTTERSTEIN, G.M.
5847*
BYALIK, V.L.
6245*
BYKOVSKII, A.F.
5883
CABANNE, F.
5718*
CABRAL, J.R.
5814*
CACCAVELLI, L.
6060*
CADENELLI, G.P.
6171*
CADIOU-GUILLEM, M.
6143*
CAPPARELL, N.J.
5990*
CARBILLET, J.
6305*
CARDAMONE, J.M.
6299*
CAROLINE, N.L.
5979
CARTER, R.L.
5773, 5959
CATOVSKY, D.
6117
CAULET, T.
6071*
CAVALLARO, A.
6261*
CEBALLOS, R.
6283*
CHAN, D.P.S.
6342*
CHAN, P.
5861
CHAN, T.C.
6312*
CHANG, C.F.
5778
CHANTLER, S.
6017*
CHARLES, R.T.
5791
CHAVES, E.
6363*
CHAYOTH, R.
5806
CHERISTANIDIS, I.
6221*

CHIARUGI, V.P.
6292*
CHIKATA, E.
5793
CHIPMAN, P.J.
5713
CHISALE, E.
6156*
CHITIYO, M.
6079
CHOPRA, H.C.
5877
CHU, T.M.
5992*
CHUBAROVA, N.V.
6070*
CHUDINA, A.P.
6219*
CHUNG, S.O.
6102*
CHURG, J.
5782
CHUTKOV, N.A.
5874*, 5928*
CICALE, F.
6202*
CITARELLA, R.
6286*
CLASSEN, M.
6376*
CLIVE, D.
5871*
CLOUT, I.
6106*
COFFIN, D.L.
5803
COHEN, D.
6104*
COHNEN, G.
6005*
COLE, P.
6078
COLEMAN, R.
5838*
COLIGAN, J.E.
5976
COLOMBIES, P.
6144*
COMPANS, R.W.
5933*
CONSTANS, J.P.
5962, 6216*
CONTESSO, G.
6195*
COOPER, E.H.
6328*
COOPER, M.D.
6283*
COOPERBAND, S.R.
5990*
CORBERAND, J.
6144*

CORRADI, G.
6278*
COTTI, L.
5815*
COWLING, D.C.
5811
CRAMER, R.
5911
CRISPEN, R.G.
6007*
CROCKER, T.T.
5835*
CROISSANT, D.
5881
CROUCH, R.
5892
CSUKA, D.
6054*
CUTRONEO, K.R.
6331*
CZECHOWICZ, W.
6277*
DALFORNO, S.
6173*
DALTON, A.J.
6291*
DANIEL, M.D.
5925
DARGENT, M.
6036*
DAUGUET, C.
5881
DAUNE, M.
5825*
DAVIES, D.R.
6021*
DAVIES, J.N.P.
6074
DAVIS, D.
5924
DAVIS, N.L.
5907
DAVYDOVA, S.YA.
6182*
DAY, N.
5791
DAY, N.E.
6082
DE GAETANI, C.F.
6061*
DE HARVEN, E.
5944*
DE JONG, U.W.
6082
DE LUCA, L.
5846*
DE SANTIS, U.
6260*
DEAN, P.N.
5872*
DECKERS, C.
6010*, 6012*

DECKNER, K.
6384*
DEDKOV, I.P.
5983*
DEICHMANN, W.B.
5741*
DEINHARDT, F.
6279*
DEL GIACCO, G.S.
6030*, 6031*, 6033*
DEL RIO MARCO, F.
6160*
DELBEKE, M.J.
6130
DELGADO-PARTIDA, P.
6297*
DEMAILLE, A.
6285*
DENLINGER, R.H.
5789
DENNIS, A.J.
6308*
DENYS, A.
6125
DERIZHANOVA, I.S.
6069*
DESFOSSÉS, B.
5769
DESSELBERGER, W.
5956*
DEUTSCHLAENDER, N.
6193*
DI PAOLO, J.A.
5770
DIAZ-FLORES, L.
6146*
DICK, F.R.
6009*
DIEBOLD, J.
6165*
DIEHL, V.
5908
DIETZ, W.
6064*
DIETZSCHOLD, B.
5940*
DIMITROV, N.V.
5988*
DINTSMAN, M.
6357*
DION, A.S.
5953*
DISCHLER, W.
6388*
DOHAN, C., JR.
5879
DOMAGALA, W.
6207*
DOMMASCH, M.
6289*
DONCHEVA, N.
6095*

DONNELLY, W.J.
6029*
DGNNER, L.
5889
DONOVAN, J.W.
6087
DORFMAN, M.V.
5983*
DORN, C.R.
5706
DOUGLAS, S.D.
6005*
DOUMENC, J.
6164*
DROGENDIJK, A.C.
6096*
DROZDOVA, V.N.
6148*
DUFF, R.
5918
DUFF, R.G.
5890
DUFOR, M.
6071*
DUPLAN, J.F.
6123
DURAND, G.
6143*
DURKOVSKY, J.
6311*
DURNOV, L.A.
6239*
DWORK, A.
6074
DYACHKOVA, L.V.
6272*
DYATLOVITSKAYA, E.V.
6373*
EARLE, K.M.
6204*
EBENHOEH, M.
5857*
EBERT, A.
6045*
EDDY, B.
5932*
EDLOW, J.B.
6309*
EDSON, J.R.
6299*
EDWARDS, J.G.
5905
EDWARDS, R.L.
6111
EIBERGEN, R.
6038*
EINHORN, M.H.
5917
ELEFTERIADIS, K.
6221*
ELLEGAARD, J.
5988*

EMMELOT, P.
6112, 6115
ENDERS, J.F.
5879
ENGLAND, J.J.
6307*
ENGSMINGER, W.D.
5717
EPSTEIN, J.H.
5862
EPSTEIN, S.
5806
EPSTEIN, S.M.
5772
ERTL, N.
6381*
ESCH, W.
6172*
ESCHBACH, W.
6065*
EXLEY, R.W.
5803
FABRIKANT, J.I.
6077
FAHMY, M.J.
5780
FAHMY, D.G.
5780
FAIOLA, R.
5987*
FANELLI, A.R.
5987*
FAUVET, J.
5816*
FAYN, S.N.
6148*
FEAGLER, J.R.
5843*
FEBVRE, H.
5962, 6216*
FEDOROV, N.A.
6070*
FEINERMAN, L.K.
6155*
FEORINO, P.M.
5973
FERRI, G.
6211*
FERRY, A.P.
6326*
FIELD, J.B.
5806
FILIPEK-WENDER, H.
6170*
FILIPPOVA, N.A.
6236*
FINE, D.L.
5877
FINK, M.A.
5979
FIRKET, H.
6003*

FIROUZ-ABADI, A.
 5755*
 FIRSOVA, V.I.
 6188*
 FIRUSIAN, N.
 6386*
 FISHER, B.
 6280*
 FLAMM, W.G.
 5871*
 FLEISCHMANN, T.
 6110
 FLORIS, C.
 6030*
 FOEDISCH, J.
 6035*
 FONTALIN, L.N.
 5968
 FORMICOLA, R.
 6202*
 FORTUNY, I.
 6009*
 FOSTER, F.H.
 6082
 FOUTS, J.R.
 5720*
 FRANKS, L.M.
 6335*
 FRANKSSON, C.
 6113
 FRANZ, H.
 5963
 FRANZE-FERNANDEZ, M.T.
 6109
 FRASER, C.E.O.
 5925
 FRASER, M.J.
 6312*
 FREIREICH, E.J.
 5966
 FRIEND, C.
 5944*
 FROEHLICH, J.E.
 6303*
 FROST, J.K.
 6362*
 FRY, M.
 6286*
 RYDENBERG, H.
 6342*
 FUCHS, R.
 5825*
 FUDENBERG, H.H.
 6017*
 FURSTENBERGER, G.
 5853*
 FUJISAKI, H.
 6166*
 FUKUI, M.
 5849*
 FUKUNISHI, R.
 5781, 5783

FURFARO, M.
 6056*
 FURUNO, I.
 5863
 FUSENIG, N.E.
 5859*
 GADELHA, N.
 6363*
 GADOMSKA, H.
 6097*
 GAERTNER, H.J.
 6220*
 GAGNI, G. DI
 6229*
 GALERA, H.
 6146*
 GALIL-OGLY, G.A.
 6138*
 GALLMEIER, W.M.
 6040*
 GALLO MORANDO, G.
 6360*
 GALLO, R.C.
 5906, 5921
 GAMMAROTA, V.
 6266*
 GANGADHARAN, P.
 6086
 GARCIA BRAGADO, F.
 6160*
 GARCIA, F.G.
 5925
 GARCIA, J.
 6090*
 GARDNER, D.G.
 6116
 GARIBDZHANIYAN, B.T.
 6001*
 GARTMANN, H.
 6247*
 GAZDAR, A.
 5952*
 GAZDAR, A.F.
 5886
 GAZZOLO, L.
 5749*
 GEAR, M.W.L.
 6337*
 GEBERT, R.
 5810
 GELB, L.D.
 5915
 GENIN, J.
 6195*, 6228*
 GEOGII, A.
 5955*, 5956*
 GEORGIEV, D.
 6037*
 GEORGII, A.
 6043*, 6393*
 GERARD, G.F.
 5922

GERBER, M.J.
 5896
 GERLIER, D.
 6036*
 GERMAIN, D.
 6142*
 GEROLANOS, S.
 6206*
 GERRARD, G.
 5735*
 GERWIN, B.I.
 5900
 GETZ, M.J.
 6375*
 GEYER, M.
 5767
 GHAZALI, S.
 6199*
 GIBSON, R.
 6084
 GILBERT-DREYFUS
 5747*
 GILBERT, P.J.
 6116
 GILDEN, R.V.
 5919
 GILLESPIE, D.
 5921
 GIRARD, C.
 5961
 GJORGOV, A.
 6076
 GLASER, R.
 5890
 GLATHE, H.
 6065*
 GLEICHMANN, E.
 6039*
 GLINSKA, H.
 6276*
 GLITZ, D.G.
 5929*
 GLOBER, G.
 6337*
 GLUZMAN, D.F.
 5943*
 GOCHO, Y.
 6134*
 GOECKE, H.
 6218*
 GOERTTLER, K.
 5779
 GOETZ, H.
 6041*, 6042*
 GOFMAN, A.M.
 6148*, 6150*
 GOGICHADZE, G.K.
 5927*
 GOLBERT, Z.V.
 6244*
 GOLD, P.
 5710, 5972

GOLDENBERG, D.M. 6014*	GRIEBLE, H.G. 6029*	HAAG, D. 5779
GOLDFEDER, A. 5792, 5833*	GRIFONI, V. 6030*, 6031*, 6032*, 6033*	HAAS, P. 6258*
GOLDSTEIN, M.N. 6329*	GRIGOLETTI, E. 6278*	HAAS, R. 6399*
GOLOSOVA, T.V. 6070*	GRIGOROVICH, N.A. 5813*	HAENNINEN, O. 5832*
GOLUB, N.I. 5818*	GRIMLEY, P.M. 5880	HAENSZEL, W. 6075
GOLUBEV, D.B. 5981*, 5982*	GRINEV, M.V. 6350*	HAHNLOSER, P. 6206*
GOMARD, E. 5920	GRONOW, M. 5800	HAKANSSON, C.H. 6110
GOMI, M. 6323*	GROSS, L. 5724*	HALGRIMSON, C.G. 5728*
GORDELADZE, A.S. 6057*	GROTH, C.G. 5728*	HALLIDAY, W.J. 5974
GORDIENKO, S.P. 5965	GROTH, U. 5798	HALTERMAN, R.H. 6008*
GORKOVA, N.P. 6373*	GROVER, P.L. 5774	HAMPERL, H. 6241*
GORNY, M. 6274*	GROZDEA, J. 6144*	HANAICHI, T. 5904
GORSKI, G. 6275*	GRUPP, H.J. 6382*	HANSEN, H.J. 6014*
GOTH, R. 5854*	GRZEBIELUCH, M. 6027*	HARDMAN, J.M. 6204*
GOYKHBERG, M.I. 6152*	GUARINI, G. 5998*	HARTMANN, J.R. 5843*
GRAEVSKAYA, N.A. 5945*	GUBAREVA, A.V. 6058*	HARTVEIT, F. 6201*
GRAFFI, A. 5885, 5931*	GUBERN SALISACHS, L. 6162*	HATANAKA, M. 5952*
GRAFFI, I. 5885, 5931*	GUBETTA, L. 6173*	HATZFELD, A. 5716
GRAHAME, R.E. 5797	GUDIM-LEVKOVICH, K.A. 5785	HAUSEN, H. ZUR 5908
GRANDGENETT, D.P. 5922	GUERIN, C. 6372*	HAYAMI, M. 5923
GRANDJON, D. 6129	GULATI, S.C. 5926	HAYMAN, J.A. 6105*
GRANDOFF, A. 5737*	GULEVSKAYA, M.R. 6099*	HEATH, C.W., JR. 6090*
GRANT, G.F. 6023*	GULLINC, P.M. 6290*	HECKER, E. 5758*, 5773, 5853*
GRAYEVSKAYA, N.A. 5939*	GUMINA, I.I. 5939*	HEIDELBERGER, C. 5774
GREALLY, J. 6009*	GURNEY, E.G. 5787	HEINE, U. 6291*
GRECO, T. 5941*	GUSEINOVA, F. 6070*	HEISLER, J.G. 6314*
GREEN, M. 5922	GUSELNIKOVA, N.A. 6099*	HELLSTROEM, I. 5923
GREENBERG, S.D. 6314*	GUTTERMAN, J.U. 5966	HELLSTROEM, K.E. 5923
GREENWALD, P. 6074	GUY, J.T. 5839*	HENKART, P.A. 5976
GREENWOOD, N. 6315*	GUZMAN, N.A. 6331*	HENLE, G. 5913
GREGORY, L. 6301*	GYORKEY, F. 6314*	HENLE, W. 5738*, 5913

HENSELEIT, E.
5853*
HERBERMAN, R.
5952*
HERBERMAN, R.B.
6022*
HEREMANS, J.F.
6010*, 6012*
HERSH, E.M.
5966
HESSLER, C.
6398*
HILFRICH, J.
5858*
HILGARD, P.
6310*
HILLYARD, L.A.
6052
HINZE, H.C.
5713
HIRAMOTO, R.
6343*
HIRSCHHAEUSER, C.
6047*
HLINIAK, A.
6275*
HLOAZNEK, I.
5916
HOCHBERG, K.
6168*
HOCHGESAND, P.
6174*
HOERTNAGL, H.
6035*
HOEVEN, R.R. VAN
6115
HOFMANN, P.
6263*
HOGAN, B.
6293*
HOLBOROW, E.J.
5739*
HOLLANDER, D.H.
6362*
HOLYOKE, D.
5992*
HONIG, G.R.
6128
HOPFNER, C.
6071*
HORAKOVA, K.
6370*
HORI, Y.
6208*
HORIBATA, K.
6023*
HORN, J.
5857*
HORST, H.
5860*
HORWITZ, M.S.
5936*

HOSINO, M.
6322*
HOSSFELD, D.K.
6380*
HRNCIR, Z.
6020*
HRNCIROVA, L.
6020*
HUBERMAN, T.E.
5774
HUDSON, J.B.
5903, 5949*
HUEBNER, N.
6108
HUELSE, D.F.
6389*
HUGGINS, C.
5762
HUNDEIKER, M.
6246*
HUNT, R.D.
5925
HUNTER, B.T.
5826*
HURST, L.
5769
HURT, T.
5877
HURWITZ, J.
5876
HWANG DONG, H.
6102*
HYMAN, B.
6355*
IGIDBASHIAN, D.K.
6278*
IKAWA, Y.
5950*, 5952*
IKEDA, S.
6208*
ILIN, K.V.
5883
IMAMURA, K.
6126
IMBERT, M.C.
6232*
INOUE, S.
6368*
IRD, YE.A.
6250*
IRLIN, I.S.
5819*, 5887
ISAEV, N.M.
6189*
ISHIBASHI, Y.
6208*
ISHIHARA, K.
6223*
ISHIKAWA, G.
6317*
ISHIKAWA, K.
6210*

ISMAILOV, B.I.
6185*
ISOBE, A.
5776
IUDICELLO, P.
5998*
IVANKOVIC, S.
5812*
JABLOKOW, V.R.
6235*
JABUSCH, H.P.
6067*
JACKISCH, R.
6349*
JACKSON, A.H.
5893
JACKSON, C.D.
5848*
JACKSON, D.A.
5895
JACOB, H.S.
6299*
JACOBS, B.B.
5989*
JAENISCH, W.
6064*
JANISCH, W.
5830*
JAUMANN, R.
6098*
JAYLE, M.F.
5769
JEANTEUR, P.
5881
JEHN, U.
5882
JENKINS, D.E.
6314*
JENSSON, O.
6117
JOFRE, J.A.
6194*
JOHANNESSEN, T.A.
6157*
JOHNSON, F.L.
5843*
JOHNSON, L.I.
5958
JOLLES, P.
6287*
JORDAN, S.W.
5872*
JULIANO, R.
6344*
JULOW, J.
6255*
JUNG, A.
6349*
JUNG, H.D.
6100*
JUNGE, U.
6279*

JURGA, L.
6226*
JUSSAWALLA, D.J.
6082
KAADEN, O.
5940*
KACHERGENE, N.B.
6183*
KADAR, T.
6091*
KAGAN, G.YA.
6070*
KAHN, L.B.
5740*, 6198*
KAHN, S.B.
6338*
KAICK, G.
6048*
KAISER, P.
6252*
KAKU, R.
6126
KALITEYEVSKY, P.F.
5870*
KALKOFF, P.
6383*
KAMPOURAKIS, N.
6221*
KANIGOWSKI, K.
6213*
KANNERSTEIN, M.
5782
KANO-TANAKA, K.
5904
KAPULLER, L.L.
6150*
KARDASZEWICZ, S.
6225*
KARMYSHEVA, V.YA.
5939*
KARTASHEVA, L.A.
6152*
KARTENBECK, J.
6179*
KASABYAN, S.S.
6237*
KASCHULA, R.O.C.
6198*
KASTNER, H.
6258*
KATAUMI, S.
6227*
KATAYAMA, I.
6332*
KATOH, T.
6222*
KATSUMI, T.
6231*
KATSUTA, H.
5796
KAUFFMANN-MACKH, G.
6269*

KAUR, J.
6117
KAVAKLIEVA-DIMITROVA, YA.
6037*
KAWAJI, K.
5781, 5783
KAWANAMI, J.
5994*
KAY, J.E.
6294*
KAZARYAN, K.A.
5968
KELLER, W.
5892
KEMMER, C.
5884
KERRIGAN, G.
6337*
KESSOUS, A.
6144*
KEYSERLINGK, D.G.
6139*
KHACHATRYAN, E.A.
5768
KHADZHIEV, SP.
6037*
KHAKIMOV, KH.A.
6073
KHAZOVA, L.A.
6257*
KHEIFETS, R.A.
5870*
KHESIN, YA.YE.
5997*
KHOKHLOVA, M.P.
5746*
KHOLMUKHAMEDOVA, N.M.
5874*
KIESSLING, A.A.
5901
KIKUCHI, A.
6209*
KILLEN, E.
6339*
KIM, I.S.
6102*
KINDERMANN, G.
6067*, 6377*
KING, N.W.
5925
KINZEL, V.
5857*
KIPERVASSER, E.M.
6070*
KIRCHNER, C.
6047*
KIRKMAN, H.
6364*
KIRSCH, W.M.
6329*
KISELEV, P.N.
5981*, 5982*

KISSELJOV, F.L.
5887
KIT, S.
5894
KITSCHKE, H.
6045*
KITSCHKE, H.J.
6046*
KLASSEN, A.
5844*
KLEIN, E.
5888
KLEIN, G.
5882, 5913
KLEINMANS, V.
6046*
KLIER, E.
6253*
KLIMA, J.
6035*
KLIMANOVA, Z.F.
6244*
KLIMENKO, I.A.
6152*
KLISAK, I.
5861
KLOSTERHALFEN, H.
6394*
KLUG, H.
6051
KLVANA, M.
6226*
KNAPSTEIN, P.
6169*
KNIGHT, R.A.
6365*
KOBAYASHI, H.
6004*, 6322*
KOBAYASHI, S.
5954*
KOCH, H.
5875*
KOCHEN, W.
6168*
KOCHETKOV, M.K.
6053
KOENIG, E.
6005*
KOESTNER, A.
5789
KOGAN, F.M.
6099*
KOGAN, I.YA.
5928*, 5996*
KOHLER, P.O.
6309*
KOJIMA, K.
5904
KOLESNICHENKO, T.S.
5766
KOLODZIEJSKA, H.
6358*

KONDO, S.
5836*
KOOBS, H.S.
6038*
KOPROWSKI, H.
6013*
KORFEL, Z.
6213*
KORMAN, D.B.
6189*
KOSHEL, I.V.
6183*
KOSTINA, L.I.
6055*
KOVALEVA, L.G.
6062*
KOVRIZHKINA, T.A.
6149*
KOZA, I.
6019*
KOZHEVNIKOVA, E.P.
5809
KRAIN, L.S.
6080
KRAISELBUND, E.
5924
KRAJCI, M.
6311*
KRAUS, R.
6399*
KRAUSE, P.H.
6043*
KRAVCHENKO, L.P.
6238*
KREBS, D.
5860*, 6045*, 6046*
KREMPASKY, V.
6019*, 6371*
KRIEK, E.
5804
KRIVANEK, J.
6101*
KRIVINKA, R.
6101*
KROL, YA.M.
6353*
KRUESMANN, G.
6072*
KRUBIK, A.
6101*
KRUCHENBUCH, H.S.
6100*
KRUDO, T.
6356*
KRUFF, E.L.
6288*
KRUNCHORN, P.D.
5886
KRUNZE, E.
6072*
KURIHARA, M.
6082

KURODA, Y.
6323*
KUROKAWA, T.
6006*
KUROKI, T.
5774
KUTSYI, A.S.
6238*
KUWAHARA, H.
6368*
KUWATA, T.
5948*
KUWERT, E.
5760*, 6040*
KUZELA, S.
6019*, 6371*
KUZNETSOV, O.K.
5930*
KWAK, H.M.
6102*
KYALWAZI, S.K.
6279*
LACASSAGNE, A.
5769
LACOUR, J.
6228*
LAFONTAINE, N.
6003*
LAGEMAN, A.
6064*
LAGEMANN, A.
6133*
LAGERMAN, A.
5767
LAMBERTS, H.B.
6038*
LAMON, E.W.
5888
LANARI, A.
6360*
LANDON, J.
6365*
LANDON, J.C.
5877
LANDSBERGER, F.R.
5933*
LANG, W.
5955*
LANGBEIN, W.
5777
LANGOWSKI, U.
6384*
LANZEROTTI, R.H.
6290*
LAPPE, M.A.
5711
LARSON, K.A.
6307*
LATAL, D.
6172*
LATTES, R.
6155*

LAU, M.
5763
LAUDADIO, P.
6212*
LAUDER, I.
6233*
LAWINSKI, M.
6027*
LE GOFF, L.
6242*
LE, M.
5732*
LEATHEN, J.H.
5847*
LEBEDEV, V.I.
6239*
LECATSAS, G.
5910
LECK, I.
6083
LECLERC, J.C.
5920
LEDER, P.
5950*
LEE, Y.K.
5919
LEGG, M.A.
6306*
LEGRAND, E.
6123
LEIS, J.P.
5876
LEMOINE, J.M.
5816*
LEMTIS, H.
6382*
LENARD, J.
5933*
LENART, G.
6135*
LENCZYK, M.
6277*
LENGES, J.
5754*
LENNERT, K.
6234*
LENTFER, D.
6120
LERNER, K.G.
5843*
LESKO, S.A.
5845*
LESKO, S.A., JR.
5845*
LETNANSKY, K.
6284*
LEUDERS, K.K.
6288*
LEVAN, A.
6110
LEVENBUK, I.S.
5945*

LEVENTHAL, B.G.
6008*
LEVIJ, I.S.
5786, 5805, 5828*
LEVINE, P.H.
5969
LEVINSON, C.
6300*
LEVY, J.P.
5920
LEZIUS, A.G.
6120
LI, C.P.
5932*
LI, C.Y.
6332*
LIBCKE, J.H.
6204*
LIEBELT, A.G.
6331*
LIFSHITS, V.M.
5873*
LIMAS, C.
6068*
LINDAHL, T.
5882
LINDBERG, L.G.
6081
LINDBERG, U.
6333*
LINDEMANN, M.
6043*
LINDEN, G.
6082
LINDSAY, V.J.
6294*
LINNIK, A.B.
5821*
LIPOVA, V.A.
6192*
LIRA-PUERTO, V.
6273*
LISCHKA, G.
6247*
LISIEWICZ, J.
6304*
LISS, E.
6240*
LITTON, L.E.
6362*
LJUNGDAHL, I.
6113
LOBUE, J.
5958
LOHOELTER, H.
6048*
LONG, C.
5919
LOPEZ BLANCO, O.
6360*
LOPEZ-RIOS, F.
6249*

LORENTZEN, R.
5845*
LOZANOV, YEM.
6095*
LUGOVOY, V.I.
6238*
LUKEMAN, J.M.
6203*
LUKES, R.J.
6392*
LUNTS, A.M.
6122
LVOVSKIY, E.A.
5981*, 5982*
LYSYUK, L.P.
5785
LYWOOD, J.G.
5750*
MAATZ, R.
6271*
MAC SWEEN, J.M.
5978
MACCHIA, V.
6282*
MACEK, M.
5934*, 5951*
MACH, O.
5916
MACHESKO, M.R.
5871*
MACINTYRE, E.H.
5898
MACKAY, I.R.
5978
MADHAVAN, K.
6118
MAENTYJAERVI, R.A.
5937*
MAENZA, R.M.
5801
MAESTRI, N.
5846*
MAEZAWA, S.
6361*
MAGNUSSON, G.
6113
MAHER, V.M., SR.
5845*
MAINZER, K.
5799
MAIR, I.W.S.
6157*
MAIRANOVSKAYA, E.B.
6053
MAIROSE, U.B.
6092*
MAJERUS, P.W.
5843*
MALICK, L.E.
6088*
MALKIEWICZ, B.
6304*

MALLUCCI, L.
5910
MANCONI, P.E.
6031*, 6033*
MANIGAULT, M.P.
6242*
MANN, D.L.
6008*
MANOYLOV, JU.S.
6188*
MANOYLOV, S.YE.
6188*
MANSANI, F.E.
6171*
MANTOVANI, G.
6032*, 6033*
MANTOYAAI, G.
6030*
MARCONI, P.
5984*
MARIC, M.
6230*
MARKARYAN, D.S.
5899
MARKHAM, P.D.
5929*
MARQUARDT, H.
5774
MARQUES, D.
6341*
MARTIN, A.
6146*
MARTIN, G.S.
5914
MARTIN, M.A.
5915
MARTIN, M.L.
5973
MARTINEZ, I.
6082
MARTINEZ TELLO, F.J.
6160*
MARTINO, E.C.
5932*
MARTIROSYAN, D.M.
5899
MARTYNENKO, A.G.
6152*
MARTYNOVA, V.A.
6070*
MASON, A.M.S.
6366*
MASON, A.S.
6366*
MASUBUCHI, K.
6085
MASUNAGA, J.
6176*
MATARAZZO, R.
6278*
MATEJA, F.
6020*

MATHEW, K.T.
6200*
MATHISEN, O.
5823*
MATILLA, A.
6146*
MATRICARDI, V.R.
6330*
MATSUDAIRA, H.
5863
MATSUMOTO, H.
5776
MATSUO, E.
6024*
MATSUO, N.
6166*
MATSUURA, H.
6177*
MATSUYAMA, M.
5837*
MATTHAES, P.
6269*
MAUGH, T.H.
5721*
MAUNOURY, R.
5962, 6216*
MAURER, H.S.
6128
MAURO, J.
6074
MAVLIGIT, G.
5966
MAY-LEVIN, F.
6195*
MAYER, D.
6349*
MAYHEW, E.
6344*
MAZURENKO, N.P.
5927*
MC ADAMS, A.J.
6313*
MC ARTHUR, J.R.
6299*
MC CREDIE, K.B.
5966
MC PHEDRAN, P.
6090*
MCISTER, H.
6133*
MCDOLESI, M.F.
6282*
MCLENDEZ, L.V.
5925
MCNIKOV, D.N.
6137*
MCNDELSON, I.S.
5829*
MCNNEL, H.D.
5719*
MCNON, I.A.
6345*

MERKOW, L.P.
5772
MERTEN, D.
6383*
MESSMER, B.
6206*
MESSMORE, H.
6029*
METTERS, J.S.
6298*
MEYER, A.
5817*
MEYER, G.
5911, 5964
MICHALIKOVA, B.
6311*
MICHEAU, C.
6228*
MICHEEL, B.
5884, 5963
MIGUEL VELASCO, J.
6249*
MIKHAILOV, I.G.
6352*
MIKITEN, T.M.
6300*
MIKOLASEK, J.
6034*
MILLER, J.A.
5787
MILSTEIN, C.
6010*
MILSTIEN, J.B.
5900
MILTON, P.J.D.
6298*
MINEKAWA, Y.
5894
MITCHELL, D.N.
6028*
MITCHELL, H.J.
6105*
MITELMAN, F.
6081
MITTELMAN, L.A.
5834*
MIYAHARA, M.
6126
MOELLER, T.
6110
MOEPERT, S.
6103*
MOGENSEN, B.
5759*
MOHALLATEE, E.A.
6318*
MOHR, J.
5963
MOHR, U.
5858*
MOLINS, M.
6360*

MOLONEY, J.P.
5742*
MOMMA, W.
5875*
MONASTYRSKAYA, B.D.
6147*
MONDOVI, B.
5987*
MONNIER, J.
6144*
MONTERO, V.F.
6160*
MONTES, L.F.
6283*
MOOLTEN, F.L.
5990*
MOORE, D.H.
5953*
MOORE, V.
6336*
MORAWETZ, F.
6385*
MOROHASHI, M.
6154*
MORRIS, H.P.
6114
MOSIYENKO, M.D.
5983*
MOTOIU-RAILEANU, I.
5867*
MOTT, D.M.
5807
MOTTA, G.
6211*
MOUTON, Y.
6285*
MOYNAHAN, E.J.
5705
MOYNE, M.A.
6372*
MOYSEYENKO, L.YE.
6340*
MOYSIADI, S.A.
5997*
MRACEK, J.
6020*
MUCKLE, D.S.
5722*
MUELLER, D.
6108
MUELLER, M.
5884, 6179*
MUIR, C.S.
6082
MULLER, R.
6286*
MUNYON, W.
5924
MUSSHOF, K.
6383*
MUSUMECI, R.
6145*

MYERS, M.H.
6355*
MYERS, M.W.
5947*
MYNORS, J.M.
6079
NADJAR-FOSSE, G.
5817*
NAGAYAMA, T.
6227*
NAGY, A.
6091*
NAKAMOTO, Y.
6196*
NARTISSOV, R.P.
6183*
NASONOV, A.P.
6153*
NEIMAN, P.E.
5901
NELSON, D.P.
5846*
NEMENOVA, N.M.
6070*
NEMOTO, H.
6085
NETTER, A.
6224*
NEUMANN, G.
6093*
NEUMANN, H.G.
5798
NEUMANN, V.
6101*
NEWELL, G.R.
5969, 6089*
NEZELOF, C.
6232*
NICHOLSON, H.O.
6111
NIELSON, D.
6324*
NIEMANN, T.
6269*
NIEPOLOMSKA, W.
6275*
NIEWEG, H.O.
6038*
NIGRO, N.
5998*
NIGRO, R.
6191*
NIIMURA, M.
6208*
NIKONOVA, T.V.
5766
NILSSON, K.
5913
NOBEL, B.
6065*
NORDENSTAM, H.
6113

NORMAN, A.
5861
NORPOTH, K.
6395*
NORRBY, E.
5986*
NOTKINS, A.L.
6013*
NOVIKOV, D.K.
5995*
NOVIKOVA, V.I.
5995*
NOWAK, K.
6275*
NUGENT, F.W.
6306*
NUZZO, G.
6261*
NYUNOYA, K.
6323*
OAKS, D.O.
5972
OBERBARNSCHEIDT, J.
5854*
ODA, T.
5909
OEHLERT, W.
6383*, 6388*
OGATA, T.
6223*
OHMORI, M.
5954*
OHTSUKI, Y.
5942*, 5954*
OKANO, T.
5776
OKUDA, K.
6166*
OKULSKI, J.
6304*
OLDHOFF, J.
6038*
OLIVETTI, G.
6171*
OLSZEWski, W.
6207*
OMCKAWA, T.
6026*
ONOZAKI, K.
6006*
OPPERMANN, A.
6305*
OREFICE, S.
6145*
ORENSTEIN, J.M.
5810
ORESTANO, F.
6169*
ORR, W.MCN.
6315*
ORTH, G.
5881

ORTON, C.
6336*
ORYE, E.
6130
ORYWALL, D.
6108
OSAWA, T.
6006*
OSTERTAG, H.
5956*
OSTROUMOVA, M.N.
6175*
OSTROVTSEV, L.D.
6053
OSTRYANINA, A.D.
5708
OSZACKI, J.
6277*
OTERO, G.O.
6194*
OTT, F.
6094*
OTTO, R.
6398*
OTTOMAN, R.E.
5861
PADLAN, E.A.
6021*
PAEGLE, R.D.
6347*
PAGEAUT, G.
6305*
PAJDAK, W.
6304*
PALMER, E.L.
5973
PALMER, M.S.
5803
PALOWSKY, G.
6271*
PAOLETTI, E.
5924
PAPANICOLAOU, N.
6221*
PAPE, C.
6262*
PAPENBURG, J.
5855*
PAPOLCZY, A.
6091*
PARDO, M.
5772
PARKHOMENKO, I.I.
5819*
PARKS, W.P.
5970
PARSONS, D.F.
6330*
PASCUAL, E.
6146*
PASTERNAK, G.
5963

SZTOR, E.
6255*
TEL, D.R.
5836*
TERNI, L.
5733*
VIA, R.A.
6014*
VLOVA, M.V.
5822*
WLICKI, M.
6276*
XTON, J.
5933*
YMASTER, J.C.
6086
YNE, P.M.
6082
DERSEN, E.
6082
DERSON, T.
6124
DIO, G.
5902
GRUM, G.D.
5957
NA, A.S.
6337*
NN, I.
5728*
RBELLINI, A.
6229*
RIN, J.P.
6287*
RSSON, T.
6333*
RZADAYEV, R.O.
6132*
STERNIKOV, V.M.
5865
STOVSKAYA, G.N.
6148*, 6150*
KOV, G.
6338*
RIC, M.
5903, 5949*
RINI, M.T.
6032*
ROV, V.G.
6350*
ROV, V.I.
6350*
UKHOV, V.I.
6257*
NITSKII, L.A.
5968
FFERMAN, R.
5805
ETZSCHNER, C.
6254*
LLIPS, A.D.
5838*

PIEKARSKI, N.
6007*
PIENKOS, E.J.
6235*
PIENTA, R.J.
5877
PIETTE, M.
6143*
PINNOW, W.
6103*
PIRONT, A.
6217*
PITZURRA, M.
5984*
PLATONOVA, G.N.
6272*
PLAVEC, V.
6230*
PLETNEV, S.D.
6053
PLOEG, E.V.D.
6038*
PLUOT, M.
6071*
PCGO, A.O.
6109
POGOSYANTS, E.E.
5938*, 6219*
POLAN, A.K.
6074
POLIVODA, B.I.
6153*
POLIVODA, O.M.
6153*
POLLARD, M.
5778
POLLIACK, A.
5786, 5805, 5828*
POLUKHINA, M.A.
5897
POPANDOPULO, S.I.
6353*
POPESCU, N.C.
5770
POPKOVA, G.A.
6373*
POPOVIC, D.
6230*
POPOVIC, K.
6230*
POROSHIN, K.K.
6138*
PORZSOLT, F.
6047*
POTTER, M.
6021*
POUGET, J.
6224*
PRADHAN, A.M.
5801
PREDA, F.
6145*

PREHN, R.T.
5711
PRESCOTT, B.
5932*
PRETLOW, T.G., II
6343*
PRIS, J.
6144*
PROPP, R.M.
6140*
PROST-DVOJAKOVIC, R.J.
6164*
PUCHKOV, JU.G.
6190*
PUGLIELLI, M.
6176*
PURCHASE, H.G.
5714
PURVES, L.R.
5788
PUTNAM, C.W.
5728*
QUENTIN, E.
5765
QUERINJEAN, P.
6010*
QUIGLEY, J.P.
5917
RABINOWITZ, Z.
5808
RABSON, A.S.
5891
RACHMELEK, M.
6303*
RADOCHAY, L.
5869*
RADUJKOV, Z.
6230*
RAIKHLIN, N.T.
6236*
RAISYS, N.
6007*
RAJEWSKY, M.F.
5756*, 6389*
RAMACHANDRAN, G.
6200*
RAMACHANDRAN, P.
6200*
RAMSEY, R.L.
6016*
RANDT, A.
5963
RAD, P.R.
6018*
RAPP, F.
5890, 5918
RAPP, W.
6048*
RAPPAPORT, H.
6205*
RASMUSSEN, R.E.
5835*

RATCLIFFE, J.G.
6365*, 6366*
REES, R.J.W.
6028*
REHDE, H.
6103*
REICH, T.
6098*
REICHARDT, W.
6383*
REICHEL, W.
6103*
REIS, H.E.
5761*, 6040*
REITZ, M.
5921
REITZ, M.S.
5906
REJTHAR, A.
5967, 6107*
REMMELE, W.
6136*
RETTIG, P.G.
6007*
REVA, C.
6164*
REYNOLDS, R.K.
5935*
REYNOSO, G.
5992*
REZNIKOFF, C.
5879
RHEINS, M.S.
6308*
RHODS, A.R.
6114
RICHARDSON, S.G.
6339*
RIDDLE, P.
5964
RIEGER, F.
6181*
RIFKIN, D.B.
5917
RINGERTZ, N.
6082
RIOS, A.
5993*
RITZ, R.G.
5712
RIVADENEYRA, J.
6273*
RIVASI, F.
6266*
RIVASI, P.
6266*
ROBERT, J.M.
6142*
ROBERT, M.
5921
ROBERTS, J.D.
6089*

ROBERTS, P.F.
6316*
ROBINSON, J.C.
6309*
ROCA, M.
6337*
ROCHEMAURE, J.
5817*
ROCKERT, H.
6174*
RODKINA, R.A.
6219*
RODO, J.E.
6360*
RODRIGUEZ-TRUJILLO, F.
6297*
ROE, F.J.C.
5773
ROEHL, L.
6168*
ROHRBACH, R.
5763
ROMANENKO, A.M.
6245*
ROMEN, W.
5856*
ROMIEU, C.
5961
ROOT, R.K.
6321*
ROSENAU, W.
6127
ROSENTHAL, S.R.
6007*
ROSS, E.M.
6338*
ROSS, J.
5950*
ROSS, W.
5855*, 5856*
ROSSMEISL, D.
6399*
ROSZEL, J.F.
6348*
ROTH, K.
5866
ROUESSE, J.
6195*
ROUSSEAU, G.G.
6127
RUBIN, A.D.
5958
RUBNITZ, M.E.
6029*
RUDD, F.V.
6321*
RUDIKOFF, S.
6021*
RUECKERT, R.R.
5907
RUETTNER, J.R.
5902

RUGSTAD, H.E.
6334*
RUIPEREZ POLO, S.
6249*
RUSSELL, E.
5952*
RUSSELL, I.S.
6342*
RYAZANOVA, L.G.
6239*
RYAZANTSEVA, I.N.
6351*
SA, H.H.
6363*
SACERDOTE, A.
5998*
SACHS, L.
5808
SACK, H.
6400*
SADOFF, L.
5736*
SAINEROVA, H.
5889
SAKAI, T.
6215*
SAKURAI, Y.
6006*
SALDITT, G.
6218*
SALSBUURY, A.J.
6028*
SALVADORES, D.
6156*
SALWA, J.
5840*
SAMAMA, M.
6164*
SAMI, B.P.
5807
SANDER, J.
5852*
SANKALE, M.
6000*
SANTAMARIA GARCIA, J.L.
6249*
SANTIAGO, H.
6155*
SANTOS, A.
6146*
SANTOTO, A.S.
5987*
SAPRIN, A.N.
5874*
SARMA, P.S.
5886
SARRAZIN, D.
6195*
SATO, T.
5944*
SATOH, S.
5971

SAUER, G.
5753*, 5757*
SAUER, Z.
6230*
SAUL, G.
5764
SAUNDERS, G.F.
6375*
SAXINGER, W.C.
5921
SCARAVILLI, F.
6229*
SCHAFF, Z.
6291*
SCHAISON, G.
5747*
SCHAPIRA, F.
5716
SCHAUER, A.
6072*
SCHERER, M.
6025*
SCHEURLEN, P.G.
6050*
SCHIMMER, B.P.
6119
SCHLEGEL, W.
6349*
SCHMIDT, C.G.
6040*, 6044*, 6384*
SCHMITZ, H.
6025*
SCHNEIDER, J.
5830*
SCHNEIDER, R.
5706
SCHNEWEIS, K.E.
5980*
SCHOCHET, S.S.
6204*
SCHOENAUER, M.
6191*
SCHOTTENFELD, D.
6355*
SCHRAMM, T.
5885, 5931*
SCHREIBER, D.
5765, 5767, 5830*
SCHREIBER, G.
6179*
SCHREIBER, M.
6179*
SCHRCHENLOHER, R.E.
5991*
SCHUBERT, G.E.
6234*
SCHUBERT, I.
5857*
SCHULTE-HOLTHAUSEN, H.
5908
SCHWARTZ, R.S.
5745*

SCHWERING, H.
6384*
SCIARRA, D.
6178*
SCOLNICK, E.M.
5970
SCOTT, M.T.
6015*
SCOTT, W.A.
6186*
SEBBA, F.
5734*
SECK, I.
6000*
SEEBER, S.
6379*
SEGAL, D.M.
6021*
SEKIYA, S.
5948*
SELKIRK, J.K.
5774
SELZER, G.
6198*
SEMJONCVA, L.A.
5887
SENITZ, D.
6180*
SERFATY, D.
6224*
SERROU, B.
5961
SGIBNEVA, O.V.
6237*
SHABAD, L.M.
5766
SHAMAYEVA, E.M.
6272*
SHAMUGARATNAM, T.
6082
SHAPOT, V.S.
6182*
SHARON, N.
5778
SHAROVSKAYA, JU.JU.
5834*
SHARPINGTON, C.
6336*
SHATALOVA, G.G.
5887
SHCHERBAKOVA, M.G.
6190*
SHIELDS, R.
6186*
SHIMANOVSKAYA, K.B.
6149*
SHIPLEY, W.U.
5864
SHIROOKER, S.R.
6043*
SHKROB, O.S.
6189*

SHUBIN, A.S.
5927*
SHUSTER, J.
5972
SIBAL, L.R.
5979
SIEGEL, M.
5843*
SIEGENTHALER, G.
5701
SIEGENTHALER, W.
5701
SIEGISMUND, G.
5955*
SIERKO, S.
6213*
SILYANOVSKA, YE.
6159*
SIMMONS, R.L.
5993*
SIMONS, M.J.
5912
SIMS, P.
5774, 5841*
SINGER, A.M.
6342*
SINNHUBER, R.O.
5827*
SIRACKA, E.
6369*
SIRACKY, J.
6369*
SKOGLUND, R.W., JR.
6321*
SKURZAK, H.M.
5888
SLIFKIN, M.
5772
SLOMSKA, J.
6275*
SMIRNOVA, YE.A.
6140*
SMITH, C.K.
5877
SMITH, G.S.
5727*
SMITH, H.S.
5915
SMITH, J.L.
5811
SMITH, R.G.
5906
SMITH, S.E.
6015*
SMITH, T.C.
6300*
SMOLAK, K.
6358*
SOEROWIDJOJO, M.
6002*
SOFINA, Z.P.
6250*

SOKOLOVSKIY, R.M.
5751*, 5752*
SOLETO SAEZ, E.
6249*
SOLHEIM, O.P.
5823*
SOLOIMSKAYA, YE.A.
5930*
SOLOVEV, V.V.
5968
SOROF, S.
5807
SOROKINA, YU.D.
5784, 5850*
SORSBY, A.
5704
SOVOVA, V.
5889
SPELSBERG, T.C.
5771
SPIEGELMAN, S.
5926
SPIELMANN, J.
6072*
SPIERS, A.S.D.
6117, 6354*
SPIRICHEV, V.B.
6272*
SPRYSHKOVA, N.A.
6251*
SPURE, ZH.ZH.
5883
ST. BERCEANU
5867*
STACKPOLE, C.
5944*
STADLER, U.C.
5810
STANKOV, G.
6095*
STANSFELD, A.G.
6365*
STARZL, T.E.
5728*
STASEK, V.
6101*
STEEL, G.G.
6104*
STEGNER, H.E.
6262*
STEINMANN, J.
5857*
STEINMULLER, D.
5802
STEPANKOVA, M.
5866
STEPANOV, E.A.
6239*
STEPHENSON, J.R.
5935*
STEVENS, D.A.
5969

STEVENS, M.B.
5969
STEWART, J.K.
6083
STEWART, M.J.
6343*
STOKER, M.G.P.
5964
STOLDT, H.
5860*, 6045*
STOLL, P.
6396*
STORCK, H.
6094*
STRAUB, O.C.
5940*
STRIZHACHENKO, N.M.
5939*, 5945*
STROM, R.
5987*
STRUM, S.B.
6205*
STUCKEY, W.J.
6346*
SUBJECK, J.
6330*
SUDA, M.
6126
SUESS, R.
5857*
SUGAR, J.
6054*
SUGAWARA, H.
6214*
SUGDEN, B.
5893
SUGIHARA, R.
6367*
SUNDERMAN, F.W., JR.
5801
SUZUKI, H.
5837*
SVEJDA, J.
6107*
SVOBODA, J.
5748*, 5916
SWENBERG, J.A.
5789
SYMONS, R.H.
5895
SZACKI, J.
6027*
SZAJMAN, S.M.
5807
SZEPESEI, K.
6135*
SZNAJD, J.
6161*
TAFELSHEIN E.YE.
5790
TAHALELE, E.
6399*

TAKAGI, M.
6317*
TAKANO, K.
5770
TAKAOKA, T.
5796
TALIB, H.
6327*
TAMM, I.
5717
TANABE, Y.
6222*
TANAKA, T.
5868*, 5904, 6126
TANIUCHI, K.
6126
TASCA, C.
5779
TAUCHI, H.
6322*
TAURASO, N.M.
5932*
TAYLOR, C.W.
6111
TAYLOR, J.F.
6279*
TCHORZEWSKI, H.
6125
TEDESCHI, F.
6171*
TEGTMEYER, P.
5879
TELLESCHI, S.
6264*, 6265*, 6267*, 6268*
TEMESI, M.
5869*
TERASHI, S.
5781
TERASHI, S.I.
5783
TERRACINI, B.
5814*
TERRY, W.D.
5976
TESSMANN, D.
6218*
TESTA, M.C.
5814*
THANGAVELU, M.
6200*
THE, T.H.
6038*
THEOLOGIDES, A.
6009*
THERMAN, E.
5824*
THIES, H.J.
6045*
THOM, W.
5859*
THOMAS, C.
5763

THOMAS, E.D.
 5843*
 THOMPSON, E.
 5957, 6301*
 THORMANN, TH.
 6051
 THORMAR, H.
 5898
 THORNE, M.G.
 6007*
 THORNTON, M.
 5964
 TICHY, M.
 6020*
 TIMOFEYEVA, N.G.
 6373*
 TIO, F.O.
 6068*
 TIDARO, G.J.
 5970
 TIDD, C.W.
 5976
 TIDD, D.
 5729*
 TIDOROV, I.
 6159*
 TIDOROV, T.
 6037*
 TIDOROVA, KHR.
 6159*
 TIFT, D.O.
 5771
 TIGNELLA, S.
 6030*, 6031*, 6032*, 6033*
 TIKITA, N.
 5985*
 TIKUDA, Y.
 6167*
 TIMITIS, L.
 5791
 TIMITA, M.
 6006*
 TINKINS, G.M.
 6127, 6186*
 TINELLI, F.
 6259*
 TIRRE, G.C.
 6156*
 TIRRES AGUERO, M.
 6360*
 TISI, P.
 6060*
 TITA, G.
 6060*
 TITH, B.
 5842*
 TROY, S.T.
 5979
 TREMBLAY, G.
 6281*
 TRENDLENBURG, F.
 6397*

TRENTINI, G.P.
 6061*
 TROITSKAYA, L.P.
 6236*
 TROELL, W.
 5844*
 TROUILLAS, P.
 5962, 6142*
 TRUELOVE, S.C.
 6337*
 TSO, M.O.M.
 5891
 TSC, P.O.P.
 5845*
 TSUKAHARA, I.
 6176*
 TURIAF, J.
 5709
 TURNER, H.C.
 5886
 TURUSOV, V.
 5791
 TYUFANDV, A.V.
 5939*
 UEHLINGER, E.
 6378*
 UJHAZY, V.
 6019*, 6371*
 UKITA, T.
 6006*
 ULTMANN, J.E.
 6016*
 UMANSKIY, YU.A.
 5785, 5983*
 USLENGHI, C.
 6145*
 UTKIN, O.B.
 5790
 UYDESS, I.
 6330*
 UZUNOV, P.
 6159*
 VACZI, P.
 6255*
 VAINIO, H.
 5832*
 VALDIMARSSON, H.
 6117
 VALENSI, Q.J.
 6320*
 VALLADARES, Y.
 5744*
 VANDENABEELE, B.
 6130
 VANDEVOORDE, J.P.
 6014*
 VARELA NUNEZ, A.
 6063*
 VARIKOJIS, D.
 6205*
 VASCONCELOS, E.
 6363*

VASILIEV, JU.M.
 5834*
 VAZQUEZ ARNEDO, M.
 6160*
 VEDRENNE, C.
 6216*
 VEIGEL, J.
 6234*
 VERHAGEN, A.
 6387*
 VERKATSKYY, P.P.
 5943*
 VIANNA, N.J.
 6074
 VICKER, M.G.
 5905
 VIDA, L.N.
 6128
 VIGIER, P.
 5946*
 VIKHERT, A.M.
 6138*
 VINNITSKAYA, V.K.
 5983*
 VINOGRADOV, V.N.
 6131*
 VINTER, V.G.
 6351*
 VITAK, M.J.
 6077
 VLADIMIROV, Y.A.
 5790
 VLAEMINCK, M.N.
 6187*, 6285*
 VOLFSON, N.I.
 5751*
 VOLM, M.
 6243*
 VON ARDENNE, M.
 6181*
 VORONINA, F.V.
 5997*
 VORONOV, S.A.
 6374*
 VORWERK, P.
 6081
 WADDELL, W.R.
 6329*
 WADELL, G.
 5986*
 WAGGONER, D.F.
 5969
 WAKONIG-VAARTAJA, T.
 5723*
 WALES, J.H.
 5827*
 WALFORD, R.L.
 5727*
 WALKER, M.
 5729*
 WALLER, D.K.
 5977

WANDSCHNEIDER, G.
 6258*
 WANG, I.Y.
 5835*
 WAPNICK, S.
 6079
 WARNER, N.L.
 5978
 WARZOK, R.
 5765, 5830*
 WASHIO, M.
 6154*
 WATANABE, K.
 5781, 5783
 WATERS, H.
 5727*
 WATSON, R.E., JR.
 6307*
 WAWRZENCZYK, B.
 6184*
 WAYSS, K.
 6243*
 WEBER, G.
 6141*
 WECHSLER, W.
 5789
 WEILER, J.
 6195*
 WEINSTEIN, I.B.
 5810
 WEISE, W.
 6197*
 WEISSBACH, A.
 6286*
 WEITZNER, S.
 6296*
 WENDEL, H.A.
 5775
 WENDER, M.
 6170*
 WERDER, H.
 6094*
 WESCH, H.
 6243*
 WEST, W.L.
 6114
 WETTER, O.
 6040*, 6044*, 6386*
 WHEELOCK, E.F.
 5979
 WHITEHEAD, E.D.
 6320*
 WHITEHEAD, R.
 6337*
 WIDMAIER, R.
 5764
 WIGAND, R.
 6002*
 WILLIAMS, D.
 5731*
 WILLIAMS, R.
 6301*

WILSON, H.E.
 6308*
 WILSON, P.D.
 6335*
 WILSON, S.H.
 6288*
 WINKLER, H.
 6035*
 WINTERSGILL, C.J.
 5898
 WISSEMAN, C.L., III
 6077
 WITTCLIFF, J.L.
 6116
 WITTING, U.
 6395*
 WIVEL, N.A.
 5880
 WOHLRAE, F.
 6220*
 WOJDALSKI, J.
 6213*
 WOLF, H.
 5908
 WOLFE, L.
 6279*
 WOOD, N.
 6009*
 WOOD, S., JR.
 6310*
 WOOD, W.S.
 6029*
 WOODRUFF, J.D.
 6324*
 WORST, P.
 6049*
 WORTH, A.J.
 5794
 WOTKE, R.
 6107*
 WOYKE, S.
 6207*
 WRAY, G.
 6330*
 WUEST, G.P.
 6395*
 WYBRAN, J.
 6017*
 YAM, L.T.
 6332*
 YAMAMOTO, S.
 5909
 YAMANOUCI, K.
 5923
 YANAGI, S.
 6126
 YANAGIDA, H.
 6223*
 YASUZUMI, G.
 6367*
 YAU, P.K.S.
 6364*

YAVELOV, V.A.
 6131*
 YENUKHOVICH, V.A.
 6151*
 YOSHIDA, T.O.
 5904
 YOSIDA, T.H.
 6295*
 YUNIS, E.J.
 6009*
 YUZHANINA, T.A.
 6256*
 ZAMORANO, L.
 6146*
 ZANAMWE, L.N.D.
 6079
 ZBARSKY, I.B.
 6236*
 ZEIGEL, R.
 5924
 ZEITLIN, B.R.
 5795
 ZER, M.
 6357*
 ZHEMALET DINOV, F.G.
 6185*
 ZIMMER, M.
 5860*
 ZIMMERER, J.
 6243*
 ZIMMERMANN, K.G.
 5701
 ZITOUN, R.
 6163*, 6164*
 ZOBL, H.
 5955*, 5956*
 ZOIDIS, T.
 6111
 ZOTTER, ST.
 5884
 ZUBERI, S.
 6306*
 ZUELCH, K.J.
 5719*

-ACETOXY-2-FLUORENYLACETAMIDE
 DNA BINDING, LIVER (5825)*
 NEOPLASTIC TRANSFORMATION, CLONED
 CELL LINES, MOUSE (5770)
 -ACETYLAMINOFLUORENE
 HYPERPLASTIC NODULE FORMATION,
 REGENERATING LIVER, RAT (5848)*
 METABOLITES, MUTAGENICITY, SALMONELLA
 (5787)
 DENOCAINOMA
 BREAST, WOMEN UNDER 30, CLINICAL STUDY
 (6195)*
 ESTROGEN-RECEPTOR, MAMMARY GLAND,
 RAT (6116)
 METHYLNITROSOUREA, SMALL INTESTINE,
 RABBIT (5767)
 OPTIC DISC, LUNG CANCER METASTASIS,
 HUMAN (6176)*
 RENAL, HERPESVIRUS, FROG, REVIEW
 (5737)*
 RETE TESTIS, CASE REPORT (6320)*
 DENOID
 CYSTIC CARCINOMA, LACRIMAL GLAND,
 CASE REPORT (6194)*
 DENOMA
 CYSTOPAPILLARY, SIDEROSIS, KIDNEY,
 CASE REPORT (6136)*
 IODINE DEFICIENCY, ULTRASTRUCTURE,
 HUMAN (6269)*
 PROSTATIC, TESTOSTERONE METABOLISM,
 CARCINOMA TISSUE (6169)*
 VAGINA, MESONEPHRIC RESIDUES, HISTO-
 PATHOLOGY, CASE REPORT (6267)*
 DENOSINE 3'-5'-CYCLIC MONOPHOSPHATE
 CELL PROLIFERATION, FIBROBLASTS, HUMAN
 (6303)*
 DRENAL GLAND
 TUMOR, ADENYLATE CYCLASE, ADRENO-
 CORTICOTROPHIC HORMONE (6119)
 FLATOXIN
 B1, NEOPLASTIC TRANSFORMATION, CLONED
 CELL LINES, MOUSE (5770)
 HEPATOMAS, SOCKEYE SALMON (5827)*
 GE FACTOR
 GASTRIC CARCINOMA, MORTALITY, HUMAN
 (6277)*
 GGLUTINATION
 TRANSFORMED CELLS, ROUS SARCOMA VIRUS,
 WHEAT GERM AGGLUTININ, CONCAVALIN
 A (5914)
 GREGATION
 CELL, NEURAMINIDASE, POLYOMA VIRUS,
 HAMSTER (5905)
 GING
 TUMOR CELLS, STEMLINE KARYOTYPE
 ALTERATION, RAT (6295)*
 AIR POLLUTION
 CANCER MORTALITY, SWITZERLAND (6098)*
 ALBUMIN
 BILIRUBIN CONJUGATION, TOXICITY,
 HEPATOMA CELL CULTURE, RAT (6334)*
 ALKYLATING AGENT
 IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY,
 MOUSE (5968)
 ALKYLATION
 NUCLEIC ACIDS, ETHYLNITROSOUREA,
 DIETHYLNITROSAMINE, LIVER, EMBRYO,
 RAT (5854)*
 ALLOPREGNANEDIOL
 LIVER CANCER, P-DIMETHYLAMINOAZO-
 BENZENE, RAT (5769)
 ALPHA-AMANITIN
 SV40 SPECIFIC RNA SYNTHESIS, MONKEY
 CELLS (5893)
 ALPHA FETOPROTEIN
 LIVER CARCINOMA, THOROTRAST CARRIERS
 (6048)*
 RADIOIMMUNOASSAY, SERUM, RAT (5972)
 SERUM LEVELS, DIETHYLNITROSAMINE
 POISONING, RABOONS (5786)
 AMINO ACID
 RNA POLYMERASE REGULATION, EHRICH
 ASCITES TUMOR CELLS, MOUSE (6109)
 SERUM COMPOSITION, MALE LEUKEMIA
 PATIENTS, FEMALE LEUKEMIA PATIENTS,
 (6062)*
 AMYLOIDOSIS
 STROMA, THYROID CANCER, HISTOCHEMISTRY
 C CELLS (6352)*
 ANEMIA
 RESISTANT, MYELO-MONOCYTIC LEUKEMIA,
 BLOOD PLATELETS, CLINICAL STUDY
 (6164)*
 SIDEROBLASTIC, MYELOID MONOCYTIC
 LEUKEMIA, CASE REPORTS (6163)*
 ANGIOSARCOMA
 1,2-DIMETHYLHYDRAZINE DIHYDROCHLORIDE,
 MORPHOLOGY, HAMSTER (5842)*
 ANTIBODY
 ANTINUCLEAR, MALIGNANCY, HUMAN (6011)*
 ATPC+ ASCITES TUMOR CELLS, IMMUNO-
 FLUORESCENCE, MOUSE (5984)*
 DIPHTHERIA TOXIN CONJUGATES, HAPEN-
 COATED TUMOR CELLS, ANTITUMOR EFFECT
 RABBIT (5990)*
 EPSTEIN-BARR VIRUS, CONNECTIVE TISSUE
 DISEASE, HUMAN (5969)
 HERPES SIMPLEX VIRUS, NASOPHARYNGEAL
 CANCER PATIENTS (5973)
 HUMORAL, FRIEND LEUKEMIA VIRUS,

INFECTION SUPPRESSION, STATOLON,
 MOUSE (5979)
 IGM, EPSTEIN-BARR VIRUS, HUMAN (5977)
 IGM, EPSTEIN-BARR VIRUS, INFECTIOUS
 MONONUCLEOSIS PATIENTS (6025)*
 PLASMA CELL TUMORS, MOUSE (6022)*
 SMOOTH-MUSCLE, VIRAL INFECTIONS,
 MALIGNANT DISEASE, HUMAN, REVIEW
 (5739)*

ANTIGEN
 ACUTE-LEUKEMIA, CLINICAL STUDY (6008)*
 ASCITES HEPATOMA, PURIFICATION, RAT
 (5971)
 AUSTRALIA
 FREQUENCY, LIVER CIRRHOSIS, CANCER
 AFRICANS (6000)*
 HEPATOCELLULAR CARCINOMA, HUMAN
 (5912)
 BREAST, OVARIAN CARCINOMAS, HUMAN
 (6045)*
 CARCINOEMBRYONIC
 ANIMALS, HUMAN, REVIEW (5742)*
 COLONIC CANCER, AMINO ACID
 SEQUENCING, HUMAN (5976)
 DIGESTIVE, SYSTEM, HUMAN (5710)
 DIGESTIVE TRACT, CARCINOMA
 PATIENTS (5992)*
 IN VITRO SYNTHESIS, HUMAN COLONIC
 CANCER, HAMSTER (6014)*
 WHOLE SERUM, TUMOR, HUMAN (5978)
 FORSSMAN HAPTEN, TUMORS, HUMAN (5994)*
 GAZDAR MURINE SARCOMA VIRUS, HAMSTER
 (5886)
 HETEROGENIC TISSUE, ADENOVIRUS SARCOMA
 HAMSTER (5996)*
 HL-A, LYMPHOGRANULOMATOSIS, MULTIPLE
 MYELOMA, CLINICAL STUDY (6040)*
 HL-A, LYMPHOID TUMORS, CLINICAL STUDY
 (6009)*
 HL-A SYSTEM, CANCER RESEARCH, REVIEW
 (5760)*
 LEUKEMIA, LYMPHOCYTE STIMULATION,
 HUMAN (5966)
 MIXED LYMPHOCYTE TUMOR REACTION,
 NORMAL CELLS, NEOPLASTIC CELLS,
 RAT (6043)*
 SOLUBLE, ADENOVIRUS TYPE 3, RABBIT
 (5986)*
 SURFACE
 GRAFFI VIRUS-INDUCED, LEUKEMIA
 CELLS, RAT (5963)
 POLYPSEUDOPODIA, POLYOMA VIRUS,
 TRANSFORMATION, BHK 21 CELLS
 (5964)
 TUMOR

CARCINOGENESIS, MOUSE (6049)*
 ISOLATION, PURIFICATION, HUMAN
 (6046)*
 MACROPHAGE MIGRATION INHIBITION,
 MOUSE (5974)
 TUMOR-ASSOCIATED TRANSPLANTATION,
 ROUND CELL CARCINOMA, SPLEEN CELL,
 MOUSE (5967)
 TUMOR-SPECIFIC, IMMUNOLOGICAL
 DETECTION METHODS (6041)*

ANTIGENICITY
 EHRLICH CARCINOMA CELLS, LIVER, MOUSE
 (6026)*
 TUMOR CELL, RAT (6004)*

APPENDIX
 CARCINOMA, HISTOLOGY, HISTOGENESIS,
 HUMAN (6069)*

ARGinine
 STARVATION, GROWTH, SIMIAN ADENOVIRUS
 SA7 (5937)*

AROMATIC AMINES
 METABOLITES, MUTAGENICITY, SALMONELLA
 (5787)

ASBESTOS
 CANCER, MORTALITY, INDUSTRY WORKERS,
 U.S.S.R. (6099)*
 LUNG CARCINOMA, INCIDENCE, HUMAN
 (5782)
 MESOTHELIOMA, CLINICAL STUDY (5823)*

ASBESTOSIS
 PLEURAL MESOTHELIOMA, HUMAN, REVIEW
 (5709)

ASCITES
 EHRLICH CELLS, IMMUNOGENICITY, HEAT
 TREATMENT, MOUSE (5987)*
 EHRLICH TUMOR
 CELLULAR PROLIFERATION, GROWTH,
 INTERFEROMETRIC MEASUREMENTS
 (6107)*
 CHICKEN EMBRYO LIVER, SPLEEN,
 TISSUE CULTURE STUDY (6187)*
 GLUCOSE REQUIREMENT, NUCLEOTIDES,
 IN VITRO (6240)*
 EHRLICH TUMOR CELLS
 METASTASIS, HISTOLOGY, ULTRA-
 STRUCTURE, EMBRYONATED CHICKEN
 EGG (6285)*
 MITOCHONDRIAL RIBOSOMES, MOUSE
 (6371)*
 NORMAL RAT SERUM (6001)*
 POLYNUCLEOTIDASE ACTIVITY, MOUSE
 (6370)*
 RNA POLYMERASE, ALPHA-AMANITIN-
 SENSITIVE FORMS (6289)*
 RNA UPTAKE (6344)*

MYELOMA, IMMUNOGLOBULIN SYNTHESIS,
 ZONAL CENTRIFUGATION, MOUSE (6343)*
 TUMOR, RADIORESISTANT CELL POPULATION,
 OVARY, RAT (6185)*
 TUMOR CELLS
 ATPC+ ANTIBODY, IMMUNOFLUORESCENCE
 MOUSE (5984)*
 80 S RIBOSOMES, POLYPEPTIDE
 SYNTHESIS (6284)*
 ASCITES TUMOR
 EHRlich, X-IRRADIATION, DNA, SINGLE-
 STRAND BREAK REJOINING, MOUSE (5863)
 ASPIRIN
 TUMOR METASTASIS, RABBIT (6310)*
 ASTROCYTE
 TRANSFORMATION, VISNA VIRUS, HUMAN
 (5898)
 BACILLUS CALMETTE-GUERIN
 NEURAMINIDASE, FIBROSARCOMA REGRESSION
 MOUSE (5993)*
 VACCINATION, LEUKEMIA MORTALITY,
 CHICAGO (6007)*
 BACTERIA
 MICROBIAL FACTOR, ACUTE LEUKEMIA,
 PATHOGENESIS, RAT (6070)*
 NITROSAMINE SYNTHESIS (5852)*
 BASEMENT MEMBRANE
 EPIDERMIS-DERMIS, CARCINOGENESIS,
 HUMAN, REVIEW (5705)
 BENZ(A)ANTHRACENE
 MACROMOLECULAR BINDING, TRANSFORMED
 CELL (5774)
 BENZO(A)PYRENE
 CARCINOGENESIS, NICKEL SULFIDE,
 INTERACTION, RAT (5801)
 DNA-BINDING METABOLITE, MICROSOMES,
 LIVER, HAMSTER (5835)*
 DNA REPAIR INHIBITION, TRANSFORMING
 ACTIVITY, MUTATION FREQUENCY (5845)*
 DRUG OXIDATION, CONJUGATION, TISSUES,
 RAT (5832)*
 HEPATIC TOXICATION-DETOXICATION
 SYSTEMS, DRUG METABOLISM, ENZYME
 INDUCTION, REVIEW (5720)*
 HYDROXYLASE, LUNG, OZONE, NITROGEN
 DIOXIDE, RABBIT (5803)
 MEDULLARY TUMORS, HISTOPATHOLOGY, BONE
 MARROW, RAT (5815)*
 NEOPLASTIC GROWTH, NUCLEAR VOLUME, DNA
 CONTENT, MOUSE (5779)
 TRANSPLACENTAL SENSITIZATION,
 THYMECTOMY, RAT (5831)*
 TUMOR PROGRESSION, MOUSE (5764)
 BLADDER
 BORTRYOID SARCOMA, URINE, CYTOLOGY,
 DOG (6348)*
 CANCER
 COFFEE, RAT (5795)
 ETIOLOGY, HUMAN (6168)*
 HISTOPATHOLOGY, HUMAN (6227)*
 HUMAN, REVIEW (6328)*
 SMOKING, REVIEW (5725)*
 CARCINOMA, CIRCULATING CELLS, HUMAN
 (6231)*
 TUMOR MORPHOLOGY, HISTOCHEMISTRY,
 HUMAN (6245)*
 BLASTOMOGENESIS
 URETHANE, DNA NUCLEOTIDE COMPOSITION,
 LUNG TISSUE, MOUSE (5813)*
 BLOOD
 CONSTITUENTS, BINDING, 4-DIMETHYL-
 AMINOSTILBENE, RAT (5798)
 DISEASES, PATHOLOGY, NON-HEMOLYTIC
 CHEMICAL AGENTS, CRYPTOGENETIC
 LEUKEMIA, REVIEW (5733)*
 LEUKEMIC, LIFE SPAN, CELLULAR CULTURES
 HUMAN (6129)
 PLATELET FUNCTION ABNORMALITIES,
 MYELOPROLIFERATIVE DISORDERS,
 CLINICAL STUDY (6299)*
 PLATELETS, MYELO-MONOCYTIC LEUKEMIA,
 RESISTANT ANEMIA, CLINICAL STUDY
 (6164)*
 TOTAL PROTEASE ACTIVITY, LEUKEMIA,
 PURULENT DISEASES, HUMAN (6257)*
 TUMOR CELLS, RECTAL CANCER PATIENTS
 (6148)*
 BONE
 EOSINOPHILIC GRANULOMA, CUTANEOUS
 LESIONS, INFILTRATED CELLS, ULTRA-
 STRUCTURE, CASE REPORT (6154)*
 IMPLANT CARCINOGENICITY, RAT (6271)*
 LYMPHOGRANULOMATOSIS, CLINICAL STUDY
 (6149)*
 MALIGNANT OSTEOLASTOCYSTOMA,
 RADIATION THERAPY, CASE REPORT
 (5870)*
 OSTEOSARCOMA, PU239, RAT (5865)*
 TUMOR
 CALCIUM METABOLISM, HUMAN (6400)*
 HISTOPATHOLOGY, HUMAN (6378)*
 BONE MARROW
 MACROPHAGE PRODUCTION, TUMOR-BEARING
 MICE (6280)*
 MEDULLARY TUMORS, HISTOPATHOLOGY,
 ONCOGENIC HYDROCARBON ADMINISTRATION
 RAT (5815)*
 BOWEL
 LARGE, CANCER, INCIDENCE,
 INTERNATIONAL (6082)

BRAIN

MALIGNANT TUMORS, IMMUNITY, ANTIGENIC STIMULATION, HUMAN (5962)
 MELANOTIC MENINGIOMA, ULTRASTRUCTURE, CASE REPORT (6068)*
 MENINGEAL MELANOCYTOMA, ULTRASTRUCTURE CASE REPORT (6068)*
 TRANSPLANTABLE TUMOR, RNA POLYMERASE, MOUSE (6345)*

TUMORS

GLUTAMIC ACID, GAMMA-AMINOBUTYRIC ACID, METABOLISM (6170)*
 LACTATE DEHYDROGENASE ISOENZYME HUMAN (6220)*
 MENINGOENCEPHALITIS, SERUM, CEREBROSPINAL FLUID ANALYSIS (6340)*
 PATHOGENESIS, ANIMALS, REVIEW (5719)*
 20-METHYLCHOLANTHRENE, MOUSE (5849)*
 ULTRASTRUCUTRE, RAT (6064)*

BREAST

ABDOMEN, CANCER, WOMEN (6396)*
 ADENOCARCINOMA, WOMEN UNDER 30, CLINICAL STUDY (6195)*
 BILATERAL CARCINOMA, INCIDENCE, PATHOLOGY, HUMAN (6275)*

CANCER

BITTNER VIRUS, MALE CARRIERS, HUMAN (5941)*
 CYTOLOGY, HUMAN (6201)*
 INCIDENCE
 INDIA (6086)
 MALE, GERMANY (6103)*
 TUMOR ANTIGENS, HUMAN (6045)*
 UTERINE CERVIX CANCER, REVIEW (5732)*

CARCINOMA

MALE, ZAMBIA (6302)*
 MENSTRUAL STATUS, RISK FACTORS, CLINICAL STUDY (6355)*
 METASTASES TO SKIN, TIBIA, LIVER, CASE REPORT (6278)*
 MORTALITY, DETECTION (6377)*
 THERMOGRAPHY
 BLOOD IRRIGATION, HUMAN (6399)*
 HUMAN (6398)*
 WOMEN (AGE 35 TO 45), AUSTRALIA (6342)*
 CARCINOMA LOBULARE IN SITU, HISTO-PATHOLOGY, HUMAN (6241)*
 CHONDROCARCINOMA, HISTOPATHOLOGY, CASE REPORT (6268)*

MALIGNANT TUMORS, ESTRADIOL BINDING, THIOLS, HUMAN (6339)*

PATHOLOGY, EXOGENOUS FACTORS, HUMAN (6217)*

TUMOR, CALCIFICATIONS, ULTRASTRUCTURE, HUMAN (6262)*

BURKITT'S LYMPHOMA

EPSTEIN-BARR VIRUS, IGM (5977)
 ETIOLOGY, REVIEW (5736)*

CALCIUM

METABOLISM, BONE TUMOR, HUMAN (6400)*

CAMPTOTHECIN

ADENOVIRUS TYPE 2, INHIBITION, HELA CELLS (5936)*

CANCER

CYTOLOGY, EXUDATES, HUMAN (6244)*
 GASTRIC STUMP, ULCER, HUMAN (6213)*
 MAMMARY GLAND, CORPUS UTERI, ANTI-GONADOTROPIC FACTOR, HUMAN (6175)*
 MORTALITY

AIR POLLUTION, SWITZERLAND (6098)*
 JEWISH POPULATIONS, UNITED STATES (6075)

YUGOSLAVIA (6076)

SPONTANEOUS REGRESSION, FACTORS, AUTOPSY STUDY (6024)*

SURFACE-CHEMICAL THEORY, REVIEW (5734)*

TYPICAL SITES, WOMEN (6396)*

VULVAR PRURITUS, TRICHOMONAS, CANDIDIASIS, HUMAN (6224)*

CANDIDIASIS

CHRONIC MUCOCUTANEOUS, MYOSITIS, THYMOMA, CASE REPORT (6283)*

CARBOHYDRATE

METABOLISM

EHRlich ASCITES TUMOR, NUCLEOTIDE, IN VITRO (6240)*

ENZYME ACTIVITY, GENETIC EXPRESSION REGULATION, CANCER CELL DETECTION (6141)*

HEPATOMAS, ENZYME ACTIVITY, MOUSE, HAMSTER (5840)*

MALIGNANT LYMPHOMA, HUMAN (6226)*

CARCINOEMBRYONIC ANTIGEN

DIGESTIVE SYSTEM, HUMAN, REVIEW (5710)

CARCINOGENESIS

BIOCHEMICAL PATHOGENESIS, MOLECULAR BIOLOGY, REVIEW (5744)*

TOPICAL ASPECTS, REVIEW (5758)*

TUMOR ANTIGENS, MOUSE (6049)*

TUMOR GROWTH, MAMMALIAN CELL SYSTEMS, PROLIFERATIVE PROPERTIES, REVIEW (5756)*

TUMOR VIRUSES, REVIEW (5753)*

VIRAL GENOME, REVIEW (5757)*
 CARCINOGENIC HYDROCARBONS
 MITOCHONDRIA, CHEMILUMINESCENCE (5790)
 CARCINOGENICITY
 AGROBACTERIUM TUMEFACIENS, BACTERIAL
 ATTENUATION, CROWN GALL TUMOR
 (6242)*
 HETEROLOGOUS BONE FRAGMENTS, RAT
 (6271)*
 CARCINOMA
 BASAL CELL, CAPILLARY STRUCTURE, HUMAN
 (6246)*
 BILATERAL, BREAST, INCIDENCE,
 PATHOLOGY, HUMAN (6275)*
 BLADDER, CIRCULATING TUMOR CELLS,
 HUMAN (6231)*
 BREAST
 BLOOD IRRIGATION, HUMAN (6399)*
 MORTALITY, DETECTION (6377)*
 THERMOGRAPHY, HUMAN (6398)*
 BRONCHIA, RISK POPULATIONS (6397)*
 GASTROINTESTINAL TRACT, EARLY DETEC-
 TION, MORTALITY (6376)*
 GREATER OMENTUM, HISTOPATHOLOGY, CASE
 REPORT (6260)*
 LUNG, ASBESTOS, INCIDENCE, HUMAN
 (5782)
 PRIMARY, BARTHOLIN GLAND, HISTO-
 PATHOLOGY, CASE REPORT (6253)*
 PROSTATE, CYTOLOGY, HUMAN (6394)*
 SQUAMOUS CELL, DISCOID LUPUS
 ERYTHEMATOSUS, CASE REPORT (6167)*
 UTERINE CERVIX, PREGNANCY, HUMAN
 (6382)*
 CARTILAGE
 CARTILAGINOUS TUMOR, FINGER, CASE
 REPORT (6135)*
 DOPAMINE
 NEUROBLASTOMA, GANGLIONEUROMA,
 CLINICAL STUDY (6035)*
 CARCINOMA, REVIEW (6313)*
 LEIOMYOSARCOMA, HISTOPATHOLOGY, CASE
 REPORT (6261)*
 CELL
 AGGREGATION, LIVER CELL CULTURE,
 DIETHYLAMINOAZOBENZENE, RAT (5793)
 CANCER, EVOLUTIONARY PROPERTIES,
 REVIEW (5722)*
 CLONES, CHRONIC MYELOID LEUKEMIA,
 CYTOCHEMISTRY, HUMAN (6144)*
 DIVISION, CHEMICAL REGULATION,
 CHALONES, REVIEW (5721)*
 EHRLICH CARCINOMA, ANTIGENICITY, LIVER
 MOUSE (6026)*

ELECTRIC CHARGE, INTERACTION, MAMMARY
 GLAND TUMOR, LIVER, RAT (6389)*
 ELECTROLYTE ALTERATIONS, LANTHANUM,
 EHRLICH ASCITES TUMOR CELLS, MOUSE
 (6300)*
 GAUCHER, MYELOID LEUKEMIA, ULTRA-
 STRUCTURE, CYTOCHEMISTRY (6139)*
 GUERIN CARCINOMA, ULTRASTRUCTURE
 (6147)*
 LINE, MURINE PLASMOCYTOMA, CULTIVATION
 IN SERUM-DEPRIVED MEDIA (6372)*
 LYMPHOID, CYTOTOXICITY, CANCER-BEARING
 MICE (6003)*
 MULTIPLICATION, SERUM, CANCER PATIENTS
 (5981)*
 PLASMA, TUMORS, ANTIBODIES, MOUSE
 (6022)*
 POPULATION, VAGINA, HORMONAL CONDITION
 HUMAN (6203)*
 POPULATION KINETICS, TRANSMISSIBLE
 VENEREAL TUMOR, THYMIDINE LABELLING
 TECHNIQUE, DOG (6104)*
 PROLIFERATION, GLOBULIN SYNTHESIS,
 RABBIT (5985)*
 SINGLE-CELL SUSPENSIONS, PREPARATION,
 NORMAL LIVER, REGENERATING LIVER,
 HEPATOMAS, MOUSE, RAT (6179)*
 TUMOR
 BLOOD, RECTAL CANCER PATIENTS
 (6148)*
 CYTOPLASMIC GRANULES, ULTRAVIOLET
 INDUCIBLE FLUORESCENCE, THIAZINE
 DYE (6341)*
 TYPING, BREAST CANCER, HUMAN (6201)*
 URINE CYTOLOGY, UROGENITAL TRACT
 TUMORS, HUMAN (6258)*
 CELL CYCLE
 LYMPHOCYTES, CHRONIC LYMPHOCYTIC
 LEUKEMIA, PROLIFERATION, RAT (5958)
 NONHISTONE CHROMOSOMAL PROTEINS, HELA
 CELL (6124)
 NUCLEIC ACID METABOLISM, CELLULAR
 PROLIFERATION, NORMAL TISSUES,
 MALIGNANT TISSUES, HUMAN (6077)
 CELL MEMBRANE
 MELANOMA, IMMUNOGLOBULIN, IMMUNO-
 FLUORESCENCE, HUMAN (6036)*
 CENTRAL NERVOUS SYSTEM
 EPENDYMOMA, SURVIVAL, HISTOLOGY,
 GERMANY (6180)*
 CEREBELLUM
 GLIOBLASTOMA, EXPERIMENTAL HYPER-
 THYREOSIS, ADRENAL CORTEX FUNCTION,
 RAT (6251)*
 HEMANGIOBLASTOMA, OCCURRENCE IN TWO

- CONSECUTIVE GENERATIONS, CASE REPORT (6255)*
- CERVIX
CANCER, HERPESVIRUS HOMINIS, TYPE 2, HUMAN, REVIEW (5715)
CARCINOMA
BIRTH CONTROL PILL, INCIDENCE, HUMAN (5794)
HYALINOSIS, PELVIC LYMPH NODES, CLINICAL STUDY (6171)*
ECTOCERVICAL CANCER, INDIRECT METAPLASIA, BASAL PLATE, ULTRASTRUCTURE, HUMAN (6059)*
- CHALONE
CELL REPLACEMENT, SKIN, TUMOR, REVIEW (5707)
CHEMICAL REGULATION, CELL DIVISION, REVIEW (5721)*
- CHEMICAL CARCINOGEN
MUTAGENICITY, RNA-FORMING GENES, DROSOPHILA (5780)
- CHEMICAL CARINOGENESIS
CELL-FREE EXTRACTS, MOUSE (5860)*
EPIDERMIS CELL CULTURES, MOUSE EMBRYO (5859)*
- CHEMILUMINESCENCE
MITOCHONDRIA, CARCINOGENIC HYDROCARBONS (5790)
- CHILDREN
NEONATAL ONCOLOGY, CLINICAL STUDY (6162)*
NEOPLASIA, INCIDENCE, INDIA (6200)*
- CHLOROPRENE
KARYOTYPE, TRANSPLANTATION, RAT (6215)*
LUNG CANCER, OCCUPATIONAL HAZARD (5768)
- CHORIOCARCINOMA
BETA-GLUCURONIDASE, HEXOSAMINIDASE, CULTURED HUMAN CELLS (6309)*
GESTATIONAL, IMMUNOLOGICAL ASPECTS, REVIEW (5759)*
UTERUS, HYDATIDIFORM MOLE, CASE REPORT (6221)*
- CHROMATIN
CARCINOGENESIS, DIETHYLNITROSAMINE, LIVER, RAT (5800)
- CHROMOSOME
ABERRATIONS
LYMPHOBLASTOID CELL LINE, BABOON (5951)*
LYMPHOSARCOMATOUS TUMOR, CASE REPORT (6110)
ABNORMALITIES
ROUS SARCOMA VIRUS, TUMOR ULTRASTRUCTURE, RAT (6081)
X-IRRADIATION, LEUKEMIC CELLS, MOUSE (6123)
ACUTE LEUKEMIA, DNA, CLINICAL STUDY (6108)
ANALYSIS, FALLOPIAN TUBE CARCINOMA, CASE REPORT (6197)*
ANOMALIES, NEOPLASIA, HUMAN (6380)*
BREAKAGE, 1-METHYL-2-BENZYLHYDRAZINE, CANCER CELLS, MOUSE (5824)*
D, DELETION, RETINOBLASTOMA, HUMAN (6130)
FAMILIAL LEUKEMIA, PELGER-HUET ANOMALY ICELAND (6117)
PHILADELPHIA, ACUTE LEUKEMIA, RADIATION, CASE REPORT (5867)*
SMALL ACROCENTRIC, ANOMALIES, TUMOR CELLS, HUMAN (6354)*
Y-CHROMATIN, INTERPHASE CANCER CELLS, HUMAN (6362)*
- CIGNOLIN
9,10-DIMETHYL-1,2-BENZANTHRACENE, SKIN TUMORS, MOUSE (5777)
- COFFEE
BLADDER CANCER, RAT (5795)
- COLLAGEN
SYNTHESIS, PEPTIDYLPROLINE HYDROXYLASE ACTIVITY, MAMMARY CANCERS, MOUSE (6331)*
- COLON
CANCER SURVIVAL RATE, SOCIOECONOMIC FACTOR, RACIAL FACTOR (6080)
LYMPHOMA, ULCERATIVE COLITIS, CASE REPORTS (6306)*
- COMPLEMENT FIXATION
SACCHAROMYCES CEREVISIAE RNA, IMMUNOONCOLOGY, INFANTS (5998)*
- CONCANAVALIN A
AGGLUTINATION, ROUS SARCOMA VIRUS, TRANSFORMED CELLS (5914)
LYMPHOCYTE STIMULATION, CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN (5811)
- CONNECTIVE TISSUE
MAMMARY GLAND CARCINOMA, HISTOCHEMICAL STUDY, HUMAN (6137)*
SPONTANEOUS EQUINE SARCOID, CELL LINE CHARACTERISTICS, HORSE (6307)*
- CONNECTIVE TISSUE DISEASE
EPSTEIN-BARR VIRUS, ANTIBODY, HUMAN (5969)
- CROWN GALL TUMOR
AGROBACTERIUM TUMEFACIENS ATTENUATION, CARCINOGENICITY (6242)*
- CYCASIN
MAMMARY GLAND, TARGET ORGAN SHIFT,

INTESTINE, RAT (5781)
 TUMOR INDUCTION, LIVER, RAT (5783)
 CLOPHOSPHAMIDE
 IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY,
 MOUSE (5968)
 IMMUNOSUPPRESSION, ANTIBODY PLAQUE-
 FORMING SPLEEN CELLS, HEMOLYTIC
 ANTIBODIES, MOUSE (6019)*
 CYLINDROMA
 UPPER RESPIRATORY TRACT, HISTOPATHOL-
 OGY, HUMAN (6211)*
 LUNG, TUMOR DEVELOPMENT, CASE REPORT
 (6374)*
 CYTOGENETICS
 NEOPLASMS, CLINICAL STUDIES, HUMAN,
 REVIEW (5723)*
 OVARIAN CANCER, HUMAN (6219)*
 CYTOLOGY
 URINE, BORTRYOID SARCOMA, BLADDER, DOG
 (6348)*
 CYTOLYSIS
 GLUCOCORTICOID, RECEPTOR, LYMPHOMA
 CELL, MOUSE (6127)
 IMMUNE, X-RAY, HAMSTER CELL (5864)
 CYTOTOXICITY
 LYMPHOID CELLS, CANCER-BEARING MICE
 (6003)*
 PHYTOAGGLUTININS, YOSHIDA SARCOMA
 CELLS (6006)*
 CANCER, RESEARCH, REVIEW (5741)*
 CARCINOGENICITY, MOUSE (5766)
 LONG-TERM EXPOSURE, MOUSE (5791)
 GRANUL
 IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY,
 MOUSE (5968)
 DIAZO-ACETIC ESTER
 SKIN TUMORS, MORPHOLOGY, RAT, MOUSE
 (5763)
 BENZ(A,C)ANTHRACENE 10,11-OXIDE
 SYNTHESIS, METABOLISM, LIVER
 MICROSOMAL PREPARATIONS, RAT (5841)*
 BENZ(A,H)ANTHRACENE
 MACROMOLECULAR BINDING, TRANSFORMED
 CELL (5774)
 BUTYRYL CYCLIC ADENOSINE PHOSPHATE
 THEOPHYLLINE, MURINE, SARCOMA VIRUS,
 TRANSFORMED CELLS, MOUSE (5952)*
 DIETHYLSTILBESTROL, CANCER, AMERICANS
 (5826)*
 GASTRIC CARCINOGENESIS, RAT (5820)*
 SMOKED MEAT PRODUCTS, CARCINOGENESIS,
 REVIEW (5754)*

DIETHYLAMINOAZOBENZENE
 LIVER CELL, AGGREGATE FORMATION, RAT
 (5793)
 DIETHYLNITROSAMINE
 ALKYLATION, NUCLEIC ACIDS, LIVER,
 EMBRYO, RAT (5854)*
 CARCINOGENESIS, CHROMATIN, LIVER, RAT
 (5800)
 NEOPLASTIC GROWTH, NUCLEAR VOLUME, DNA
 CONTENT, RAT (5779)
 NEOPLASTIC TRANSFORMATION, CLONED CELL
 LINES, MOUSE (5770)
 POISONING, SERUM ALPHA-FETOPROTEIN
 LEVELS, BARBOONS (5738)
 DIETHYLSTILBESTROL
 CANCER, DIET, AMERICANS (5826)*
 DIFFERENTIATION
 EPITHELIAL, RETINOL, RAT, HAMSTER
 (5846)*
 DIGESTIVE SYSTEM
 CARCINOEMBRYONIC ANTIGEN, HUMAN,
 REVIEW (5710)
 DIGESTIVE TRACT
 CARCINOMA
 CARCINOEMBRYONIC ANTIGEN, HUMAN
 (5992)*
 CASE REPORTS (6161)*
 TUMOR, IMMUNOLOGY, CLINICAL STUDY
 (6042)*
 DIMETHYLAMINE
 SODIUM NITRITE, LIVER TOXICITY, MOUSE
 (5778)
 DIMETHYLAMINOAZOBENZENE
 KIDNEY, EMBRYONIC TISSUE CULTURE,
 MOUSE (5818)*
 4-DIMETHYLAMINOAZOBENZENE
 KIDNEY, EMBRYONIC TISSUE CULTURE,
 MOUSE (5818)*
 P-DIMETHYLAMINOAZOBENZENE
 LIVER CANCER, PREGNANEDIOL, ALLO-
 PREGNANEDIOL, RAT (5769)
 4-DIMETHYLAMINOSTILBENE
 BLOOD CONSTITUENTS, BINDING, RAT
 (5798)
 DIMETHYLBENZANTHRACENE
 MEDULLARY TUMORS, HISTOPATHOLOGY,
 BONE MARROW, RAT (5815)*
 TRANSPLACENTAL EFFECT, EMBRYONAL
 KIDNEY CULTURE, MOUSE (5784)
 7,12-DIMETHYLBENZ(A)ANTHRACENE
 CARCINOGENESIS, GRENZ RADIATION, SKIN,
 MOUSE (5862)
 EMBRYONAL KIDNEY CULTURE, MOUSE
 (5850)*
 MALIGNANT TUMOR INDUCTION, OVARY, RAT

RAT (5858)*
 NEOPLASTIC FIBROBLASTS, MOUSE (5834)*
 SKIN, TUMOR INITIATION, MOUSE (5773)
 TUMOR INDUCTION, MITOTIC RATE, MAMMARY
 GLAND, RAT (5797)
 9,10-DIMETHYL-1,2-BENZANTHRACENE
 CIGNOLIN, SKIN TUMORS, MOUSE (5777)
 DNA REPAIR INHIBITION, TRANSFORMING
 ACTIVITY, MUTATION FREQUENCY (5845)*
 MEMBRANE-ACTIVITY AGENTS, MITOTIC
 FREQUENCY, EPITHELIUM, MOUSE (5828)*
 TUMOR INDUCTION, THYMECTOMY, CHEEK
 POUCH, HAMSTER (5805)
 1,2-DIMETHYLHYDRAZINE DIHYDROCHLORIDE
 ANGIOSARCOMA, MORPHOLOGY, HAMSTER
 (5842)*
 DIMETHYLNITROSAMINE
 TUMOR, REVERSION, HAMSTER (5808)
 DISEASE
 IMMUNE RESPONSE, VIRUS, HUMAN (6013)*
 DNA
 ACUTE LEUKEMIA, CHROMOSOMES, CLINICAL
 STUDY (6108)
 COVALENT BINDING, N-ACETOXY-N-2-
 ACETYLAMINOFLUORENE, LIVER (5825)*
 9,10-DIMETHYL-1,2-BENZANTHRACENE,
 BENZO(A)PYRENE, REPAIR INHIBITION,
 TRANSFORMING ACTIVITY, MUTATION
 FREQUENCY (5845)*
 LYMPH NODES, LYMPHOPROLIFERATIVE
 DISEASE, HUMAN (6225)*
 MITOCHONDRIAL, REPLICATION, SV40,
 HUMAN, MONKEY, RODENT (5894)
 MOLECULAR JOINING, SV40 (5895)
 NUCLEOTIDE COMPOSITION, BLASTOMO-
 GENESIS, URETHANE, LUNG TISSUE,
 MOUSE (5813)*
 POLYMERASE
 EXOGENOUS PRIMER, AVIAN MYELO-
 BLASTOSIS VIRUS, ROUS SARCOMA
 VIRUS (5901)
 PHYTOHEMAGGLUTININ, LYMPHOCYTE,
 HUMAN (5906)
 POLYRIBOADENYLIC ACID-DEPENDENT,
 EUKARYOTIC CELLS (6286)*
 POLYMERASE ACTIVITY, AVIAN MYELO-
 BLASTOSIS VIRUS (5876)
 QUINOLINES, INTERACTION, CHARGE
 TRANSFER (5776)
 REPLICATION
 SHOPE VIRUS-INDUCED PAPILLOMAS,
 MOLECULAR HYBRIDIZATION, RABBIT
 (5881)
 VIRAL INFECTION, REVIEW (5717)
 RNA-DEPENDENT POLYMERASE, MURINE
 LEUKEMIA VIRUS, PRIMER (5900)
 ROUS SARCOMA VIRUS, VIRUS RELEASE,
 CHICKEN CELL (5916)
 SINGLE-STRAND BREAK REJOINING,
 X-IRRADIATION, EHRlich TUMOR, MOUSE
 (5863)
 SV40
 REPLICATION, ULTRASTRUCTURAL STUDY
 (5909)
 TRANSFORMED CLONES, MOUSE (5915)
 SYNTHESIS
 POLYMERASE ACTIVITY, MYELOMA,
 MOUSE (6288)*
 UV IRRADIATION, SPONTANEOUS TUMOR,
 HUMAN (5861)
 VIRUS, EPSTEIN-BARR VIRUS INFECTION,
 LYMPHOID CELL LINES, HUMAN (5882)
 DOMESTIC ANIMAL
 LEUKEMIA, EPIDEMIOLOGY, HUMAN, REVIEW
 (5706)
 DOWN'S SYNDROME
 ACUTE LEUKEMIA, LEUCOCYTE FUNCTION,
 CLINICAL STUDY (6301)*
 ENDOCRINE GLAND
 METASTASIS, INCIDENCE, DISTRIBUTION,
 HUMAN (6273)*
 ENDOMETRIAL CARCINOMA
 CLINICAL STUDY (6298)*
 ENDOMETRIUM
 CARCINOMA
 CLINICAL STUDY (6298)*
 ENZYME ACTIVITY (6066)*
 HUMAN, REVIEW (5731)*
 MORPHOLOGY, ORGAN CULTURES (6369)*
 HYPERPLASIA, PRE-MALIGNANT LESION,
 HUMAN (6063)*
 SARCOMA, CELLULAR STROMA, HISTOLOGY,
 CLINICAL STUDY (6173)*
 ENDOPLASMIC RETICULUM
 TUBULES, THYROID TUMOR CELLS, ULTRA-
 STRUCTURE, DOG (6193)*
 ENVIRONMENTAL HAZARD
 LEUKEMIA, HOUSEHOLD PET, INCIDENCE
 (6084)
 OIL MIST POLLUTION, REVIEW (5750)*
 POLLUTION, OZONE, NITROGEN DIOXIDE,
 LUNG, BENZO(A)PYRENE HYDROXYLASE,
 RABBIT (5803)
 ENZYME
 ACID PHOSPHATASE, RETICULOENDOTHELIO-
 SIS, HAIRY CELLS, ULTRASTRUCTURE,
 LEUKEMIA PATIENTS (6332)*
 ADENYLATE CYCLASE, ADRENOCORTICO-
 TROPHIC HORMONE, ADRENAL TUMOR
 (6119)

DOLASE ISOZYMES, LUNG CANCER TISSUES (6196)*
 ALKALINE PHOSPHATASE, REVERSIBLE SUPPRESSION, THYROID MEDULLARY CARCINOMA CELLS, HUMAN (5880)
 PASE
 HISTOCHEMISTRY, HEPATOMA CELL NUCLEI, MOUSE (6236)*
 LYMPHOCYTES, HUMAN (5988)*
 NIZO(A)PYRENE HYDROXYLASE, LUNG, OZONE, NITROGEN DIOXIDE, RABBIT (5803)
 OLINESTERASE, INTRACELLULAR LOCALIZATION, HEPATOMA, RAT (6373)*
 HYDROGENASE ACTIVITY, CIRCADIAN RHYTHM, BLOOD CELLS, ACUTE LEUKEMIA, CHILDRENE (6183)*
 AMINEOXIDASE, ROUS SARCOMA VIRUS INFECTION, FIBROBLASTS, CHICKEN (5930)*
 A POLYMERASE
 AVIAN MYELOBLASTOSIS VIRUS (5876)
 LYMPHOID LEUKEMIA, LYMPHOCYTES, OX (5940)*
 POLYRIBOADENYLIC ACID-DEPENDENT, EUKARYOTIC CELLS (6286)*
 ASE, TUMOR DEVELOPMENT, BLOOD SERUM, ASCITIC FLUID (6351)*
 TAL MOLECULAR FORMS, HEPATOMA, RAT, HUMAN, REVIEW (5716)
 TA-GLUCURONIDASE, CHORIOCARCINOMA, CULTURED HUMAN CELLS (6309)*
 XOKINASE, EHRlich ASCITES TUMOR, LIVER, MOUSE (6126)
 XOSAMINIDASE, CHORIOCARCINOMA, CULTURED HUMAN CELLS (6309)*
 CTATE DEHYDROGENASE ISOENZYMES, BRAIN TUMORS, HUMAN (6220)*
 SOSOMAL, MAMMARY TUMOR REGRESSION, RAT (6290)*
 LATE DEHYDROGENASE, DETECTION, LEUKEMIA, HUMAN (6143)*
 NOAMINEOXIDASE, ROUS SARCOMA VIRUS INFECTION, FIBROBLASTS, CHICKEN (5930)*
 NITHINE DECARBOXYLASE, INDUCTION CULTURED HEPATOMA CELLS, RAT (6293)*
 PHYTOHEMAGGLUTININ, CULTURED LYMPHOCYTES, HUMAN (6294)*
 PTIDYLPROLINE HYDROXYLASE, COLLAGEN SYNTHESIS, MAMMARY CANCERS, MOUSE (6331)*
 OSPHODIESTERASE, HEPATOMAS, RAT (6114)

PHOSPHORYLASE, METABOLISM, SQUAMOUS CELL CARCINOMA, LUNG, HISTOCHEMICAL STUDY (6121)
 POLYNUCLEOTIDASE, ASCITIC TUMOR CELLS, MOUSE (6370)*
 PROTEOLYTIC ENZYME INHIBITOR, LYMPHOCYTE TRANSFORMATION, GUINEA PIG (6125)
 PYRUVATE KINASE, EHRlich ASCITES TUMOR LIVER, MOUSE (6126)
 REDOX, MONKEY ADENOVIRUS, HISTOCHEMISTRY, HAMSTER (5897)
 REVERSE TRANSCRIPTASE
 AVIAN MYELOBLASTOSIS VIRUS (5921)
 IMMUNOLOGICAL MARKER, PRIMATE VIRUS (5970)
 MURINE MAMMARY TUMOR VIRUS, GEL ELECTROPHORESIS, MOUSE (5953)*
 RIBONUCLEASE, ISOLATION, CHARACTERIZATION & LEUKEMIA PATIENTS (6161)*
 RIBONUCLEASE H
 DNA-RNA HYBRID DEGRADATION (5892)
 RNA TUMOR VIRUSES (5922)
 RNA POLYMERASE
 ALPHA-AMANITIN-SENSITIVE FORMS, EHRlich ASCITES TUMOR CELLS (6289)*
 MELANOMA, HAMSTER (6300)*
 RIFAMPICIN-INSENSITIVE PURIFICATION, EHRlich ASCITES TUMOR CELLS (6349)*
 TRANSPLANTABLE BRAIN TUMOR, MOUSE (6345)*
 RNA POLYMERASE ACTIVITY, MAMMARY GLAND TUMOR, RAT (5829)*
 RNA POLYMERASE B, TEMPLATE SPECIFICITY MYELOMA, MOUSE (6120)
 RNA POLYMERASE REGULATION, AMINO ACIDS EHRlich ASCITES TUMOR CELLS, MOUSE (6109)
 SIALYL TRANSFERASE ACTIVITY, RNA- AND DNA-VIRUS, TRANSFORMED CELLS (5878)
 TRNA-GUANINE METHYLTRANSFERASE, PARTIAL PURIFICATION, EHRlich ASCITES TUMOR CELLS, MOUSE (6312)*
 TYROSINE AMINOTRANSFERASE, HORMONAL INDUCTION, HEPATOMA CELLS (6186)*
 EPENDYMOMA
 SURVIVAL, HISTOLOGY, GERMANY (6180)*
 EPIDEMIOLOGY
 BREAST CANCER
 INDIA (6086)
 MALE, GERMANY (6103)*
 INCIDENCE, U.S.S.R. (6073)
 LEUKEMIA, CHILDREN, BULGARIA (6095)*

- LUNG CANCER, MALE, CZECHOSLOVAKIA (6101)*
- MALIGNANT MELANOMA
AUSTRALIA (6105)*
ENGLAND (6106)*
- PENILE CARCINOMA, GERMANY (6100)*
- UTERINE CANCER, JAPAN (6085)
- UTERINE CERVIX CARCINOMA
GERMANY (6093)*
HUNGARY (6091)*
JAPAN (6102)*
POLAND (6097)*
- EPITHELIOMA
SEBACEOUS, HISTOLOGY, CASE REPORT (6210)*
- EPITHELIUM
DIFFERENTIATION, RETINOL, RAT, HAMSTER (5846)*
MEMBRANE-ACTIVITY AGENTS, MITOTIC FREQUENCY, DMBA TREATMENT, MOUSE (5828)*
- EPOXIDES
K-REGION, DIBENZ(A,H)ANTHRACENE, BENZ(A)ANTHRACENE, MACROMOLECULAR BINDING, TRANSFORMED CELL (5774)
- ERTHYROCYTE
FETAL, JUVENILE CHRONIC MYELOGENOUS LEUKEMIA, CASE REPORT (6128)
PYRUVATE KINASE ACTIVITY, ACUTE LEUKEMIA, CHILDREN (6256)*
- ESOPHAGUS
CARCINOMA, INCIDENCE, RHODESIA (6079)
LEIOMYOMA, PATHOLOGY, CASE REPORT (6249)*
- ESTRADIOL
BINDING, THIOLS, MALIGNANT BREAST TUMORS, HUMAN (6339)*
- ESTROGEN
BINDING, 3-METHYLCHOLANTHRENE, UTERUS (5771)
RECEPTOR, LACTATING MAMMARY GLAND, MAMMARY ADENOCARCINOMA, RAT (6118)
- ETHIONINE
MALIGNANT HEPATIC NODULES, CYCLIC AMP LEVELS, LIVER, RAT (6606)
- ETHYLNITROSUREA
ALKYLATION, NUCLEIC ACIDS, LIVER, EMBRYO, RAT (5664)*
- NERVOUS SYSTEM TUMORS, TRANSPLACENTAL INDUCTION, RAT (5830)*
- TRANSPLACENTAL TUMOR INDUCTION, QUANTITATIVE ASPECTS, RAT (5789)
- ETIOLOGY
BLADDER CANCER, HUMAN (6188)*
BURKITT'S LYMPHOMA, REVIEW (5736)*
- LEUKEMIA, EPIDEMIOLOGY, PATHOLOGY, REVIEW (5746)*
- VIRAL, LEUKEMIA, LYMPHOMA, MOUSE, REVIEW (5724)*
- EYE
FIBROSARCOMA, CONJUNCTIVA, CILIARY BODY, CASE REPORT (6297)*
METASTASIS, PRIMARY MALIGNANT SKIN MELANOMA, CASE REPORTS (6326)*
ORBIT, RETICULUM CELL SARCOMA, CASE REPORTS (6174)*
ORBITAL TUMORS, INCIDENCE, IRAQ (6327)*
RETINAL PIGMENT EPITHELIUM, SV40, TUMOR, HAMSTER (5891)
RETINOBLASTOMA
D-CHROMOSOME DELETIONS, HUMAN (6130)
GENETIC TRANSMISSION, REVIEW (5704)
- FALLOPIAN TUBE
CARCINOMA, CHROMOSOME ANALYSIS, CASE REPORT (6197)*
- FASCIITIS
NODULAR, PSEUDOSARCOMATOUS, CLINICO-MORPHOLOGICAL STUDY (6138)*
- FIBROBLAST
MULTIPLICATION, SERUM, CANCER PATIENTS (5982)*
PROLIFERATION, ADENOSINE 3'-5'-CYCLIC MONOPHOSPHATE, HUMAN (6303)*
TRANSFORMATION
HERPES SIMPLEX VIRUS TYPE 2, HAMSTER EMBRYO (5916)
UV RADIATION, HERPES SIMPLEX TYPE 2 VIRUS, ULTRASTRUCTURE, HAMSTER (5890)
- FIBROSARCOMA
CONJUNCTIVA, CILIARY BODY, CASE REPORT (6297)*
REGRESSION, NEURAMINIDASE, RCG, MOUSE (5993)*
SKIN, HISTOPATHOLOGY, CASE REPORT (6214)*
- FINGER
CARCINOMATOUS TUMOR, CASE REPORT (6135)*
- N-2-FLUORENYLACETAMIDE
LIVER, HYPERPLASTIC NODULE, RAT (5772)
- FOOD
SMOKED MEAT PRODUCTS, CARCINOGENESIS, REVIEW (5754)*
- FORMYNOBLOTAKINIC ACID
URINE, BRONCHIAL CARCINOMA PATIENTS (6184)*

KLE
 MELANOTIC, MALIGNANT MELANOMA, ULTRA-
 STRUCTURE, CASE REPORTS (6368)*
 AND ADJUVANT
 RETICULOSARCOMA, ONCOGENIC ALTERATIONS
 RAT (5965)
 IUM
 SUBCELLULAR DISTRIBUTION, LIVER,
 TUMORIGENESIS, MOUSE (6384)*
 LIONEUROMA
 NEUROBLASTOMA, CATECHOLAMINE, CLINICAL
 STUDY (6035)*
 ROINTESTINAL TRACT
 CARCINOMA, EARLY DETECTION, MORTALITY
 (6376)*
 GASTRIC MELANOMA, HISTOPATHOLOGY, CASE
 REPORT (6229)*
 LIVER, STOMACH, PAROTID GLAND,
 HODGKIN'S DISEASE, CASE REPORT
 (6276)*
 PARTIAL GASTRECTOMY, GASTRIC STUMP
 CANCER, HUMAN (6213)*
 PRIMARY LYMPHOMA, CASE REPORT (6198)*
 GENETIC EXPRESSION REGULATION, ENZYME
 ACTIVITY, CARBOHYDRATE METABOLISM,
 NUCLEIC ACID METABOLISM, CANCER CELL
 DETECTION (6141)*
 RNA-FORMING, MUTATION, CHEMICAL
 CARCINOGEN, DROSOPHILA (5780)
 BLASTOMA
 CEREBELLUM, ADRENAL CORTEX FUNCTION,
 EXPERIMENTAL HYPERTHYREOSIS, RAT
 (6251)*
 OCORTICOID
 CYTOLYSIS, RECEPTOR, LYMPHOMA CELL,
 MOUSE (6127)
 URONIC ACID
 MAMMARY GLAND CARCINOMA, URINE, BLOOD,
 HUMAN (6122)
 OGEN
 METABOLISM, SQUAMOUS CELL CARCINOMA,
 LUNG, HISTOCHEMICAL STUDY (6121)
 OPROTEIN
 CELL SURFACE ALTERATIONS, MAMMARY
 GLAND TUMORS, HUMAN (6054)*
 SERUM LEVELS, INFLAMMATION, MALIGNANT
 DISEASES, FEMALE BREAST, CLINICAL
 STUDY (6156)*
 SYNTHESIS, MITOCHONDRIA, MOUSE (5947)*
 D
 GONADOBLASTOMAS, GONADIC PRIMORDIUM
 TUMORS, CLINICAL STUDY, REVIEW
 (5718)*
 DOBLASTOMA

GONADIC PRIMORDIUM TUMORS, CLINICAL
 STUDY, REVIEW (5718)*
 GRAFT-VERSUS-HOST REACTION
 MALIGNANT LYMPHOMAS, MOUSE (6039)*
 GRANULOMA
 EOSINOPHILIC BONE, CUTANEOUS LESIONS,
 INFILTRATED CELLS, ULTRASTRUCTURE,
 CASE REPORT (6154)*
 TALCUM, CASE REPORT (5836)*
 GROWTH
 CHRYSOIDINE HEPATOMA, SPLENECTOMY,
 MOUSE (6027)*
 EHRLICH ASCITES TUMOR, INTERFEROMETRIC
 MEASUREMENTS, CELLULAR PROLIFERATION
 (6107)*
 EHRLICH CARCINOMA, LIPID FLUCTUATION,
 LIVER, MOUSE (6356)*
 HEPATOMA, ULTRASTRUCTURE, MOUSE
 (6088)*
 MYXOMATOUS NEOPLASMS, HUMAN (6190)*
 NEOPLASTIC, DNA CONTENT, NUCLEAR
 VOLUME, MOUSE, RAT (5779)
 OSTEOSARCOMA, PU239, RAT (5865)*
 PLACENTAL, STEROID TREATMENT, RAT
 (5847)*
 RETARDING MECHANISMS, LYMPHATIC TUMORS
 MOUSE, HUMAN (5726)*
 SIMIAN ADENOVIRUS SA7, ARGININE
 STARVATION (5937)*
 TUMOR
 IMMUNOSUPPRESSION, TUMORIGENESIS,
 REVIEW (5761)*
 MAMMALIAN CELL SYSTEMS, PROLIFERA-
 TIVE PROPERTIES, REVIEW (5756)*
 VITAMIN B12, RAT, MOUSE, HAMSTER,
 GUINEA PIG, REVIEW (5708)
 GUERIN TUMOR
 CELLS, ULTRASTRUCTURE (6147)*
 HAPTEN
 FORSSMAN, TUMORS, HUMAN (5994)*
 HEART
 TUMOR INDUCTION, METHYLNITROSOUREA,
 RAT (5765)
 HEMANGIOENDOTHELIOMA
 HISTOLOGY, CASE REPORT (6208)*
 MALIGNANT, SPLEEN, ULTRASTRUCTURE,
 CASE REPORT (6071)*
 HEMANGIOMA
 CAVERNOUS, PLASMA CELL PROLIFERATION,
 CASE REPORT (6359)*
 HEMOPOIESIS
 HETEROTOPIC RENAL, LEUKOERYTHROBLASTIC
 BLOOD REACTION, ACUTE LEUKEMIA,
 CASE REPORT (6133)*
 HEPATOMA

- AFLATOXIN-INDUCED, SOCKEYE SALMON (5827)*
 CELL NUCLEI, ATPASE, HISTOCHEMISTRY, MOUSE (6236)*
 CHEMICAL INDUCTION, C-TYPE VIRUS, RAT (5810)
 CHRYSOIDINE, GROWTH, SPLENECTOMY, MOUSE (6027)*
 FETAL MOLECULAR ENZYME FORMS, LIVER, RAT, HUMAN, REVIEW (5716)
 GROWTH RATE, ULTRASTRUCTURE, MOUSE (6088)*
 MORRIS
 GROWTH, PLASMA COPPER LEVELS, RAT (6243)*
 SINGLE-CELL SUSPENSION PREPARATION LIVER, RAT, MOUSE (6179)*
 NOVIKOFF
 LIVER INVASION, ULTRASTRUCTURE, RAT (6281)*
 RNA, LIVER, RAT (6379)*
 PHOSPHODIESTERASE ACTIVITY, RAT (6114)
 PLASMA MEMBRANE, LIPID COMPOSITION, RAT, MOUSE (6115)
 HEPTACHLOR
 ADMINISTRATION, TUMOR INCIDENCE, SUCKLING RATS (5814)*
 HISTOPATHOLOGY
 BARTHOLIN GLAND CARCINOMA, CASE REPORT (6253)*
 CANCER
 BLADDER, HUMAN (6227)*
 UTERINE CERVIX, HUMAN (6237)*
 CANCER TO CANCER METASTASES, CASE REPORT (6274)*
 CARCINOMA LOBULARE IN SITU, BREAST, HUMAN (6241)*
 CEREBELLAR HEMANGIOBLASTOMA, TWO CONSECUTIVE GENERATIONS, CASE REPORT (6255)*
 CHONDROCARCINOMA OF THE BREAST, CASE REPORT (6268)*
 CLEAR CELL CARCINOMA, KIDNEY, HUMAN (6266)*
 GASTRIC MELANOMA, CASE REPORT (6229)*
 HEMANGIOMA, SYNOVIOMA, MONKEY (6270)*
 HODGKIN'S DISEASE, HUMAN (6383)*, (6392)*, (6393)*
 LEIOMYOSARCOMA OF THE CECUM, CASE REPORT (6261)*
 MALIGNANT MELANOCYTIC NEVUS, CASE REPORT (6247)*
 MELANOMA, CHEEK, HUMAN (6222)*
 MUCOEPIDERMOID TUMOR, PAROTID, MOUTH, HUMAN (6228)*
 MYOBLASTOMYOMA, TONGUE, CASE REPORT (6265)*
 NEPHROBLASTOMA, ENZYME HISTOCHEMISTRY, COMPARISON WITH FETAL KIDNEY, CHILDREN (6232)*
 PRIMARY BONE TUMORS, HUMAN (6378)*
 PRIMARY CARCINOMA OF THE GREATER OMENTUM, CASE REPORT (6260)*
 RETICULUM CELL SARCOMA, OVARY, CASE REPORT (6252)*
 SERACEOUS EPITHELIOMA, CASE REPORT (6210)*
 SPONTANEOUS MELANORBLASTOMA, RABBIT (6248)*
 HODGKIN'S DISEASE
 BLASTIC TRANSFORMATION, LYMPH NODE CELLS, PHYTOHEMAGGLUTININ (6030)*
 DELAYED SENSITIVITY (6033)*
 EPIDEMIOLOGY, REVIEW (6078)
 EXTRANODAL SITE, CASE REPORT (6276)*
 FOAMY MACROPHAGES, CLINICAL STUDY (6205)*
 HISTOPATHOLOGY, HUMAN (6383)*, (6392)*, (6393)*
 INCIDENCE, NEW YORK (6074)
 LIVER, PARENCHYMAL DAMAGE, HUMAN (6388)*
 LUNG PATHOLOGY, HUMAN (6385)*
 PREGNANCY, HUMAN (6387)*
 SKELETON PATHOLOGY, HUMAN (6386)*
 HORMONE
 ACTH
 SECRETION, BRONCHIAL CARCINOID TUMORS, CASE REPORTS (6366)*
 TUMOR CONCENTRATIONS, PLASMA CONCENTRATIONS, ECTOPIC ACTH SYNDROME, CLINICAL STUDY (6365)*
 ADRENOCORTICOTROPHIC, ADRENAL TUMOR, ADENYL CYCLASE (6119)
 ANDROGENIC STEROIDS, HEPATOCELLULAR CARCINOMA, HUMAN (5839)*
 ANDROGENIC-ANABOLIC STEROID THERAPY, HEPATOCELLULAR CARCINOMA, CASE REPORTS (5843)*
 ESTRADIOL, BINDING, THIOLS, MALIGNANT BREAST TUMORS, HUMAN (6339)*
 ESTROGEN-RECEPTORS, LACTATING MAMMARY GLAND, MAMMARY ADENOCARCINOMA, RAT (6116)
 JUVENILE, MELANOTIC PSEUDOTUMOR, DROSOPHILA (6118)
 PRODUCTION, TUMORS, HUMAN, REVIEW (5701)
 REACTIVITY, TRANSPLANTABLE, UTERINE CERVIX CANCER, MOUSE (6250)*

STEROID TREATMENT, PLACENTAL GROWTH,
 RAT (5847)*
 TESTOSTERONE METABOLISM, PROSTATIC
 ADENOMA, CARCINOMA TISSUE (6169)*
 YALINOSIS
 PELVIC LYMPH NODES, CERVICAL CARCINOMA
 CLINICAL STUDY (6171)*
 YDRADENOMA
 CLEAR-CELL, SKIN, CLINICAL STUDY,
 REVIEW (5730)*
 -HYDROXY-N-1-ACETYLAMINOFLUORENE
 GUANINE BINDING, LIVER, RAT (5804)
 YPERCALCEMIA
 TUMOR-INDUCED, CASE REPORT (6321)*
 YPERPLASIA
 ENDOMETRIAL, PRE-MALIGNANT LESION,
 HUMAN (6063)*
 YPOXIA
 MAMMARY GLAND NEOPLASMS, PATHOGENESIS,
 CLINICAL STUDY (6053)
 MMUNITY
 CELL-MEDIATED, ROUS SARCOMA, QUAIL
 (5923)
 MALIGNANT BRAIN TUMORS, ANTIGENIC
 STIMULATION, HUMAN (5962)
 TRANSPLANTATION, RAT ASCITIC TUMOR,
 MOUSE (5995)*
 TUMOR
 CELL-MEDIATED, ONCORNAVIRUS, MOUSE
 (5920)
 RESISTANCE, CORYNEBACTERIUM PARVUM
 TREATMENT, MOUSE (6015)*
 TUMOR GROWTH STIMULATION, REVIEW
 (5711)
 MMUNIZATION
 AUTOLOGOUS TUMOR CELLS, CANCER PATIENT
 (5983)*
 DOUBLE, ADENOVIRUS TYPES 1,3, RABBIT
 (6002)*
 MMUNOCYTOMA
 MONOCLONAL PROTEINS, RAT (6012)*
 MMUNOGENICITY
 EHRlich ASCITES CELL, HEAT TREATMENT,
 MOUSE (5987)*
 MMUNOGLOBULIN
 CONTROL MECHANISMS, PLASMOCYTOMA,
 CLINICAL STUDY (6044)*
 GAMMAGLOBULIN, ALTERATIONS, LEUKEMIA,
 SERUM, CHILDREN (5999)*
 HEAVY CHAIN IGA VARIANT, MYELOMA,
 MOUSE (6023)*
 IGA, PEPsin FRAGMENTS, HAPTEN BINDING,
 X-RAY CRYSTALLOGRAPHY, MOUSE (6021)*
 KAPPA CHAIN, PURIFICATION, CHEMICAL
 CHARACTERIZATION, RAT (6010)*

LEUKEMIA, CHILDREN (5960)
 MELANOMA, CELL MEMBRANE, IMMUNO-
 FLUORESCENCE, HUMAN (6036)*
 MEMBRANE, PERIPHERAL BLOOD LYMPHOCYTE,
 HODGKIN'S DISEASE PATIENTS (6031)*
 PARAPROTEIN, PHYSICAL ABNORMALITIES,
 CHEMICAL ABNORMALITIES, CASE REPORTS
 (6020)*
 SPONTANEOUS LYMPHOMAS, MOUSE (5991)*
 SYNTHESIS, ZONAL CENTRIFUGATION,
 ASCITES MYELOMA CELLS, MOUSE (6343)*
 IMMUNOLOGY
 DIGESTIVE TRACT TUMORS, CLINICAL STUDY
 (6042)*
 GESTATIONAL CHORIOCARCINOMA, INVASIVE
 MOLF, REVIEW (5759)*
 HISTOCOMPATIBILITY SYSTEMS, CANCER,
 REVIEW (5727)*
 HOST-ALLOGRAFT RELATIONSHIPS, TUMORS,
 LYMPHOID CELLS, MOUSE (5989)*
 IMMUNE CYTOLYSIS, X-RAY CYTOLYSIS,
 HAMSTER CELL (5864)
 IMMUNE RESPONSE
 IMMUNOLOGICAL MEMORY, ALKYLATING
 AGENTS, RADIATION, MOUSE (5968)
 VIRUS, DISEASE, HUMAN (6013)*
 IMMUNOGLOBULIN CONTROL MECHANISMS,
 PLASMOCYTOMA, CLINICAL STUDY (6044)*
 IMMUNOLOGIC SURVEILLANCE, IATROGENIC
 ALTERATIONS, MALIGNANCY, HUMAN,
 REVIEW (5728)*
 IMMUNOREGULATION, MALIGNANT LYMPHOMAS,
 ONCOGENIC VIRUSES, HUMAN, REVIEW
 (5745)*
 IMMUNOSUPPRESSION, TUMOR GROWTH,
 TUMORIGENESIS, REVIEW (5761)*
 LYMPHOGRANULOMATOSIS, HUMAN (6050)*
 MIXED LYMPHOCYTE TUMOR REACTION,
 ANTIGEN DETECTION IN VITRO, NORMAL
 CELLS, NEOPLASTIC CELLS, RAT (6043)*
 REVERSE TRANSCRIPTASE, IMMUNOLOGICAL
 MARKER, MONKEY (5970)
 TUMOR, HUMAN, REVIEW (5712)
 TUMOR CELL, ANTIGENICITY, RAT (6004)*
 IMMUNOSUPPRESSION
 CYCLOPHOSPHAMINE, ANTIBODY PLAQUE-
 FORMING SPLEEN CELLS, HEMOLYTIC
 ANTIBODIES, MOUSE (6019)*
 INDUCTION
 INTERFERON, TILORONE HYDROCHLORIDE,
 NORMAL, LEUKEMIC LYMPHOCYTE CULTURES
 HUMAN (6308)*
 MALIGNANT TUMOR
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 OVARY, RAT (5858)*

N-ISOPROPYL-ALPHA-2-(METHYL-
 HYDRAZINE)-P-TOLUAMIDE HYDRO-
 CHLORIDE, RAT (5812)*
 ORNITHINE DECARBOXYLASE
 CULTURED HEPATOMA CELLS, RAT
 (6293)*
 PHYTOHEMAGGLUTININ, CULTURED
 LYMPHOCYTES, HUMAN (6294)*
 TUMOR
 BOVINE ADENOVIRUS TYPE 3
 BIOLOGICAL PROPERTIES,
 MORPHOLOGY, HAMSTER (5945)*
 HAMSTER (5939)*
 SIMIAN ADENOVIRUS SA7(C8), HAMSTER
 (5938)*
 INFECTION
 RESISTANCE, SV40, MONKEY CELL (5879)
 INFECTIOUS MONONUCLEOSIS
 EPSTEIN-BARR VIRUS
 HUMAN, REVIEW (5738)*
 IGM (5977)
 IGM ANTIBODIES, EPSTEIN-BARR VIRUS
 (6025)*
 INFLUENZA
 PREGNANCY, LYMPHATIC CANCERS,
 INCIDENCE, ENGLAND (6083)
 INTERFERON
 INDUCTION, TILORONE HYDROCHLORIDE,
 NORMAL, LEUKEMIC LYMPHOCYTE CULTURES
 HUMAN (6308)*
 PRODUCTION, HERPES VIRUS, IMMUNO-
 LOGICAL REACTIVITY, LEUKOCYTES,
 MACROPHAGES, RABBIT (5997)*
 INTESTINE
 CYCASIN, TARGET ORGAN SHIFT, MAMMARY
 GLAND, RAT (5781)
 SMALL
 ADENOCARCINOMA, METHYLNITROSOUREA,
 RABBIT (5767)
 CARCINOMA, HISTOLOGY, HISTOGENESIS
 HUMAN (6069)*
 PRIMARY TUMOR, HISTOLOGY, HUMAN
 (6206)*
 INVASIVE MOLE
 IMMUNOLOGICAL ASPECTS, REVIEW (5759)*
 IODINE
 RADIOACTIVE, RNA, MOLECULAR HYBRIDIZA-
 TION EXPERIMENTS (6375)*
 JAW
 LYMPHOSARCOMA, BURKITT'S TUMOR, CASE
 REPORTS (6317)*
 TUMORIGENESIS, TRAUMA, HUMAN (5875)*
 KAPOSII'S SARCOMA
 LYMPHOCYTE TRANSFORMATION (6279)*
 KARYOTYPE
 CHLOROMA, TRANSPLANTATION, RAT (6215)*
 STEMLINE ALTERATIONS, AGING, TUMOR
 CELLS, RAT (6295)*
 KETONE
 TOSYL PHENYLALANINE CHLOROMETHYL,
 CARCINOGENESIS, SKIN, MOUSE (5844)*
 KIDNEY
 ADENOCARCINOMA, HERPESVIRUS, FROG,
 REVIEW (5737)*
 CLEAR CELL TUMOR, HISTOPATHOLOGY,
 HUMAN (6266)*
 CYSTOPAPILLARY ADENOMA, SIDEROSIS,
 CASE REPORT (6136)*
 GRAFTS, DONOR-CANCER DEVELOPMENT,
 CASE REPORTS (6360)*
 HYPERNEPHROID CARCINOMA, IMMUNOLOGICAL
 TESTS, SERUM, URINE, HUMAN (6047)*
 LYMPHANGIOMA, CYSTIC STRUCTURES, CASE
 REPORT (6259)*
 MORPHOLOGY, MULTIPLE MYELOMA, HUMAN
 (6234)*
 RENAL CARCINOMA, SIBLINGS, CASE REPORT
 (6113)
 RENAL DAMAGE, RADIATION, DOG (5868)*
 SARCOMA, POLYOMA VIRUS-INDUCED,
 PROLIFERATION KINETICS, RAT (5955)*
 TRACE ELEMENT LEVELS, METHYLCHOL-
 ANTHRENE SENSITIZATION, MOUSE (5809)
 LACRIMAL GLAND
 ADENOID CYSTIC CARCINOMA, CASE REPORT
 (6194)*
 LANTHANUM
 CELLULAR ELECTROLYTE ALTERATIONS,
 EHRlich ASCITES TUMOR CELLS, MOUSE
 (6300)*
 LARYNX
 CANCER, LEUKEMIA-LIKE VIRUSES, HUMAN
 (5883)
 CHEMOECTOMA, HISTOPATHOLOGY, CASE
 REPORT (6212)*
 PRECANCEROUS ALTERATIONS, HISTOLOGY,
 CLINICAL STUDY (6056)*
 LEIOMYOMA
 ESOPHAGUS, PATHOLOGY, CASE REPORT
 (6249)*
 LEIOMYOSARCOMA
 SKIN, CASE REPORT (6363)*
 LEUKEMIA
 ACUTE
 BLOOD CELL DEHYDROGENASE ACTIVITY,
 CIRCADIAN RHYTHM, CHILDREN
 (6183)*
 DNA, CHROMOSOMES, CLINICAL STUDY
 (6108)
 DOWN'S SYNDROME, LEUCOCYTE FUNC-

TION, CLINICAL STUDY (6301)*
 ERYTHROCYTIC PYRUVATE KINASE,
 CHILDREN (6256)*
 LEUKOERYTHROBLASTIC BLOOD REACTION
 HETEROTOPIC RENAL HEMOPOIESIS,
 CASE REPORT (6133)*
 MICROBIAL FACTOR, PATHOGENESIS,
 RAT (6070)*
 RADIATION, PH1 CHROMOSOME, CASE
 REPORT (5867)*
 RONIC GRANULOCYTIC, SERUM
 RIBONUCLEASES, ISOLATION, CHARACTER-
 IZATION (6161)*
 RONIC LYMPHATIC, T CELL ISOLATION,
 HUMAN (6017)*
 RONIC LYMPHOCYTIC
 LYMPHOCYTE STIMULATION, PLANT
 MITOGEN, HUMAN (5811)
 LYMPHOCYTES, PROLIFERATION, CELL
 CYCLE KINETICS, RAT (5958)
 PROTEIN SYNTHESIS, RIBOSOMES,
 BLOOD LYMPHOCYTES, HUMAN (6016)*
 RONIC MYELOID, CYTOCHEMISTRY,
 CELL CLONES, HUMAN (6144)*
 YPTOGENETIC, BLOOD DISEASES,
 PATHOLOGY, NON-HEMOLYTIC CHEMICAL
 AGENTS, REVIEW (5733)*
 A, RNA, SYNTHESIS INHIBITION,
 LYMPHOCYTES, HUMAN (5957)
 MESTIC ANIMAL, EPIDEMIOLOGY, HUMAN,
 REVIEW (5706)
 SINOPHILIC, THROMBOPLASTIC ACTIVITY,
 CASE REPORT (6304)*
 IOLOGY, EPIDEMIOLOGY, PATHOLOGY,
 REVIEW (5746)*
 MILIAL, PELGER-HUET ANOMALY,
 CHROMOSOME, ICELAND (6117)
 MMAGLOBULIN, IMMUNOGLOBULIN
 ALTERATIONS, SERUM, CHILDREN (5999)*
 USEHOLD PET, EXPOSURE, INCIDENCE
 (6084)
 MMUNOGLOBULINS, CHILDREN (5960)
 CIDENCE
 CHILDREN, BULGARIA (6095)*
 SOUTHERN IRAN (6318)*
 U.S.S.R. (6073)
 FLUENZA, PREGNANCY, REVIEW (5743)*
 JUVENILE CHRONIC MYELOGENOUS, FETAL
 ERYTHROCYTE, CASE REPORT (6128)
 MYPHOID, DNA POLYMERASE, LYMPHOCYTES,
 OX (5940)*
 ALIC ACID, MALATE DEHYDROGENASE
 DETECTION, HUMAN (6143)*
 RTALITY
 BCG VACCINATION, CHICAGO (6007)*

GERMANY (6092)*
 MYELOID, GAUCHER CELLS, ULTRASTRUCTURE
 CYTOCHEMISTRY (6139)*
 MYELOID MONOCYTIC, SIDEROBLASTIC
 ANEMIA, CASE REPORTS (6163)*
 OVARIAN DYSGERMINOMA, SIMULTANEOUS
 OCCURRENCE, CASE REPORT (6230)*
 PURULENT DISEASES, TOTAL BLOOD
 PROTEASE ACTIVITY, HUMAN (6257)*
 RECKLINGHAUSEN'S DISEASE, CASE REPORTS
 CHILDREN (6142)*
 SUB-ACUTE MYELO-MONOCYTIC
 PATHOLOGY, CLINICAL STUDY (6165)*
 RESISTANT ANEMIA, BLOOD PLATELETS,
 CLINICAL STUDY (6164)*
 7,8,12-TRIMETHYLBENZ(A)ANTHRACENE
 LYMPHOID TISSUES, RAT (5799)
 SPLEEN, THYMUS, RAT (7562)
 TUMOR ANTIGEN, LYMPHOCYTE STIMULATION,
 HUMAN (5966)
 VIRAL ETIOLOGY, MOUSE, REVIEW (5724)*
 LEUKOCYTE
 FUNCTION, DOWN'S SYNDROME, ACUTE
 LEUKEMIA, CLINICAL STUDY (6301)*
 INTERFERON PRODUCTION, HERPES VIRUS,
 IMMUNOLOGICAL REACTIVITY, RABBIT
 (5997)*
 MALIGNANCY ASSOCIATED CHANGES, ULTRA-
 STRUCTURE AIR DRYING, WRIGHT'S, PAS
 STAINING, HUMAN (6347)*
 LEUKEMOGENICITY
 DI GUGLIELMO'S ERYTHREMIC MYELOSIS,
 CELL-FREE FILTRATE, MOUSE (5943)*
 LEUKOSIS
 ACUTE, NUCLEIC ACIDS, COPPER LEVELS,
 MANGANESE LEVELS, RAT (5873)*
 TRANSPLANTED RAT ERYTHROMYELOSIS,
 CELL-FREE FILTRATES, MOUSE (5943)*
 LIP
 CANCER, METASTASES, CLINICAL STUDY
 (6311)*
 PIGMENTED TUMOR, ULTRASTRUCTURE, HUMAN
 (6177)*
 SQUAMOUS-CELL CARCINOMA, DISTANT
 CUTANEOUS METASTASES, CASE REPORT
 (6296)*
 LIPID
 FLUCTUATION, GROWTH PERIOD, EHRLICH
 CARCINOMA, LIVER, MOUSE (6356)*
 PLASMA MEMBRANE, HEPATOMA, RAT, MOUSE
 (6115)
 LIPOSARCOMA
 HUMAN NERVE-GROWTH FACTOR, CASE REPORT
 (6329)*
 LIVER

ASCITES HEPATOMA, ANTIGEN, RAT (5971)
 CARCINOMA, ALPHA-FETOPROTEIN,
 THOROTRAST CARRIERS (6048)*
 CELL CULTURE, AGGREGATE FORMATION,
 DIETHYLAMINOAZOBENZENE, RAT (5793)
 CHRYSOIDINE HEPATOMA, GROWTH,
 SPLENECTOMY, MOUSE (6027)*
 GALLIUM, INTRACELLULAR DISTRIBUTION,
 TUMORIGENESIS, MOUSE (6384)*
 HEPATIC CARCINOGENS, DNA BINDING
 (5825)*
 HEPATOCELLULAR CARCINOMA
 ANDROGENIC-ANABOLIC STEROID
 THERAPY, CASE REPORTS (5843)*
 ANDROGENIC STEROIDS, HUMAN (5839)*
 AUSTRALIA ANTIGEN, HUMAN (5912)
 HEPATOCTE, CYTOPLASMIC ALTERATIONS,
 NITROSAMINE, RAT (5855)*
 HEPATOMA
 FETAL MOLECULAR ENZYME FORMS, RAT,
 HUMAN, REVIEW (5716)
 GROWTH RATE, ULTRASTRUCTURE, MOUSE
 (6088)*
 PHOSPHODIESTERASE ACTIVITY, RAT
 (6114)
 HEXOKINASE, PYRUVATE KINASE ACTIVITY,
 EHRLICH ASCITES TUMOR, MOUSE (6126)
 HYPERPLASTIC NODULE, N-2-FLUORENYL-
 ACETAMIDE, RAT (5772)
 INVASION, NOVIKOFF HEPATOMA, ULTRA-
 TURE, RAT (6281)*
 MALIGNANT NODULES, CYCLIC AMP LEVELS,
 ETHIONINE TREATED RATS (5806)
 MORRIS HEPATOMA, SINGLE-CELL SUSPEN-
 SION PREPARATION, MOUSE, RAT (6179)*
 PARENCHYMAL DAMAGE, HODGKIN'S DISEASE,
 HUMAN (6388)*
 SQUAMOUS CELL CARCINOMA, NON-PARASITIC
 CYST, CASE REPORT (6315)*
 TOXICATION-DETOXICATION SYSTEMS,
 BENZO(A)PYRENE, DRUG METABOLISM,
 ENZYME INDUCTION, REVIEW (5720)*
 TOXICITY, SODIUM NITRITE, DIMETHYL-
 AMINE, MOUSE (5778)
 TUMOR INDUCTION, CYCASIN, RAT (5783)
 LONGEVITY
 SEX DIFFERENTIAL, GONADECTOMY, HORMONE
 TREATMENT, NORMAL HAMSTERS,
 NEOPLASTIC HAMSTERS (6364)*
 LUNG
 BRONCHI, PRIMARY EPIDERMOID CARCINOMA,
 SMOKING, STATISTICAL STUDY (5817)*
 BRONCHIAL CARCINOID, ULTRASTRUCTURE,
 CASE REPORT (6305)*
 BRONCHIAL CARCINOID TUMORS, ACTH
 SECRETION, CASE REPORTS (6366)*
 BRONCHIAL CARCINOMA
 FORMIMINOGLUTAMINIC ACID LEVELS,
 URINE, CLINICAL STUDY (6184)*
 HISTOLOGY, HISTOGENESIS, HUMAN
 (6069)*
 SMOKING, WOMEN, STATISTICAL STUDY
 (5816)*
 CANCER
 CHLOROPRENE, OCCUPATIONAL HAZARD
 (5768)
 INCIDENCE, MALE, CZECHOSLOVAKIA
 (6101)*
 SMOKING, INCIDENCE, WOMEN,
 NETHERLANDS (6096)*
 CARCINOMA, ASBESTOS, INCIDENCE, HUMAN
 (5782)
 CONGENITAL CYSTS, TUMOR DEVELOPMENT,
 CASE REPORT (6374)*
 HODGKIN'S DISEASE, HUMAN (6385)*
 PLEURAL MESOTHELIOMA, ASBESTOSIS,
 HUMAN, REVIEW (5709)
 PRIMARY CARCINOMA, HUMAN, REVIEW
 (5729)*
 PULMONARY CANCER, PERSISTANT CAVITARY
 FORM, CLINICAL STUDY (6353)*
 PULMONARY LYMPHOMA, PSEUDOLYMPHOMA,
 CLINICAL STUDY (6314)*
 SQUAMOUS CELL CARCINOMA, GLYCOGEN
 METABOLISM, PHOSPHORYLASE METABOLISM
 HISTOCHEMICAL STUDY (6121)
 LYMPH NODE
 PELVIC, HYALINOSIS, CERVICAL CARCINOMA
 CLINICAL STUDY (6171)*
 LYMPHANGIOMA
 KIDNEY, CYSTIC FORMATIONS, CASE REPORT
 (6259)*
 LYMPHATIC TUMOR
 GROWTH RETARDING MECHANISMS, MOUSE,
 HUMAN (5726)*
 INFLUENZA, PREGNANCY, INCIDENCE,
 ENGLAND (6083)
 LYMPHOCYTE
 ANTIGENIC STIMULATION, LEUKEMIA,
 TUMOR ANTIGEN, HUMAN (5966)
 ATP-ASE ACTIVITY, HUMAN (5988)*
 CHRONIC LYMPHOCYTIC LEUKEMIA,
 PROLIFERATION, CELL CYCLE KINETICS,
 RAT (5958)
 DNA, RNA, SYNTHESIS INHIBITION,
 LEUKEMIC CELLS, HUMAN (5957)
 DNA POLYMERASE, LYMPHOID LEUKEMIA,
 OX (5940)*
 INFILTRATION, NEUROBLASTOMA, SURVIVAL
 RAT, CHILDREN (6233)*

LEUKEMIC, IMMUNE REACTIVITY, PHYTO-
 HEMAGGLUTININ, METABOLISM, LEUKEMIA
 PATIENTS (5975)
 LYMPH NODE, DNA CONTENT, METHYL-
 CHOLANTHRENE-INDUCED CARCINOGENESIS,
 MOUSE (5785)
 PHYTOHEMAGGLUTININ, DNA POLYMERASE,
 HUMAN (5906)
 PROLIFERATION, VITAMIN A, HAMSTER
 (5786)
 RESPONSE, MOLONEY SARCOMA VIRUS, MOUSE
 (5888)
 T CELLS, LEUKEMIA PATIENTS (6017)*
 TRANSFORMATION
 KAPOSI'S SARCOMA PATIENTS (6279)*
 PROTEOLYTIC ENZYME INHIBITOR,
 GUINEA PIG (6125)
 MPHOGRANULOMATOSIS
 BONES, CLINICAL STUDY (6149)*
 IMMUNOLOGICAL PROBLEMS, HUMAN (6050)*
 MULTIPLE MYELOMA, HL-A ANTIGENS,
 CLINICAL STUDY (6040)*
 MPHOID CELLS
 CULTURE, EPSTEIN-BARR VIRUS, HUMAN
 CELL (5913)
 CYTOTOXICITY, CANCER-BEARING MICE
 (6003)*
 TUBULORETICULAR STRUCTURES, ULTRA-
 STRUCTURE (6291)*
 MPHOMA
 COLONIC, ULCERATIVE COLITIS, CASE
 REPORTS (6306)*
 GLUCOCORTICOID, CYTOLYSIS, RECEPTOR,
 MOUSE (6127)
 INFILTRATING MACROPHAGES, ULTRA-
 STRUCTURE, HAMSTER (5959)
 MACROGLOBULINEMIA, CASE REPORT (6029)*
 MALIGNANT
 EPSTEIN-BARR VIRUS, HUMAN, REVIEW
 (5738)*
 GRAFT-VERSUS-HOST REACTION, MOUSE
 (6039)*
 HERPESVIRUS, RABBIT, REVIEW (5713)
 HERPESVIRUS SAIMIRI, ATELES,
 MONKEY (5925)
 HYPOGLYCEMIA, HUMAN (6226)*
 ONCOGENIC VIRUSES, IMMUNOREGULA-
 TION, HUMAN, REVIEW (5745)*
 PATHOLOGY, CLASSIFICATION, REVIEW
 (5740)*
 PRIMARY GASTROINTESTINAL, CLINICAL
 STUDY (6198)*
 PULMONARY, PSEUDOLYMPHOMA, CLINICAL
 STUDY (6314)*
 SPONTANEOUS, IMMUNOGLOBULIN, MOUSE
 (5991)*
 VIRAL ETIOLOGY, MOUSE, REVIEW (5724)*
 LYMPHOPROLIFERATIVE DISEASE
 LYMPH NODE, DNA, HUMAN (6225)*
 LYMPHOCYTIC TRANSFORMATION, PHYTO-
 HEMAGGLUTININ (6032)*
 LYMPHOSARCOMA
 CHROMOSOME ABERRATIONS, CASE REPORT
 (6110)
 JAW, BURKITT'S TUMOR, CASE REPORTS
 (6317)*
 LYSOSOME
 AUTOLYSIS, BIOLOGICAL VARIABILITY,
 LYTIC CHAIN REACTION (6181)*
 LYSOZYME
 LEUCOCYTES, NORMAL, CHRONIC MYELOGEN-
 OUS LEUKEMIA PATIENTS, COMPARATIVE
 STUDY (6287)*
 MACROGLOBULINEMIA
 LYMPHOMA, CASE REPORT (6029)*
 MACROPHAGE
 FOAMY, HODGKIN'S DISEASE, CLINICAL
 STUDY (6205)*
 INTERFERON PRODUCTION, HERPES VIRUS,
 IMMUNOLOGICAL REACTIVITY, RABBIT
 (5997)*
 MIGRATION INHIBITION, TUMOR ANTIGENS,
 MOUSE (5974)
 PRODUCTION, BONE MARROW, TUMOR-BEARING
 MICE (6280)*
 MALIC ACID
 MALATE DEHYDROGENASE, LEUKEMIA, HUMAN
 (6143)*
 MALIGNANCY
 ANTINUCLEAR ANTIBODIES, HUMAN (6011)*
 GRANULAR CELL OVARIAN TUMORS, MOUSE
 (6058)*
 MALIGNANT DISEASE
 SERUM GLYCOPROTEIN LEVELS, FEMALE
 BREAST, CLINICAL STUDY (6156)*
 MALIGNANT MELANOMA
 INCIDENCE
 AUSTRALIA (6105)*
 ENGLAND (6106)*
 QUEENSLAND, REVIEW (5755)*
 LYMPHOGRAPHY, CLINICAL STUDY (6145)*
 MELANOTIC FRECKLE, ULTRASTRUCTURE,
 CASE REPORTS (6368)*
 MAMMARY GLAND
 ADENOCARCINOMA
 ESTROGEN-RECEPTOR, RAT (6116)
 RNA, MOUSE, MAMMARY TUMOR VIRUS,
 HUMAN (5926)
 CANCER, COLLAGEN SYNTHESIS, PEPTIDYL-
 PROLINE HYDROXYLASE ACTIVITY, MOUSE

(6331)*
 CARCINOMA
 CONNECTIVE TISSUE, HISTOCHEMICAL
 STUDY, HUMAN (6137)*
 GLUCURONIC ACID, URINE, BLOOD,
 HUMAN (6122)
 INCIDENCE, YOUNG WOMEN, ITALY
 (6158)*
 METASTASIS, SURVIVAL, HUMAN
 (6358)*
 VIRUS AND NON-VIRUS PRODUCING,
 IMMUNOLOGICAL CROSS REACTIONS,
 MOUSE (5884)
 CORPUS UTERI, CANCER, ANTIGONADOTROPIC
 FACTOR, HUMAN (6175)*
 CYCASIN, TARGET ORGAN SHIFT, INTESTINE
 RAT (5781)
 7,12-DIMETHYLBENZ(A)ANTHRACENE, TUMOR
 INDUCTION, MITOTIC RATE, RAT (5797)
 MEMBRANE PROLIFERATION, PHOSPHATIDYL-
 CHOLINE SYNTHESIS, MOUSE (6052)
 NEOPLASIA, OSTEOCHONDROID STRUCTURES,
 HUMAN (6178)*
 TUMOR
 CELL SURFACE ALTERATIONS,
 GLYCOPROTEIN, HUMAN (6054)*
 RNA POLYMERASE ACTIVITY, RAT
 (5829)*
 SERUM ENZYMES, HUMAN (6238)*
 TUMOR REGRESSION, LYSOSOMAL ENZYME
 ACTIVITY, RAT (6290)*
 MAREK'S DISEASE
 HERPESVIRUS, CHICKEN, REVIEW (5714)
 MELANOBLASTOMA
 SPONTANEOUS, HISTOPATHOLOGY, RABBIT
 (6248)*
 MELANOCYTOMA
 MENINGEAL, ULTRASTRUCTURE, CASE REPORT
 (6068)*
 MELANOMA
 CELL MEMBRANE, IMMUNOGLOBULIN, IMMUNO-
 FLUORESCENCE, HUMAN (6036)*
 FACE, HISTOPATHOLOGY, HUMAN (6222)*
 MALIGNANT
 INCIDENCE
 AUSTRALIA (6105)*
 ENGLAND (6106)*
 LYMPHOGRAPHY, CLINICAL STUDY
 (6145)*
 MELANOTIC FRECKLE, ULTRASTRUCTURE,
 CASE REPORTS (6368)*
 MALIGNANT CELLS, IMMUNE PHAGOCYTOSIS
 HUMAN (6038)*
 MORTALITY, SWITZERLAND (6094)*
 PIGMENTARY TUMORS, BIOLOGICAL FEATURES
 ULTRASTRUCTURE (6051)
 PRIMARY MALIGNANT SKIN, METASTASIS,
 EYE, CASE REPORTS (6326)*
 PROTEIN METABOLISM, HAMSTER (6391)*
 RNA POLYMERASES, HAMSTER (6390)*
 MELANOSOME
 PIGMENTARY TUMORS, BIOLOGICAL FEATURES
 ULTRASTRUCTURE (6051)
 MENINGIOMA
 MELANOTIC, ULTRASTRUCTURE, CASE REPORT
 (6068)*
 MESOTHELIOMA
 ASBESTOS, CLINICAL STUDY (5823)*
 PLEURAL, ASBESTOSIS, HUMAN, REVIEW
 (5709)
 TRANSPLANTABLE, C-TYPE VIRUS PARTICLES
 HAMSTER (5931)*
 METABOLISM
 CALCIUM, BONE TUMORS, HUMAN (6400)*
 CARBOHYDRATE
 HEPATOMAS, ENZYME ACTIVITY, MOUSE,
 HAMSTER (5840)*
 NUCLEIC ACID, ENZYME ACTIVITY,
 GENETIC EXPRESSION REGULATION,
 CANCER CELL DETECTION (6141)*
 DRUG, ENZYME INDUCTION, HEPATIC
 TOXICATION-DETOXICATION SYSTEMS,
 BENZO(A)PYRENE, REVIEW (5720)*
 GLUTAMIC ACID, GAMMA-AMINOBUTYRIC ACID
 BRAIN TUMORS (6170)*
 GLYCOGEN, PHOSPHORYLASE, SQUAMOUS
 CELL CARCINOMA, LUNG, HISTOCHEMICAL
 STUDY (6121)
 NUCLEIC ACID, CELL CYCLE, CELLULAR
 PROLIFERATION, NORMAL TISSUES,
 MALIGNANT TISSUES, HUMAN (6077)
 PROTEIN, MELANOMA, HAMSTER (6391)*
 TESTOSTERONE, PROSTATIC ADENOMA,
 CARCINOMA TISSUE (6169)*
 TRYPTOPHAN, URINARY BLADDER CANCER,
 CLINICAL STUDY (6152)*
 METABOLITE
 WALKER'S CARCINOMA, EFFECTS ON
 DIFFERENT ORGANS, RAT (6381)*
 METAL
 POTASSIUM IONS, SWELLING, NORMAL CELLS
 TUMOR CELLS, MOUSE (6153)*
 METASTASIS
 BREAST CARCINOMA, HISTOPATHOLOGY, CASE
 REPORT (6278)*
 BRONCHIOGENIC CYST, NECK, CASE REPORT
 (6254)*
 CANCER TO CANCER, HISTOPATHOLOGY,
 CASE REPORT (6274)*
 EHRlich ASCITES TUMOR CELLS, HISTOLOGY

ULTRASTRUCTURE, EMBRYONATED CHICKEN
 EGG (6285)*
 ENDOCRINE GLANDS, INCIDENCE, DISTRIBUTION,
 HUMAN (6273)*
 EYE, PRIMARY MALIGNANT SKIN MELANOMA,
 CASE REPORTS (6326)*
 LIP CANCER, CLINICAL STUDY (6311)*
 MAMMARY CARCINOMA, SURVIVAL, HUMAN
 (6358)*
 OPTIC DISC, LUNG CANCER, HUMAN (6176)*
 OVARIAN CARCINOMA, HISTOPATHOLOGY,
 HUMAN (6263)*
 RADIATION, SARCOMA, RAT (6336)*
 RECTAL CANCER, VENOUS WALL CHANGES,
 LIVER, CLINICAL STUDY (6150)*
 SERUM ENZYME PATTERN, LIVER, AH109A-
 BEARING RATS (6361)*
 SQUAMOUS CELL CARCINOMA, LIP, CASE
 REPORT (6296)*
 TESTES, HISTOPATHOLOGY, HUMAN (6235)*
 TUMOR, ASPIRIN, RABBIT (6310)*
 ETHYL-2-BENZYLHYDRAZINE
 CHROMOSOME BREAKAGE, CANCER CELLS,
 MOUSE (5824)*
 ETHYLCHOLANTHRENE
 CARCINOGENESIS, LYMPH NODE LYMPHOCYTES
 DNA CONTENT, MOUSE (5785)
 SENSITIZATION, TRACE ELEMENT LEVELS,
 KIDNEY TISSUES, MOUSE (5809)
 ETHYLCHOLANTHRENE
 CARCINOGENESIS, EPIDERMAL TRANS-
 PLANTATION, STROMAL PERMUTATION
 HYPOTHESIS, MOUSE (5802)
 DRUG OXIDATION, CONJUGATION, TISSUES,
 RAT (5832)*
 ESTROGEN BINDING, UTERUS (5771)
 TRANSPLACENTAL SENSITIZATION,
 THYMECTOMY, RAT (5831)*
 METHYLCHOLANTHRENE
 BRAIN TUMORS, MOUSE (5849)*
 TUMOR CELLS, TRANSFORMATION, POLYOMA
 VIRUS, HAMSTER (5819)*
 METHYL-4-DIMETHYLAMINOAZOBENZENE
 PROTEIN DETECTION, LIVER, RAT (5807)
 ETHYL-N'-NITRO-N-NITROSOGUANIDINE
 NEOPLASTIC TRANSFORMATION, CLONED CELL
 LINES, MOUSE (5770)
 ETHYLNITROSOUREA
 ADENOCARCINOMA, SMALL INTESTINE,
 RABBIT (5767)
 HEART TUMOR INDUCTION, RAT (5765)
 NERVOUS SYSTEM TUMORS, TRANSPLACENTAL
 INDUCTION, RAT (5830)*
 CHONDRIA
 ADRENAL CORTICAL CARCINOMA, ULTRA-
 STRUCTURE, NUCLEI, HAMSTER (5837)*
 CHEMILUMINESCENCE, CARCINOGENIC
 HYDROCARBONS (5790)
 DNA, REPLICATION, SV40, HUMAN, MONKEY,
 RODENT (5894)
 IONIZING RADIATION, ULTRASTRUCTURE,
 MOUSE (5872)*
 PROTEIN, GLYCOPROTEIN SYNTHESIS, MOUSE
 (5947)*
 RIBOSOMES, EHRlich ASCITES TUMOR CELLS
 MOUSE (6371)*
 TISSUE RESPIRATION, LIVER, TUMOR-
 BEARING RATS (6188)*
 MITOGEN
 PLANT, LYMPHOCYTE STIMULATION,
 CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN
 (5811)
 MITOSIS
 CELL REPLACEMENT, CHALONE, SKIN,
 TUMOR, REVIEW (5707)
 MAMMARY GLAND, METABOLIC STATE, RAT
 (5797)
 MORBIDITY
 CANCER, TUBERCULIN, SKIN REACTIVITY,
 BULGARIA (6037)*
 MORPHOLOGY
 BASALOMA, CAPILLARY STRUCTURE, HUMAN
 (6246)*
 CYTOLOGICAL CHARACTERIZATION OF
 CANCER, EXUDATES, HUMAN (6244)*
 HISTOCHEMISTRY, BLADDER TUMOR, HUMAN
 (6245)*
 SKIN TUMORS, DIAZO-ACETIC ESTER, RAT,
 MOUSE (5763)
 MORTALITY
 ASBESTOS CANCER, INDUSTRY WORKERS,
 U.S.S.R. (6099)*
 CANCER
 AIR POLLUTION, SWITZERLAND
 (6098)*
 JEWISH POPULATIONS, UNITED STATES
 (6075)
 NEW ZEALAND (6087)
 GASTRIC CARCINOMA, AGF FACTOR, HUMAN
 (6277)*
 LEUKEMIA
 BCG VACCINATION, CHICAGO (6007)*
 GERMANY (6092)*
 MELANOMA, SWITZERLAND (6094)*
 RETINOBLASTOMA, NEGRO CHILDREN, WHITE
 CHILDREN, UNITED STATES (6089)*
 SQUAMOUS CELL CARCINOMA, SKIN, HUMAN
 (6223)*
 MUCIN
 HISTOCHEMISTRY, NORMAL, NEOPLASTIC

PANCREATIC TISSUE, HUMAN (6316)*
 MULTIPLE MYELOMA
 INCIDENCE, ATLANTA, GEORGIA (6090)*
 KIDNEY STRUCTURE, HUMAN (6234)*
 LEUKEMIC PLASMA CELLS, ULTRASTRUCTURE,
 CASE REPORT (6346)*
 MUTAGEN
 AROMATIC AMINES, 2-ACETYLAMINOFLUORENE
 METABOLITES, SALMONELLA (5787)
 MUTAGENICITY
 ASSAY SYSTEM, THYMIDINE KINASE LOCUS,
 LYMPHOMA CELLS, MOUSE (5871)*
 CHEMICAL CARCINOGEN, RNA-FORMING GENE,
 DROSOPHILA (5780)
 MYELOID LEUKEMIA
 GAUCHER CELLS, ULTRASTRUCTURE, CYTO-
 CHEMISTRY (6139)*
 MYELOMA
 ASCITES, IMMUNOGLOBULIN SYNTHESIS,
 ZONAL CENTRIFUGATION, MOUSE (6343)*
 IMMUNOGLOBULIN SECRETION, HEAVY CHAIN
 IGA VARIANT, MOUSE (6023)*
 MULTIPLE
 INCIDENCE, ATLANTA, GEORGIA
 (6090)*
 LEUKEMIC PLASMA CELLS, ULTRA-
 STRUCTURE, CASE REPORT (6346)*
 LYMPHOGRANULOMATOSIS, HL-A ANTIGEN
 CLINICAL STUDY (6040)*
 RNA POLYMERASE B, TEMPLATE SPECIFICITY
 MOUSE (6120)
 MYELOPROLIFERATIVE DISORDER
 PLATELET FUNCTION ABNORMALITIES,
 CLINICAL STUDY (6299)*
 PLATELET KINETICS, FIBRINOGEN KINETICS
 CLINICAL STUDY (6338)*
 MYELOSIS
 DI GUGLIELMO'S ERYTHREMIA, CELL-FREE
 FILTRATE, LEUKEMOGENICITY, MOUSE
 (5943)*
 MYOSITIS
 CHRONIC MUCOCUTANEOUS CANDIDIASIS,
 THYMOMA, CASE REPORT (6283)*
 NASOPHARYNGEAL CARCINOMA
 EPSTEIN-BARR VIRUS, IGM, HUMAN (5977)
 NECK
 BRONCHIOGENIC CYST, METASTASIS, CASE
 REPORT (6254)*
 NEOPLASIA
 BREAST, OSTEOCHONDROID STRUCTURES,
 HUMAN (6178)*
 CHROMOSOMAL ANOMALIES, HUMAN (6380)*
 GLIA, IN VITRO GROWTH, ULTRASTRUCTURE
 (6216)*
 INCIDENCE, CHILDREN, INDIA (6200)*

NEOPLASM
 CYTOGENETICS, CLINICAL STUDIES, HUMAN,
 REVIEW (5723)*
 MAMMARY GLAND, HYPOXIA, PATHOGENESIS,
 CLINICAL STUDY (6053)
 MURINE SARCOMA VIRUS, RAT, MOUSE
 (5904)
 MYXOMATOUS, GROWTH, HUMAN (6190)*
 NEPHROBLASTOMA
 HISTOENZYMOTOLOGY, COMPARISON WITH
 FETAL KIDNEY, CHILDREN (6232)*
 NERVOUS SYSTEM
 SYMPATHETIC, TUMORS, PATHOLOGY,
 CHILDREN (6239)*
 TUMORS, TRANSPLACENTAL INDUCTION,
 METHYL- AND ETHYLNITROSOUREA, RAT
 (5830)*
 NEURAMINIDASE
 BCG, FIBROSARCOMA REGRESSION, MOUSE
 (5993)*
 CELL AGGREGATION, POLYOMA VIRUS,
 HAMSTER (5905)
 NEURINOMA
 TRAUMA, CASE REPORT (5869)*
 NEUROBLASTOMA
 GANGLIONEUROMA, CATECHOLAMINE,
 CLINICAL STUDY (6035)*
 LYMPHOCYTIC INFILTRATION, SURVIVAL
 RATE, CHILDREN (6233)*
 SYMPATHETIC NERVOUS SYSTEM TUMORS,
 PATHOLOGY, CHILDREN (6239)*
 NEVUS
 BLUE, MORPHOGENESIS, HISTOLOGICAL
 STRUCTURE (6057)*
 MELANOCYTIC MALIGNANT, HISTOPATHOLOGY,
 CASE REPORT (6247)*
 NICKEL SULFIDE
 CARCINOGENESIS, BENZO(A)PYRENE,
 INTERACTION, RAT (5801)
 NITROGEN DIOXIDE
 LUNG, BENZO(A)PYRENE HYDROXYLASE,
 RABBIT (5803)
 4-NITROQUINOLINE-1-OXIDE
 CARCINOGENESIS, PHOTODYNAMIC ACTION,
 LIVER CELLS, RAT (5796)
 NITROSAMINE
 CYTOPLASMIC ALTERATIONS, HEPATOCYTES,
 RAT (5855)*
 NUCLEAR SIZE ALTERATIONS, LIVER, RAT
 (5856)*
 SYNTHESIS, BACTERIAL CULTURES (5852)*
 NUCLEIC ACID
 ALKYLATION, ETHYLNITROSOUREA,
 DIETHYLNITROSAMINE, LIVER, EMBRYO,
 RAT (5854)*

COPPER LEVELS, MANGANESE LEVELS, ACUTE
 LEUKOSIS, RAT (5873)*
 METABOLISM
 CELL CYCLE, CELLULAR PROLIFERATION
 NORMAL TISSUES, MALIGNANT TISSUE
 HUMAN (6077)
 ENZYME ACTIVITY, GENETIC EXPRESS-
 ION REGULATION, CANCER CELL
 DETECTION (6141)*
 PRECURSOR INCORPORATION, TUMOR TISSUE,
 NORMAL TISSUE, IN VITRO (6395)*
 RADIOACTIVE IODINE, MOLECULAR
 HYBRIDIZATION TECHNIQUES (6375)*
 NUCLEOPROTEIN
 UTERINE CERVIX CARCINOMA, CHORIO-
 ALLANTOIS MEMBRANE, EMBRYONIC
 CHICKEN EGG (6065)*
 NUCLEOTIDE
 TERMINAL, AVIAN MYELOBLASTOSIS VIRUS
 RNA, RIBOSOMAL RNA, CHICKEN LEUKEMIC
 MYELOBLASTS (5929)*
 NUCLEUS
 INTRANUCLEAR CANALICULUS COMPLEX,
 ULTRASTRUCTURE, EHRLICH ASCITES
 TUMOR CELLS, MOUSE (6367)*
 IONIZING RADIATION, ULTRASTRUCTURE,
 MOUSE (5872)*
 LYMPH NODE LYMPHOCYTES, DNA CONTENT,
 METHYLCHOLANTHRENE-INDUCED
 CARCINOGENESIS, MOUSE (5785)
 MITOCHONDRIA, ADRENAL CORTICAL
 CARCINOMA, ULTRASTRUCTURE, HAMSTER
 (5837)*
 OCCUPATIONAL HAZARD
 ASBESTOS CANCER, MORTALITY, U.S.S.R.
 (6099)*
 CHLOROPRENE, LUNG CANCER (5768)
 OIL MIST POLLUTION, REVIEW (5750)*
 URANIUM RADIATION, MINE WORKERS
 (5866)*
 NUCOCYTOMA
 CYTOCHROME OXIDASE, ULTRASTRUCTURE,
 CASE REPORT (6322)*
 PAROTID GLAND, BENIGN, MALIGNANT,
 CASE REPORTS (6157)*
 NEOGENESIS
 NEOPLASTIC PROCESSES
 BIOLOGY, REVIEW (5752)*
 GENERAL CLASSIFICATION, REVIEW
 (5751)*
 ORAL CONTRACEPTIVE
 CANCER, RAT, MOUSE (5775)
 CARCINOMA OF CERVIX, INCIDENCE, HUMAN
 (5794)
 ORCHIOBLASTOMA
 HISTOPATHOLOGY, HISTOGENESIS, HUMAN
 (6060)*
 OSTEORBLASTOCLASTOMA
 MALIGNANT, RADIATION THERAPY, CASE
 REPORT (5870)*
 OSTEOMA
 SKIN, CHILD, CASE REPORT (6209)*
 OSTEOSARCOMA
 PU239-INDUCED, GROWTH, RAT (5865)*
 OVARY
 ASCITIC TUMOR, RADIORESISTANT CELL
 POPULATION, RAT (6185)*
 CANCER
 CYTOGENETICS, HUMAN (6219)*
 TUMOR ANTIGENS, HUMAN (6045)*
 TUMOR CELL GROWTH, CYTO-
 MORPHOLOGICAL CHARACTERISTICS,
 HUMAN (6192)*
 DYSGERMINOMA, LEUKEMIA, SIMULTANEOUS
 OCCURRENCE, CASE REPORT (6230)*
 FEMINIZING TUMORS, CHILDHOOD (6202)*
 GRANULAR CELL TUMORS, MOUSE (6058)*
 MALIGNANT TUMOR INDUCTION,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 RAT (5858)*
 METASTATIC TUMORS, OVARIA CARCINOMA,
 HISTOPATHOLOGY, HUMAN (6263)*
 PERSISTENT ESTRUS, HORMONAL SHIFTS,
 TUMOR LOCALIZATION, RAT (5822)*
 RETICULUM CELL SARCOMA, HISTOPATHOLOGY
 CASE REPORT (6252)*
 TERATOMA, ROSENTHAL FIBERS, HUMAN
 (6204)*
 TUMORS
 CHILDREN (6199)*
 POST-MENOPAUSAL WOMEN, ENDOCRINE
 STUDY (6111)
 OXYGEN
 TENSION, MALIGNANT TUMORS, HUMAN
 (6323)*
 OZONE
 LUNG, BENZO(A)PYRENE HYDROXYLASE,
 RABBIT (5803)
 PAGET'S DISEASE
 INVASIVE VULVAR, ULTRASTRUCTURE, CASE
 REPORTS (6324)*
 PANCREAS
 CANCER, KARYOLOGIC STUDY, HISTOLOGIC
 STUDY (6132)*
 PAPILLOMA
 SHOPE VIRUS, DNA REPLICATION,
 MOLECULAR HYBRIDIZATION, RABBIT
 (5881)
 PAROTID
 MOUTH, MUCOEPIDERMOID TUMOR, HISTO-

CHEMISTRY, HUMAN (6228)*
 PAROTID GLAND
 ONCOCYTOMA, BENIGN, MALIGNANT, CASE
 REPORTS (6157)*
 PELGER-HUET ANOMALY
 FAMILIAL LEUKEMIA, CHROMOSOME, ICELAND
 (6117)
 PENIS
 CARCINOMA, INCIDENCE, GERMANY (6100)*
 PET
 EXPOSURE, LEUKEMIA, INCIDENCE (6064)
 PHAGOCYTOSIS
 IMMUNE, MALIGNANT MELANOMA CELLS,
 HUMAN (6038)*
 PHORBOL
 DERIVATIVES, INFLAMMATORY ACTION,
 COCARCINOGENIC ACTION, RELATIONSHIP
 (5853)*
 PHORBOL ESTER
 COCARCINOGENESIS, ACTION MECHANISMS
 (5857)*
 PHOSPHATIDYLCHOLINE
 SYNTHESIS, MEMBRANE PROLIFERATION,
 MAMMARY GLAND TISSUES, MOUSE (6052)
 PHTHIVAZIL
 CARCINOGENESIS, MOUSE (5821)*
 PHYTOAGGLUTININ
 CYTOTOXICITY, YOSHIDA SARCOMA CELLS
 (6006)*
 PHYTOHEMAGGLUTININ
 BLASTIC STIMULATION, ROSSETTE TEST,
 CANCER PATIENTS (5961)
 BLASTIC TRANSFORMATION, LYMPH NODE
 CELLS, HODGKIN'S DISEASE PATIENTS
 (6030)*
 LEUKEMIC LYMPHOCYTES, IMMUNE
 REACTIVITY, METABOLISM, LEUKEMIA
 PATIENTS (5975)
 LYMPHOCYTE STIMULATION, CHRONIC
 LYMPHOCYTIC LEUKEMIA, HUMAN (5811)
 LYMPHOCYTIC TRANSFORMATION, LYMPHO-
 PROLIFERATIVE DISEASE PATIENTS
 (6032)*
 ORNITHINE DECARBOXYLASE INDUCTION,
 CULTURED LYMPHOCYTES, HUMAN (6294)*
 POKEWEE MITOGEN, CHRONIC LYMPHOCYTIC
 LEUKEMIA PATIENTS (6005)*
 PLASMA
 COPPER LEVELS, MORRIS HEPATOMA GROWTH,
 RAT (6243)*
 PLASMA CELL
 LEUKEMIC, ULTRASTRUCTURE, MULTIPLE
 MYELOMA, CASE REPORT (6346)*
 PROLIFERATION, CAVERNOUS HEMANGIOMA,
 CASE REPORT (6359)*
 TUMORS, ANTIBODIES, MOUSE (6022)*
 PLASMA MEMBRANE
 CHEMICAL COMPOSITION, HEPATOMAS, LIVER
 MOUSE, RAT (6112)
 LIPID COMPOSITION, HEPATOMA, RAT,
 MOUSE (6115)
 STRUCTURAL COMPONENTS, NORMAL CELLS,
 TUMOR CELLS, RAT (6182)*
 PLASMACYTOMA
 CELL LINE, CULTIVATION IN SERUM-
 DEPRIVED MEDIA (6372)*
 HIPA, TRANSPLANTATION INHIBITION,
 SPLFEN CELL, MOUSE (5902)
 IMMUNOGLOBULIN CONTROL MECHANISMS,
 CLINICAL STUDY (6044)*
 POKEWEE MITOGEN
 LYMPHOCYTE STIMULATION, CHRONIC
 LYMPHOCYTIC LEUKEMIA, HUMAN (5811)
 POLLUTION
 OIL MIST, OCCUPATIONAL HAZARD,
 ENVIRONMENTAL HAZARD, REVIEW (5750)*
 OZONE, NITROGEN DIOXIDE, LUNG,
 BENZO(A)PYRENE HYDROXYLASE, RABBIT
 (5803)
 POLYCYCLIC HYDROCARBON
 NEOPLASTIC TRANSFORMATION, CLONED
 CELL LINES, MOUSE (5770)
 POLYPEPTIDE
 SYNTHESIS, 80 S RIPOSOSES, ASCITES
 TUMOR CELLS (6284)*
 PREGNANCY
 HODGKIN'S DISEASE, HUMAN (6387)*
 PREGNANEDIOL
 LIVER CANCER, P-DIMETHYLAMINOAZO-
 BENZENE, RAT (5769)
 PROLIFERATION
 CELLULAR
 EHRlich ASCITES TUMOR, GROWTH,
 INTERFEROMETIC MEASUREMENTS
 (6107)*
 GLOBULIN SYNTHESIS, RABBIT (5965)*
 NUCLEAR ACIDIC PROTEINS, MAMMALIAN
 CELLS (6319)*
 NUCLEIC ACID METABOLISM, CELL
 CYCLE, NORMAL TISSUES, MALIGNANT
 TISSUES, HUMAN (6077)
 FIBROBLASTS, ADENOSINE 3'-5'-CYCLIC
 MONOPHOSPHATE, HUMAN (6303)*
 MEMBRANE, PHOSPHATIDYLCHOLINE
 SYNTHESIS, MAMMARY GLAND TISSUES,
 MOUSE (6052)
 PLASMA CELL, CAVERNOUS HEMANGIOMA,
 CASE REPORT (6359)*
 PROSTATE
 ADENOMA, TESTOSTERONE METABOLISM,

CARCINOMA TISSUE (6169)*
 CARCINOMA
 CYTOLOGY, HUMAN (6394)*
 PROSTATECTOMY, CLINICAL STUDY (6172)*

PROTEIN
 BENICE-JONES, KAPPA CHAIN, PURIFICATION
 CHEMICAL CHARACTERIZATION, RAT (6010)*
 DETECTION, 3'-METHYL-4-DIMETHYLAMINO-AZOBENZENE, LIVER, RAT (5807)
 MICROSOMAL SMOOTH MEMBRANE, ELECTROPHORETIC ANALYSIS, MORRIS HEPATOMA, LIVER, RAT (6292)*
 MONOCLONAL, IMMUNOCYTOMAS, RAT (6012)*
 MYELOMA, PEPsin FRAGMENTS, HAPTEN BINDING, X-RAY CRYSTALLOGRAPHY, MOUSE (6021)*
 NONHISTONE CHROMOSOMAL, HELA CELL (6124)
 NUCLEAR ACIDIC, CELLULAR PROLIFERATION MAMMALIAN CELLS (6319)*
 SEQUENCING, CARCINOEMBRYONIC ANTIGEN, COLONIC CANCER, HUMAN (5976)
 SYNTHESIS
 MITOCHONDRIA, MOUSE (5947)*
 RIBOSOMES, BLOOD LYMPHOCYTE LEUKEMIA PATIENTS (6016)*

NEOPLASM
 MELANOTIC, JUVENILE HORMONE, DROSOPHILA (6118)

IONIZING
 DNA INTERACTION, CHARGE TRANSFER (5776)

CELL
 COLON CANCER SURVIVAL, SOCIOECONOMIC FACTOR, HUMAN (6080)

IRRADIATION
 DNA, SINGLE-STRAND BREAK REJOINING, EHRLICH TUMOR, MOUSE (5863)
 GRENZ, 7,12-DIMETHYLBENZ(A)ANTHRACENE, CARCINOGENESIS, SKIN, MOUSE (5862)

IONIZING
 CARCINOGENIC ACTION, DOSE, REVIEW (5703)
 MITOCHONDRIA, NUCLEUS, ULTRASTRUCTURE, MOUSE (5872)*
 RENAL DAMAGE, DOG (5868)*
 SARCOMA, METASTASES, RAT (6336)*
 ULTRAVIOLET, ADENOVIRUS, TYPE 12 INFECTION, FIBROBLASTS, RAT (5874)*
 URANIUM, OCCUPATIONAL HAZARD, MINE WORKERS (5866)*
 WHOLE-BODY IONIZING, IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY, MOUSE (5968)

X-IRRADIATION, CHROMOSOME ABNORMALITIES, LEUKEMIC CELLS, MOUSE (6123)
 X-RAY
 NEOPLASMS, ULTRASTRUCTURE, MOUSE (5833)*
 TUMOR INDUCTION, SMALL ANIMALS (5851)*
 URETHANE, TUMOR-RESISTANT MOUSE (5792)
 X-RAY CYTOLYSIS, IMMUNE CYTOLYSIS, HAMSTER CELL (5864)
 RECKLINGHAUSEN'S DISEASE
 LEUKEMIA, CASE REPORTS, CHILDREN (6142)*

RECTUM
 CANCER
 TUMOR CELLS, BLOOD, CLINICAL STUDY (6148)*
 VENOUS WALL CHANGES, METASTASIS, LIVER, CLINICAL STUDY (6150)*
 CARCINOMA, HISTOLOGY, HISTOGENESIS, HUMAN (6069)*

REGRESSION
 MAMMARY TUMOR, LYSOSOMAL ENZYME ACTIVITY, RAT (6290)*
 METHYLCHOLANTHRENE FIBROSARCOMA, NEURAMINIDASE, RCG, MOUSE (5993)*
 SPONTANEOUS, CANCER, AUTOPSY STUDY (6024)*

REJECTION
 TUMOR ALLOGRAFTS, ANTISTREPTOLYSINE O LEVEL, SERUM, MOUSE (6034)*

RESCUE
 PSEUDOTYPE SARCOMA, MURINE SARCOMA VIRUS (5919)

RESISTANCE
 TUMORS, ACTIVE IMMUNITY, CORYNEBACTERIUM PARVUM TREATMENT, MOUSE (6015)*

RESPIRATORY TRACT
 BRONCHIAL CARCINOMA, RISK POPULATIONS (6397)*
 GLANDULAR TISSUE CYLINDROMA, HISTOPATHOLOGY, HUMAN (6211)*

RETICULOENDOTHELIAL SYSTEM
 YOSHIDA SARCOMA, ULTRASTRUCTURE, RAT (6134)*

RETICULOENDOTHELIOSIS
 ACID PHOSPHATASE ACTIVITY, HAIRY CELLS, ULTRASTRUCTURE, LEUKEMIC PATIENTS (6332)*

RETICULOSARCOMA
 FREUND'S ADJUVANT, ONCOGENIC ALTERATIONS, RAT (5965)

OVARY, HISTOPATHOLOGY, CASE REPORT (6252)*
 RETICULUM CELL SARCOMA
 EYELID, VIRUS-LIKE PARTICLES, CASE REPORT (6166)*
 ORBIT, CASE REPORT (6174)*
 RETICULUM CELL SARCOMA
 MURINE LEUKEMIA VIRUS, HAMSTER (5896)
 RETINOBLASTOMA
 D-CHROMOSOME DELETIONS, HUMAN (6130)
 GENETIC TRANSMISSION, REVIEW (5704)
 MORTALITY, NEGRO CHILDREN, WHITE CHILDREN, UNITED STATES (6089)*
 RETINOL
 EPITHELIAL DIFFERENTIATION, RAT HAMSTER (5846)*
 RIBONUCLEOPROTEIN
 ROUS SARCOMA VIRUS (5907)
 RIBOSOME
 80 S, POLYPEPTIDE SYNTHESIS, ASCITES TUMOR CELLS (6284)*
 MITOCHONDRIAL, EHRLICH ASCITES TUMOR CELLS, MOUSE (6371)*
 PROTEIN SYNTHESIS, BLOOD LYMPHOCYTES, LEUKEMIA PATIENTS (6016)*
 RIFAMYCIN
 ROUS SARCOMA VIRUS, SELECTIVE INHIBITION, TRANSFORMED FIBROBLASTS, CHICKEN (5946)*
 RNA
 MESSENGER
 FRIEND LEUKEMIA VIRUS, ERYTHROID DIFFERENTIATION, TRANSFORMED CELLS, MOUSE (5950)*
 ISOLATION, AFFINITY CHROMATOGRAPHY, KB-CELLS (6333)*
 MOUSE MAMMARY TUMOR VIRUS, MAMMARY CARCINOMA, HUMAN (5926)
 NOVIKOFF HEPATOMA, LIVER, RAT (6379)*
 ONCOGENIC VIRUSES, REVIEW (5748)*
 POLYMERASE
 ALPHA-AMANITIN-SENSITIVE FORMS, EHRLICH ASCITES TUMOR CELLS (6289)*
 RIFAMPICIN-INSENSITIVE, PURIFICATION, EHRLICH ASCITES TUMOR CELLS (6349)*
 TRANSPLANTABLE BRAIN TUMOR, MOUSE (6345)*
 POLYMERASE REGULATION, AMINO ACIDS, EHRLICH ASCITES TUMOR CELLS, MOUSE (6109)
 POLYOMA VIRUS INFECTION, MOUSE CELLS (5903)
 RADIOACTIVE IODINE, MOLECULAR HYBRIDIZATION EXPERIMENTS (6375)*
 RAUSCHER LEUKEMIA VIRUS, SPLEEN, MOUSE (5887)
 RIBOSOMAL, AVIAN MYELOBLASTOSIS VIRUS, TERMINAL NUCLEOTIDES, CHICKEN LEUKEMIC MYELOBLASTS (5929)*
 SACCHAROMYCES CEREVISIAE, COMPLEMENT FIXATION, IMMUNO-ONCOLOGY, INFANTS (5998)*
 SYNTHESIS, POLYOMA VIRUS MOUSE CELLS (5949)*
 UPTAKE, EHRLICH ASCITES CARCINOMA CELLS (6344)*
 SARCOLYSIN
 IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY, MOUSE (5968)
 SARCOMA
 ADENOVIRUS, HETEROGENIC TISSUE ANTIGEN HAMSTER (5996)*
 BORTRYOID, BLADDER, URINE CYTOLOGY, DOG (6348)*
 ENDOMETRIUM, CELLULAR STROMA, HISTOLOGY, CLINICAL STUDY (6173)*
 EPITHELIOID, CLINICAL, PATHOLOGIC STUDY (6155)*
 HUMAN CELL LINES, ONCOGENIC PROPERTIES HAMSTER (6159)*
 KAPOSI'S, LYMPHOCYTE TRANSFORMATION (6279)*
 RETICULUM CELL
 EYELID, VIRUS-LIKE PARTICLES, CASE REPORT (6166)*
 ORBIT, CASE REPORTS (6174)*
 ROUS, CELL-MEDIATED IMMUNITY, QUAIL (5923)
 YOSHIDA, RETICULOENDOTHELIAL SYSTEM, ULTRASTRUCTURE, RAT (6134)*
 SENSITIVITY
 DELAYED, HODGKIN'S DISEASE (6033)*
 SERUM
 AMINO ACID COMPOSITION, MALE LEUKEMIA PATIENTS, FEMALE LEUKEMIA PATIENTS (6062)*
 CELL MULTIPLICATION, CANCER PATIENTS (5981)*
 ENZYME PATTERN, METASTASIS, LIVER, AH109A-BEARING RATS (6361)*
 ENZYMES, MALIGNANT TUMOR, MAMMARY GLAND, HUMAN (6238)*
 GLYCOPROTEIN LEVELS, INFLAMMATION, MALIGNANT DISEASES, FEMALE BREAST, CLINICAL STUDY (6156)*
 NORMAL RAT, EHRLICH ASCITES TUMOR CELL (6001)*

SEX

LIGHT, WALKER'S CARCINOMA, SURVIVAL
RATE, RAT (6218)*

SIDEROSIS

CYSTOPAPILLARY ADENOMA, KIDNEY, CASE
REPORT (6136)*

SKELETON

PATHOLOGY, HODGKIN'S DISEASE, HUMAN
(6386)*

SKIN

BASEMENT MEMBRANE CHANGES, CARCINO-
GENESIS, ANIMAL, HUMAN, REVIEW
(5705)

CANCER

OSTEOMYELITIC FISTULAS, MALIGNANT
ULCERS, CLINICAL STUDY (6350)*
SUNLIGHT, ULTRAVIOLET, HUMAN,
REVIEW (5702)

CARCINOGENESIS, TOSYL PHENYLALANINE
CHLOROMETHYL KETONE, MOUSE (5844)*
CELL REPLACEMENT, CHALONE, TUMOR,
REVIEW (5707)

CLEAR-CELL HYDRADENOMA, CLINICAL STUDY
REVIEW (5730)*

7,12-DIMETHYLBENZ(A)ANTHRACENE, TUMOR
INITIATION, MOUSE (5773)

EPIDERMIS CELL CULTURES, CHEMICAL
CARCINOGENESIS, MOUSE EMBRYO (5859)*

GRENZ RADIATION, 7,12-DIMETHYLBENZ(A)-
ANTHRACENE, CARCINOGENESIS, MOUSE
(5862)

HEMANGIOENDOTHELIOMA, HISTOLOGY, CASE
REPORT (6208)*

HISTOPATHOLOGY, DERMATOFIBROSARCOMA
PROTUBERANS, CASE REPORT (6214)*

LEIOMYOSARCOMA, CASE REPORT (6363)*

LESIONS, VITAMIN A, HAMSTER (5786)

OSTEOMA, CHILD, CASE REPORT (6209)*

PRIMARY MALIGNANT MELANOMA, METASTASIS
EYE, CASE REPORTS (6326)*

SPIRADENOMA, EXOCRINE, ULTRASTRUCTURE,
CASE REPORT (6131)*

SQUAMOUS CELL CARCINOMA, MORTALITY,
HUMAN (6223)*

TUMOR

CIGNOLIN, 9,10-DIMETHYL-1,2-BENZ-
ANTHRACENE, MOUSE (5777)

MORPHOLOGY, DIAZO-ACETIC ESTER,
RAT, MOUSE (5763)

SODIUM NITRITE

DIMETHYLAMINE, LIVER TOXICITY, MOUSE
(5778)

SPIRADENOMA

EXOCRINE, ULTRASTRUCTURE, CASE REPORT
(6131)*

SPLEEN

CELL, PLASMACYTOMA, TRANSPLANTATION
INHIBITION, MOUSE (5902)

MALIGNANT HEMANGIOENDOTHELIOMA,
ULTRASTRUCTURE, CASE REPORT (6071)*
RAUSCHER LEUKEMIA VIRUS, RNA, MOUSE
(5887)

TUMOR-ASSOCIATED TRANSPLANTATION
ANTIGEN, ROUND CELL CARCINOMA, MOUSE
(5967)

SQUAMOUS CELL CARCINOMA

CARCINOMA, NON-PARASITIC CYST, LIVER,
CASE REPORT (6315)*

STATOLON

FRIEND LEUKEMIA VIRUS, INFECTION
SUPPRESSION, HUMORAL ANTIBODY, MOUSE
(5979)

STOMACH

GASTRIC CANCER, CLINICAL-STATISTICAL
ANALYSIS, OPERABLE PATIENTS,
INOPERABLE PATIENTS (6189)*

GASTRIC CARCINOGENESIS, DIET, RAT
(5820)*

INTESTINAL METAPLASIA, ABO BLOOD GROUP
RHESUS FACTOR, CLINICAL STUDY
(6337)*

PRIMITIVE CARCINOMA, PEPTIC ULCER,
CASE REPORTS (6191)*

SUNLIGHT

SKIN CANCER, HUMAN, REVIEW (5702)

SURVIVAL

EPENDYMOMA, HISTOLOGY, GERMANY (6180)*

MAMMARY CARCINOMA, METASTASIS, HUMAN
(6358)*

SV40

RETINAL PIGMENT EPITHELIUM, TUMOR,
HAMSTER (5891)

TALCUM

GRANULOMA, CASE REPORT (5836)*

TERATOMA

OVARY, ROSENTHAL FIBERS, HUMAN (6204)*

TESTES

ORCHIOBLASTOMA, HISTOPATHOLOGY,
HISTOGENESIS, HUMAN (6060)*

SECONDARY TUMOR, HISTOPATHOLOGY, HUMAN
(6235)*

TESTIS

RETE, ADENOCARCINOMA, CASE REPORTS
(6320)*

TESTOSTERONE

METABOLISM, PROSTATIC ADENOMA,
CARCINOMA TISSUE (6169)*

THEOPHYLLINE

DIBUTYRYL CYCLIC ADENOSINE PHOSPHATE,
MURINE SARCOMA VIRUS, TRANSFORMED

CELLS, MOUSE (5952)*

THIAMINE
REQUIREMENTS, TUMOR GROWTH, TRANS-
KETOLASE ACTIVITY, MOUSE (6272)*

THIO-TEPA
IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY,
MOUSE (5968)

THIOL
ESTRADIOL BINDING, MALIGNANT BREAST
TUMORS, HUMAN (6339)*

THORIUM DIOXIDE
COLLOIDAL, RETENTION, LIVER, SPLEEN,
FROG (5838)*

THOROTRAST
ALPHA-FETOPROTEIN, LIVER CARCINOMA,
HUMAN (6048)*

THYMOMA
CHRONIC MUCOCUTANEOUS CANDIDIASIS,
MYOSITIS, CASE REPORT (6283)*

THYROID
CALCITONIN-SECRETING TUMORS, MEDULLOID
CANCER, AMYLOID STROMA, CASE
REPORTS, REVIEW (5747)*
CANCER, AMYLOIDOSIS OF THE STROMA,
HISTOCHEMISTRY, C CELLS (6352)*
CARCINOMA, CLINICAL STUDY (6146)*
TUMOR
ASHKINASI CELLS, CLINICO-
MORPHOLOGICAL STUDY (6140)*
EMBDEN-MEYERHOF PATHWAY REGULATION
RAT (6282)*
TUMOR CELLS, ENDOPLASMIC RETICULUM
TUBULES, ULTRASTRUCTURE, DOG (6193)*

TILORONE HYDROCHLORIDE
INTERFERON INDUCTION, NORMAL, LEUKEMIC
LYMPHOCYTE CULTURES, HUMAN (6308)*

TOBACCO
SMOKING
BLADDER CANCER, REVIEW (5725)*
LUNG CANCER, INCIDENCE, WOMEN,
NETHERLANDS (6096)*
LUNG CARCINOMA, WOMEN, STATISTICAL
STUDY (5816)*
PRIMARY EPIDERMAL CARCINOMA,
BRONCHI, STATISTICAL STUDY
(5817)*

TONGUE
BOTRYOID SARCOMA, UTERINE BOTRYOID
SARCOMA, CASE REPORT (3264)*
MYOBLASTOMA, HISTOPATHOLOGY, CASE
REPORT (6265)*

TOXICITY
ALBUMIN, BILIRUBIN CONJUGATION,
HEPATOMA CELL CULTURE, RAT (6334)*

TRANSFORMATION
L-CELLS, HERPES SIMPLEX VIRUS,
UV RADIATION (5924)
DNA, RNA, ONCOGENIC VIRUSES, CYTO-
GENETICS (5934)*
FIBROBLAST
HERPES SIMPLEX VIRUS TYPE 2,
HAMSTER EMBRYO (5918)
UV RADIATION, HERPES SIMPLEX
TYPE 2 VIRUS, ULTRASTRUCTURE,
HAMSTER (5890)
FORESKIN CELLS, MASON-PFIZER VIRUS,
MONKEY (5877)
LEUKEMIC, GRAFTED MARROW, MOUSE
(6028)*
LYMPH NODE CELLS, PHYTOHEMAGGLUTININ,
HODGKIN'S DISEASE PATIENTS (6030)*
LYMPHOCYTE
KAPOSI'S SARCOMA PATIENTS (6279)*
PHYTOHEMAGGLUTININ, LYMPHOPRO-
LIFERATIVE DISEASE PATIENTS
(6032)*
PROTEOLYTIC ENZYME INHIBITOR,
GUINEA PIG (6125)
NEOPLASTIC, CHEMICALLY INDUCED, CLONED
CELL LINES, MOUSE (5770)
POLYOMA VIRUS, 20-METHYLCHOLANTHRENE,
TUMOR CELLS, HAMSTER (5819)*
VISNA VIRUS, ASTROCYTE, HUMAN (5898)
TRANSPLANTATION
BOVINE ADENOVIRUS-INDUCED TUMOR,
HAMSTER (5954)*
IMMUNITY, RAT ASCITIC TUMOR, MOUSE
(5995)*
INHIBITION, PLASMOCYTOMA, SPLEEN CELL,
MOUSE (5902)
UTERINE CERVIX CANCER, HORMONE
REACTIVITY, MOUSE (6250)*

TRAUMA
BREAST PATHOLOGY, HUMAN (6217)*
NEURINOMA, CASE REPORT (5869)*
TUMORIGENESIS, JAW, HUMAN (5875)*
7,8,12-TRIMETHYLBENZ(A)ANTHRACENE
LEUKEMIA
LYMPHOID TISSUES, RAT (5799)
SPLEEN, THYMUS, RAT (5762)

TRYPTOPHAN
METABOLISM, URINARY BLADDER CANCER,
CLINICAL STUDY (6152)*

TUBAZID
CARCINOGENESIS, MOUSE (5821)*

TUBERCULIN
SKIN REACTIVITY, CANCER MORBIDITY,
BULGARIA (6037)*

TUMOR
ALLOGRAFT REJECTION, ANTISTREPTOLYSINE

O LEVEL, SERUM, MOUSE (6034)*
 CELL ANTIGENICITY, RAT (6004)*
 CEREBELLAR HEMANGIOBLASTOMA, TWO
 CONSECUTIVE GENERATIONS, CASE REPORT
 (6255)*
 CHEMODECTOMA, LARYNX, CASE REPORT
 (6212)*
 CHOLINESTERASE, INTRACELLULAR
 LOCALIZATION, RAT (6373)*
 DEVELOPMENT, DNASE ACTIVITY, BLOOD
 SERUM, ASCITIC FLUID (6351)*
 FEMINIZING, OVARY, CHILDHOOD (6202)*
 GROWTH, THIAMINE REQUIREMENTS, TRANS-
 KETOLASE ACTIVITY, MOUSE (6272)*
 HEMANGIOMA, SYNOVIOMA, MONKEY (6270)*
 HORMONE-PRODUCING, HUMAN, REVIEW
 (5701)
 JENSEN, SARCOMA, NUCLEIC ACID
 PRECURSOR INCORPORATION, IN VITRO
 (6395)*
 MALIGNANT, OXYGEN TENSION, HUMAN
 (6323)*
 MAMMARY GLAND, CELL INTERACTION,
 ELECTRIC CHARGE, LIVER, RAT (6389)*
 PRIMARY, SMALL INTESTINE, HISTOLOGY,
 HUMAN (6206)*
 RECURRENCE, TUMOR CELL IMPLANTATION,
 SURGICAL WOUNDS, HUMAN (6357)*
 REVERSION, DIMETHYLNITROSAMINE,
 HAMSTER (5808)
 SIZE, POLYOMA VIRUS, ANTIGEN,
 THYMECTOMY, RAT (5958)*
 SPINDLE-CELL, ULTRASTRUCTURE, HUMAN
 (6207)*
 TUMORIGENESIS
 TUMOR GROWTH, IMMUNOSUPPRESSION,
 REVIEW (5761)*
 ULCER
 MALIGNANT, OSTEOMYELITIC FISTULAS,
 SKIN CANCER, CLINICAL STUDY (6350)*
 ULTRASTRUCTURE
 BREAST TUMOR, CALCIFICATIONS, HUMAN
 (6262)*
 FOLLICULAR ADENOMA, IODINE DEFICIENCY,
 GOLGI APPARATUS, HUMAN (6269)*
 GLIAL TISSUE, NEOPLASIA, GROWTH
 IN VITRO (6216)*
 HIGH-VOLTAGE ELECTRON MICROSCOPY,
 WET WHOLE CANCER CELLS (6330)*
 PIGMENTED TUMOR, LIP, HUMAN (6177)*
 SPINDLE-CELL TUMOR, HUMAN (6207)*
 TUMORS, SPONTANEOUSLY TRANSFORMED
 TISSUE CULTURE CELLS, MOUSE (6335)*
 ULTRAVIOLET
 SUNLIGHT, SKIN CANCER, HUMAN, REVIEW
 (5702)
 URANIUM
 RADIATION, OCCUPATIONAL HAZARD MINE
 WORKERS (5866)*
 URETHANE
 BLASTOMOGENESIS, DNA NUCLEOTIDE
 COMPOSITION, LUNG TISSUE, MOUSE
 (5813)*
 NEOPLASMS, ULTRASTRUCTURE, MOUSE
 (5833)*
 X-RAY, TUMOR-RESISTANT MOUSE (5792)
 URINARY BLADDER
 CANCER, TRYPTOPHAN METABOLISM,
 CLINICAL STUDY (6152)*
 EPITHELIAL TUMORS, HISTOCHEMISTRY,
 CLINICAL STUDY (6151)*
 TUMOR, PRENEOPLASTIC STAGES, RAT
 (6072)*
 UROGENITAL TRACT
 TUMORS, URINARY CYTOLOGY, HUMAN
 (6258)*
 UTERUS
 CANCER
 INCIDENCE, JAPAN (6068)
 PATHOGENETIC VARIETIES, CLINICAL
 STUDY (6055)*
 CARCINOMA, HUMAN, REVIEW (5735)*
 CERVICAL CANCER, HISTOCHEMISTRY, HUMAN
 (6237)*
 CERVIX CARCINOMA, PREGNANCY, HUMAN
 (6392)*
 CHORIOCARCINOMA, HYDATIDIFORM MOLE,
 CASE REPORT (6221)*
 3-METHYLCHOLANTHRENE, ESTROGEN BINDING
 (5771)
 TONGUE, BOTRYOID SARCOMA, CASE REPORT
 (6264)*
 UVEA
 CANCER, BREAST CANCER, REVIEW (5737)*
 CARCINOMA
 INCIDENCE
 GERMANY (6093)*
 HUNGARY (6091)*
 JAPAN (6102)*
 POLAND (6097)*
 MORPHOLOGY, ORGAN CULTURES (6369)*
 NUCLEOPROTEIN, CHORIOALLANTOIS
 MEMBRANE, EMBRYONIC CHICKEN EGG
 (6065)*
 EPITHELIAL LESIONS, CONNECTIVE TISSUE,
 HISTOPATHOLOGICAL STUDY, HISTO-
 CHEMICAL STUDY, HUMAN (6061)*
 SQUAMOUS CELL CARCINOMA, BLOOD VESSELS
 HISTOLOGICAL STUDY (6067)*
 VAGINA

ADENOMA WITH MESONEPHRIC RESIDUES,
HISTOPATHOLOGY, CASE REPORT (6267)*
CELL POPULATION, HORMONAL CONDITION,
HUMAN (6203)*

VIRUS

ADENO

TYPES 1,3
DOUBLE IMMUNIZATION, RABBIT
(6002)*

TYPE 2
INHIBITION, CAMPTOTHECIN,
HELA CELLS (5936)*

TYPE 3
SOLUBLE ANTIGENS, RABBIT
(5986)*

TYPES 3,6,12
CELL CULTURE INTERACTIONS,
CHICK EMBRYO FIBROBLASTS
(5928)*

TYPE 12
INFECTION, UV-RADIATION,
FIBROBLASTS, RAT (5874)*
TUMOR DEVELOPMENT, NASAL
INFECTION, MOUSE (5942)*
TUMOR FORMATION, CLAM EXTRACTS
METHOTREXATE, HAMSTER
(5932)*

AVIAN LEUKOSIS SARCOMA
TRANSFORMED CELLS, ULTRASTRUCTURE,
AVIAN, MAMMALIAN, REVIEW (5749)*

AVIAN MYELOBLASTOSIS
ANTIGENIC VARIATION, FIBROBLASTS,
CHICK EMBRYO (6018)*
DNA POLYMERASE ACTIVITY (5876)
REVERSE TRANSCRIPTASE (5921)
ROUS SARCOMA, DNA POLYMERASE,
DNA POLYMERASE, EXOGENOUS PRIMER
(5901)

BITTNER, BREAST CANCER, MALE CARRIERS,
HUMAN (5941)*

BOVINE ADENOVIRUS
TUMOR TRANSPLANTATION, HAMSTER
(5954)*

BOVINE ADENOVIRUS TYPE 3
TUMOR INDUCTION
BIOLOGICAL PROPERTIES,
MORPHOLOGY, HAMSTER (5945)*
HAMSTER (5939)*

C-TYPE
HEPATOMA, RAT (5810)
REVERSE TRANSCRIPTASE, IMMUNO-
LOGICAL MARKER, MONKEY (5970)

C-TYPE PARTICLES
CELL-FREE-INDUCED SARCOMAS,
HAMSTER (5885)

TRANSPLANTABLE MESOTHELIOMA,
HAMSTER (5931)*

DNA, EPSTEIN-BARR, ABORTIVE INFECTION,
LYMPHOID CELL LINES, HUMAN (5882)

EPSTEIN-BARR
ANTIBODY, CONNECTIVE TISSUE
DISEASE, HUMAN (5969)
IGM, INFECTIOUS MONONUCLEOSIS,
BURKITT'S LYMPHOMA, NASOPHARYN-
GEAL CARCINOMA (5977)
IGM ANTIBODIES, INFECTIOUS MONO-
NUCLEOSIS PATIENTS (6025)*
INFECTIOUS MONONUCLEOSIS,
MALIGNANT LYMPHOMAS, HUMAN,
REVIEW (5738)*
LYMPHOBLASTOID CELL LINES, HUMAN
(5908)
LYMPHOID CELL CULTURE, HUMAN CELL
(5913)

FRIEND LEUKEMIA
COATING, SPECIFIC ANTISERUM
TREATMENT, MOUSE (5944)*
ERYTHROID DIFFERENTIATION, GLOBIN
MRNA INDUCTION, TRANSFORMED
CELLS, MOUSE (5950)*
INFECTION SUPPRESSION, STATOLON
HUMORAL ANTIBODY, MOUSE (5979)
GAZDAR MURINE SARCOMA, ANTIGENICITY,
HAMSTER (5886)

HERPES SIMPLEX
ANTIBODY, NASOPHARYNGEAL CANCER
PATIENTS (5973)
IMMUNOLOGICAL ANALYSIS (5980)*

TYPE 2
CELL TRANSFORMATION, FIBRO-
BLASTS, HAMSTER EMBRYO
(5918)
UV RADIATION, TRANSFORMED
FIBROBLASTS, ULTRASTRUCTURE,
HAMSTER (5890)
UV RADIATION, TRANSFORMATION,
L-CELLS (5924)

HERPESVIRUS
INTERFERON PRODUCTION, IMMUNO-
LOGICAL REACTIVITY, LEUKOCYTES,
MACROPHAGES, RABBIT (5997)*
MALIGNANT LYMPHOMA, RABBIT, REVIEW
(5713)
MAREK'S DISEASE, CHICKEN, REVIEW
(5714)
RENAL ADENOCARCINOMA, FROG, REVIEW
(5737)*

HERPESVIRUS HOMINIS
TYPE 2, HUMAN CERVICAL CANCER,
REVIEW (5715)

RPESVIRUS SAIMIRI
 ATELES, MALIGNANT LYMPHONAS,
 MONKEY (5925)
 FECTION, DNA REPLICATION, REVIEW
 (5717)
 UKEMIA-LIKE, LARYNGEAL CANCER, HUMAN
 (5883)
 MMARY TUMOR, IMMUNOLOGICAL CROSS
 REACTIONS, MOUSE (5884)
 SON-PFIZER, FORESKIN CELL TRANS-
 FORMATION, MONKEY (5877)
 LONEY SARCOMA, LYMPHOCYTE RESPONSE,
 MOUSE (5888)
 NKEY ADENOVIRUS, REDOX ENZYMES,
 HISTOCHEMISTRY, HAMSTER (5897)
 RINE LEUKEMIA
 CELL PENETRATION, MECHANISMS
 (5927)*
 RETICULUM CELL SARCOMA, HAMSTER
 (5896)
 RNA-DEPENDENT DAN POLYMERASE,
 PRIMER (5900)
 TEMPERATURE-SENSITIVE MUTANTS
 (5935)*
 RINE MAMMARY TUMOR
 REVERSE TRANSCRIPTASE ACTIVITY,
 GEL ELECTROPHORESIS, MOUSE
 (5953)*
 RNA-DEPENDENT DNA POLYMERASE, RNA,
 MAMMARY CARCINOMA, HUMAN (5926)
 RINE SARCOMA
 NEOPLASTIC RESPONSE, RAT, MOUSE
 (5904)
 RESCUE, PSEUDOTYPE SARCOMA VIRUS
 DERIVATION (5919)
 TRANSFORMED CELLS, DIBUTYRYL
 CYCLIC ADENOSINE PHOSPHATE,
 THEOPHYLLINE, MOUSE (5952)*
 COGENIC
 DNA, RNA TRANSFORMATION, CYTO-
 GENETICS (5934)*
 MALIGNANT LYMPHOMAS, IMMUNO-
 REGULATION, HUMAN, REVIEW
 (5745)*
 CORNAVIRUS, TUMOR, CELL-MEDIATED
 IMMUNITY, MOUSE (5920)
 LYOMA
 ANTIGEN, THYMECTOMY, TUMOR SIZE,
 RAT (5956)*
 CAPSID STRUCTURE, ULTRASTRUCTURAL
 STUDY (5910)
 CELL AGGREGATION, NEURAMINIDASE,
 HAMSTER (5905)
 INHIBITOR PRODUCTION, MOUSE,
 HAMSTER (5911)
 KIDNEY SARCOMA INDUCTION, PRO-
 LIFERATION KINETICS, RAT (5955)*
 RNA, INFECTION, MOUSE CELLS (5903)
 SURFACE ANTIGEN, POLYPSEUDOPODIA,
 TRANSFORMATION, BHK 21 CELLS
 (5964)
 RAUSCHER LEUKEMIA
 RNA, SPLEEN, MOUSE (5887)
 RAUSCHER MURINE LEUKEMIA
 LIPID PHASE STRUCTURE (5933)*
 RNA, DNA, SIALYL TRANSFERASE ACTIVITY,
 TRANSFORMED CELLS (5878)
 RNA ONCOGENIC, REVIEW (5748)*
 RNA TUMOR, RIBONUCLEASE H CONTENT
 (5922)
 ROUS SARCOMA
 CELL TRANSFORMATION, AGGLUTINATION,
 CONCAVALIN A, WHEAT GERM
 AGGLUTININ (5914)
 DNA, VIRUS RELEASE, CHICKEN CELL
 (5916)
 PERSISTENCE, RESISTANT CELLS,
 MOUSE (5948)*
 PHOSPHOLIPID COMPOSITION, FIBRO-
 BLASTS, CHICK EMBRYO (5917)
 RIBONUCLEOPROTEIN (5907)
 RIFAMYCIN, TRANSFORMED FIBROBLASTS
 CHICKEN (5946)*
 TRANSFORMED CELL LINES, CHROMOSOME
 STUDY, HAMSTER (5899)
 TUMOR, TRANSPLANTATION, RAT, MOUSE
 (5889)
 SCHMIDT-RUPPIN ROUS, CHROMOSOME
 ABNORMALITY, TUMOR ULTRASTRUCTURE,
 RAT (6081)
 SHOPE, PAPILLOMAS, DNA REPLICATION,
 MOLECULAR HYBRIDIZATION, RABBIT
 (5881)
 SIMIAN ADENOVIRUS SA7, GROWTH,
 ARGININE STARVATION (5937)*
 SIMIAN ADENOVIRUS SA7(C8), TUMOR
 INDUCTION, HAMSTER (5938)*
 SV40
 DNA, TRANSFORMED CLONES, MOUSE
 (5915)
 DNA MOLECULE, COVALENT JOINING
 (5895)
 DNA REPLICATION, ULTRASTRUCTURAL
 STUDY (5909)
 MITOCHONDRIAL DNA, REPLICATION,
 HUMAN, MONKEY, RODENT (5894)
 RESISTANCE TO INFECTION, MONKEY
 CELL (5879)
 RNA SYNTHESIS, ALPHA-AMANITIN,
 MONKEY CELLS (5893)

TUMOR, CARCINOGENESIS, REVIEW (5753)*
 VIRAL GENOME, CARCINOGENESIS, REVIEW
 (5757)*
 VIRUS-LIKE PARTICLES, RETICULUM CELL
 SARCOMA, EYELID, CASE REPORT (6166)*
 VISNA, TRANSFORMATION, ASTROCYTE,
 HUMAN (5898)
 VITAMIN A
 LYMPHOPROLIFERATIVE LESION, SKIN
 LESION, HAMSTER (5786)
 VITAMIN B12
 TUMOR GROWTH, RAT, MOUSE, HAMSTER,
 GUINEA PIG, REVIEW (5708)
 VULVA
 INTRAEPITHELIAL CARCINOMA, CLINICAL
 STUDY (6325)*
 PAGET'S DISEASE, ULTRASTRUCTURE, CASE
 REPORTS (6324)*
 PRURITUS, TRICHOMONAS, CANDIDIASIS,
 CANCER, HUMAN (6224)*
 WALKER'S CARCINOMA
 LIGHT, SEX FACTOR, SURVIVAL, RAT
 (6218)*
 METABOLITE EFFECTS, RAT ORGANS (6381)*
 WHEAT GERM AGGLUTININ
 AGGLUTINATION, ROUS SARCOMA VIRUS,
 TRANSFORMED CELLS (5914)

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Subject Author Index

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National Cancer Institute

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Editor

Robert Love, M.D.
Jefferson Medical College, Philadelphia

Associate Editor

George P. Studzinski, M.D.
Jefferson Medical College, Philadelphia

NCI Staff Consultants

Elizabeth Weisburger, Ph.D.

Sidney Siegel, Ph.D.

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PREFACE

Carcinogenesis Abstracts is a publication of the National Cancer Institute. The journal serves as a vehicle through which current documentation of carcinogenesis research highlights are compiled, condensed, and disseminated on a regular basis. It represents an integral part of the Institute's program of fostering and supporting coordinated research into cancer etiology. Issues of *Carcinogenesis Abstracts* normally contain three-hundred-fifty abstracts and three-hundred-fifty citations (unaccompanied by corresponding abstracts). Abstracts and citations refer to the current scientific literature that describes the most significant carcinogenesis research carried on at the National Cancer Institute, other governmental agencies, and private institutions. *Carcinogenesis Abstracts* is intended to be a highly useful current awareness tool for scientists engaged in carcinogenesis research or related areas. The great number and diversity of publications relevant to carcinogenesis make imperative the availability of this service to investigators whose work requires that they keep abreast with current developments in the field.

Carcinogenesis Abstracts is normally published monthly. Volume X covers the scientific literature published from July 1971 through Dec 1972. A cumulative subject and author index for Volume X will be published shortly after the final regular issue. This journal is available free of charge to libraries and to individuals who have a professional interest in carcinogenesis. Requests for *Carcinogenesis Abstracts* from qualified individuals should include statements of their relationship to carcinogenesis research. All correspondence should be addressed as follows.

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NOTE

Journal names are abbreviated according to the list of abbreviations used by *Index Medicus*. For journals not covered by *Index Medicus*, the abbreviations (with some modifications) found in *World Medical Periodicals*, 3rd Edition, are used.

LANGUAGE ABBREVIATIONS

Afr.	Afrikaans	It.	Italian
Ar.	Arabic	Jap.	Japanese
Bul.	Bulgarian	Kor.	Korean
Ch.	Chinese	Latv.	Latvian
Cz.	Czech	Lith.	Lithuanian
Dan.	Danish	Nor.	Norwegian
Dut.	Dutch	Pol.	Polish
E.	English	Por.	Portuguese
Eston.	Estonian	Rum.	Rumanian
Fin.	Finnish	Rus.	Russian
Fl.	Flemish	Ser.	Serbo-Croatian
Fr.	French	Sl.	Slovak
Ger.	German	Sp.	Spanish
Gr.	Greek	Sw.	Swedish
Heb.	Hebrew	Th.	Thai
Hun.	Hungarian	Turk.	Turkish
Ic.	Icelandic	Uk.	Ukrainian
ln.	Indonesian	Viet.	Vietnamese

ABBREVIATIONS USED IN ABSTRACTS

ACTH	adrenocorticotrophic hormone	mg	milligram(s)
ADP	adenosine diphosphate	min	minute(s)
AMP	adenosine monophosphate	ml	milliliter(s)
ATP	adenosine triphosphate	mm	millimeter(s)
C	degrees centigrade	MTD	maximum tolerated dose
cm	centimeter(s)	ng	nanogram (10^{-9})
CNS	central nervous system	pg	picogram (10^{-12})
cpm	counts per minute	p.o.	orally
DNA	deoxyribonucleic acid	ppm	parts per million
e.g.	for example	r	Roentgen
g	gram(s)	RBC	red blood cells (erythrocytes), red blood count
µg	microgram(s)	resp.	respectively
hr	hour(s)	Rev.	review (only in citations)
i.m.	intramuscular	RNA	ribonucleic acid
i.p.	intraperitoneal	s.c.	subcutaneous
IU	international unit(s)	sec	second(s)
i.v.	intravenous	U	unit(s)
kg	kilogram(s)	UV	ultraviolet
LD ₅₀	median lethal dose(s)	WBC	white blood cells (leukocytes), white blood count
m	meter(s)	wk	week(s)
M	molar	wt	weight
mEq	milliequivalent(s)	yr	year(s)
mM	millimolar		
µM	micromolar		
mC, µC	milli-, microcurie(s)		

CONTENTS

	PAGE
REVIEW.....	1, 47, 99, 157, 207, 253, 365, 471, 583, 695, 799, 899
CHEMICAL CARCINOGENESIS.....	4, 51, 105, 162, 211, 258, 374, 475, 590, 702, 809, 905
PHYSICAL CARCINOGENESIS.....	16, 61, 112, 173, 221, 280, 396, 500, 610, 726, 836, 920
VIRAL CARCINOGENESIS.....	18, 62, 113, 175, 223, 285, 399, 502, 613, 728, 838, 922
IMMUNOLOGY.....	25, 75, 128, 184, 233, 305, 423, 532, 635, 748, 855, 936
PATHOGENESIS.....	30, 85, 138, 192, 242, 324, 439, 548, 655, 775, 874, 946
EPIDEMIOLOGY AND BIOMETRY....	33, 86, 141, 194, 244, 330, 442, 551, 660, 779, 876, 948
MISCELLANEOUS.....	37, 90, 145, 198, 245, 335, 450, 560, 664, 784, 880, 953
AUTHOR INDEX.....	973
SUBJECT INDEX.....	1097

AUTHOR INDEX

- AARONOV, A.
2712*
- AARONSON, S.A.
413, 450, 1330, 3096, 3126,
3665, 3808, 3867, 4523,
4535, 5232, 5935*
- ABABEI, L.
2142*
- ABAD, L.
6066*
- ABBATT, J.D.
4490
- ABBREDERIS, K.
3507*
- ABDALLA, A.M.
503*
- ABDO, S.E.
1470*, 2030*, 2062*, 5457*,
5458*, 5459*
- ABDOU, N.I.
4776*
- ABDOU, N.L.
4776*
- ABE, C.
3223*
- ABE, K.
4292*
- ABE, Y.
4740*
- ABEL, C.A.
771*
- ABELEV, G.I.
153, 901, 4723*
- ABELL, C.W.
4861
- ABELL, M.R.
1413, 2180*
- ABERDEEN, E.R.
2375*
- ABLASHI, D.
5345
- ABLASHI, D.V.
443*, 741*, 1337, 3099,
3104
- ABLIN, R.J.
1377, 1865*, 2626, 3177,
3187, 6011*
- ABOU-DAQUD, K.T.
893*
- ABRAHAM, S.
6052
- ABRAHAMSON, J.R.
4241*
- ABRAMOVICH, A.B.
4260*, 6062*
- ABTAHI, H.
6136*
- ACCAME, E.A.
4202*
- ACERBI, L.
6145*
- ACEVEDO, H.F.
1134*
- ACEVES-ORTEGA, R.
207
- ACHESON, E.D.
89*, 2751
- ACHESON, N.H.
2560
- ACHTERRATH, M.
2405*
- ACKERMAN, N.B.
1970, 5554*
- ACOSTA, A.
4340*
- ACS, G.
1318
- ADACHI, K.
1436
- ADAM, A.
2431*
- ADAM, D.
2431*
- ADAM, E.
1718, 4691
- ADAM, Y.G.
4244*
- ADAMCZYK, B.
3217*
- ADAMEK, M.
5866
- ADAMEK, T.
1076*
- ADAMENKO, G.P.
5995*
- ADAMS, G.E.
2465*
- ADAMS, K.
3303
- ADAMS, R.A.
5313
- ADAMS, R.L.P.
3992
- ADAMSON, R.H.
35, 631, 1337
- ADECHY-BENKOEL, L.
4077*
- ADELSBERGER, L.
4195*
- ADELSTEIN, A.M.
2750, 4308
- ADENIS, L.
362, 4139*, 6187*, 6285*
- ADERCA, I.
1029
- ADINOLFI, A.
3849
- ADINOLFI, M.
3849
- ADKINS, P.C.
3446*
- ADKISON, B.
1132
- ADLDINGER, H.K.
1006
- ADLER, L.N.
3445*
- ADLER, S.
3072
- ADLER, W.H.
2692*
- ADNET, J.J.
5101
- ADOLF, W.
1651*
- ADRIANOV, L.
350
- ADZHIGITOV, F.I.
692, 3200
- AGARWAL, S.S.
1980
- AGATHA, G.
571*
- AGEENKO, A.I.
5874*, 5965
- AGER, E.
498*
- AGEYENKO, A.I.
5928*, 5996*
- AGLIOZZO, C.M.
5663*
- AGOSTINI, C.
5583*
- AGOSTON, I.
6359*
- AGRANOFF, B.W.
300*
- AGRELL, I.P.S.
5644*
- AGREN, G.
1442
- AGUILAR, M.J.
2568*
- AGUILAR-PARADA, E.
6273*
- AGUREEV, A.I.
6189*
- AHEARN, M.J.
3360*, 4020
- AHERNE, W.
4221*, 6233*
- AHLQUIST, J.
5872*
- AHMAD, M.S.
5929*
- AHMED, M.
138*, 2546
- AHREN, C.
285*
- AIIMED, M.Y.
2460*
- AISENBERG, A.C.
4061*
- AITIO, A.
5832*
- AJURIA, E.

2666*
AKAGI, T.
3293, 4519
AKAD, M.
2946, 4369
AKEDO, H.
4942*
AKERBLOM, H.K.
2063*
AKGUEN, T.
974*
AKINO, T.
223
AKIYAMA, K.
2711*
AKSENOV, O.A.
2577*, 3826*
AKSOY, M.
974*, 2976
AL BAZZAZ, F.J.
983*
AL-MONDHIRY, H.
1849*
AL SAADI, A.
2732*
AL'TSHTEIN, A.D.
2532
ALAM, B.S.
71, 378*
ALAVI, I.A.
876*
ALBARRACIN, N.S.
599*
ALBERT, D.J.
2899*
ALBERT, D.M.
1725, 1984, 5891
ALBERT, R.E.
4434, 5200
ALBERT, Z.
1796, 2619
ALBERTO, P.
3173
ALBINO, A.P.
5256
ALBORES-SAAVEDRA, J.
884*
ALBRECHT, M.
6139*
ALBRIGHT, N.L.
3838
ALCORTA-ANGUIZOLA, B.
884*
ALEKSANDROV, S.N.
5703
ALEKSANDROWICZ, J.
18*, 309*, 1076*, 1539,
2167*, 3018*, 4446
ALEKSANYAN, YU.T.
5693*
ALETRAS, H.A.
3577*

ALEXANDER, J.A.
4068*
ALEXANDER, L.L.
620*
ALEXANDER, P.
30*, 3873, 5319
ALEXANDER, P.A., JR.
3070
ALEXANDER, W.D.
4762*
ALEXANDRE, J.H.
629*
ALEXANDRESCU, D.
1037*
ALEXANDROV, K.
3012, 5130
ALEYASSINE, H.
279*
ALFIERI, O.
4806*
ALFORD, T.C.
2644, 4697
ALKEN, P.
6240*
ALLAN, P.W.
265*
ALLDERDICE, P.W.
3473*
ALLEGRA, S.R.
795*
ALLEGRI, G.
4921*
ALLEN, D.W.
1508
ALLEN, J.R.
4169*
ALLEN, M.
5729*
ALLEN, P.T.
688
ALLERTON, S.E.
4228*
ALLI, A.F.
4876*
ALLISON, A.C.
1776*, 5979
ALLISON, J.E.
2039*
ALLISTON, G.V.
1647*
ALLWOOD, G.G.
1370, 1371
ALM, G.V.
4672
ALONI, Y.
1124
ALPERT, A.E.
6122
ALPERT, E.
759, 1842*, 1953, 3401*
ALPERT, M.E.
511

ALTAMIRANO-DIMAS, M.
884*
ALTANEROVA, V.
5271
ALTENAEHR, E.
539
ALTENKIRK, B.
2959
ALTER, M.
2804*, 3260
ALTERNBURG, L.C.
6375*
ALTMAN, M.
535
ALTSHEIN, A.D.
5938*
ALTSHULER, B.
5844*
ALTWEIN, J.
6092*
ALTWEIN, J.E.
4155*
ALTWEIN, Y.E.
519*
ALVARES, A.P.
5133
ALVAREZ-MORENO, C.
488*
ALVI, F.R.M.
2278*
AMANDZHOLOV, B.S.
6250*
AMANO, M.
223, 4174*
AMANO, T.
552, 595*
AMATI, A.
2096*
AMATO, D.
4726*
AMATRUDA, T.T., JR.
847
AMATULLI, J.M.
1182*
AMATUZZIO, D.S.
113, 3856
AMBROSE, K.R.
717, 1042, 1063
AMBROSI, B.
5614*
AMCHENKOVA, A.M.
5289*, 5997*
AMEMIYA, Y.
2982
AMENOMORI, Y.
2344
AMER, S.M.
5859*
AMERIO, P.L.
1897*
AMERSON, J.R.
1788

AMES, B.N.	ANDERSON, N.	6321*
2984, 5787	2573*	ANTHONY, P.P.
AMETANI, T.	ANDERSON, N.G.	3166
235, 1174*, 4852	717, 1042, 1063	ANTOINE, T.
AMHERDT, M.	ANDERSON, P.S., JR.	2269*
868*	3740	ANTONELLO, C.
AMIEL, J.L.	ANDERSON, R.E.	2961
2680*	1656, 1663, 5013	ANTONIV, V.F.
AMIEL, Y.L.	ANDERSON, R.J.	3552*
480	2641, 3878	AOKI, T.
AMKRAUT, A.	ANDERSON, S.A.	1814, 2013, 3144, 3852,
3920*	3135	4010, 4555, 4694, 6022*
AMLACHER, E.	ANDERSON, W.	AOSHIMA, M.
2384*	3607	1628*
AMOS, B.	ANDERSSON, B.	APATENKO, A.K.
5307	140*, 1567	2917*, 5730*
AMOS, D.B.	ANDERSSON, G.	APIOU, F.
4688	4870	340
AMOS, H.	ANDERSSON, G.K.A.	APOSHIAN, H.V.
1496*	5644*	1761, 5261
AMOUROUX, J.	ANDO, K.	APOSTOLIDIS, P.
4295*	4852	530*
AMPOFO, D.A.	ANDOH, T.	APPELLA, E.
5690*	360, 2936, 3005	3909
AMSTEY, M.S.	ANDONOV, P.	ARAKI, M.
2533, 2566*	136*, 613, 2598*, 6159*	1593, 2983
AMZEL, L.M.	ANDRE, R.	ARAO, T.
2656*	678*	6368*
ANAGNOSTE, B.	ANDREA, J.	ARAOZ, C.A.
4023	4366	2468*
ANCHEVA, M.	ANDREOLI, A.	ARASZKIEWICZ, H.
5322	834	4250*, 4815
ANDERER, F.A.	ANDREWS, E.J.	ARATA, T.
4549	1381, 5353	4886*, 5517*
ANDERSEN, B.	ANDRIANOV, L.A.	ARBENZ, U.
2046*	5186*	3346*
ANDERSEN, H.K.	ANDRIANOVA, M.M.	ARCADI, J.A.
3884, 5268	649*, 5831*	2393*
ANDERSEN, P.R.	ANDZHAPARIDZE, D.G.	ARCERITO, S.
4481*	3760, 5208	3567*
ANDERSEN, S.R.	ANGELOPOULOS, A.P.	ARCHER, M.C.
5643*	3419*	1544
ANDERSON, A.C.	ANGEVINE, D.M.	ARCOS, J.C.
799*	1682*	642, 1578, 5105
ANDERSON, C.W.	ANGHILERI, L.J.	ARCOS, J.M.
3140, 5263	537, 538, 846, 2396*, 2883*,	488*
ANDERSON, D.E.	5536*	ARDERIU TORNER, R.
842, 1802	ANGLESIO, E.	4146*
ANDERSON, D.P.	205, 3267, 3978*	ARDITO, G.
451, 3527*, 5578*	ANGUERA, A.	6261*
ANDERSON, J.	5392*	ARENDT, A.
1314, 3130, 4506	ANISIMOV, V.N.	6180*, 6220*
ANDERSON, J.P.	2943, 5822*	ARGAST, G.
414, 476, 703	ANJARWALLA, K.A.	4156*
ANDERSON, K.M.	2752	ARGEMI, B.
1645*, 2395*, 5829*	ANKERST, J.	4077*
ANDERSON, L.G.	479	ARGUS, M.F.
4803*	ANNES, G.P.	642, 1578, 5105
ANDERSON, L.J.	2114*	ARIAKE, S.
1035*	ANSARI, A.	5545*
ANDERSON, M.D.	193*	ARIANO, M.
590*	ANSELL, J.S.	6211*

ARICI, C. 3918*	4249*	1124
ARIES, V.C. 1101	ARTZT, K. 2828	ATTIA, Y. 3255
ARIMA, T. 3502*, 4880*	ARZAMASTSEV, V.P. 5161	ATUK, N.O. 4995*
ARKHIPENKO, V.I. 231	ASAFU-ADJAYE, J.H. 5689*	AUBERT, CH. 4163*
ARKHIPOV, G.N. 3661, 5820*	ASAHIMA, S. 4366	AUER, V. 4116*
ARLEN, M. 1303, 3736*	ASAHINA, S. 975*	AUERBACH, H. 993, 1001*
ARLINGHAUS, R.B. 3738	ASAKAWA, H. 5318	AUERSPERG, N. 4030
ARMELI, G. 2987	ASAMER, H. 255*, 3507*, 6035*	AUFFRET, B. 2301
ARMIN, K. 2771	ASANO, M. 1432, 1433	AUGUST, J.T. 1016
ARMSTRONG, D. 1317	ASAYAMA, T. 1355*	AULISIO, C.G. 3178
ARMSTRONG, G. 5345	ASHERSON, G.L. 1370, 1371, 5375*	AULISIO, G.A. 3565*
ARMSTRONG, G.R. 443*, 741*, 1337, 3099, 3104	ASHIKAWA, K. 1402	AULL, F. 3547*
ARMSTRONG, M.Y.K. 2664*	ASIRE, A.J. 1881	AUMUELLER, G. 4115*
ARMSTRONG, R.W. 4318	ASKEW, J.B., JR. 2165*	AURELIAN, L. 1723, 3895, 5715
ARMUTH, V. 4392	ASOFSKY, R. 4402	AURICH, G. 2682*, 3847
ARNHEIM, N. 1040	ASSAF, S.A. 1446*	AURIOL, J.C. 5028
ARNOLD, C. 5563*	ASTALDI, A., JR. 5396*	AUSLANDER, M.O. 5839*
ARNOLD, E. 975*, 4366	ASTALDI, G. 2849, 4357*, 5396*	AUST, J.C. 460
ARNOLD, R. 2149*	ASTAPOV, B.M. 494*	AUSTEN, K.F. 2697*
ARNOTT, S.J. 248	ASTEDT, B. 4983*	AUSTIN, K.E. 2695*
ARNOULT, J. 4151*, 6216*	ASTRAKANTSEV, F.A. 3562*	AUVERGNAT, J.CH. 3561*
ARNSTEIN, H.R.V. 5651*	ASVADI, S. 1449*	AVDZHIAN, M.V. 5899
ARON, M. 3912*	ASVALL, J. 805	AVERDUNK, R. 570*
ARORA, S. 763	ATERMAN, K. 4423	AVEY, H.P. 2656*
ARSAGOVA, N.S. 2389*	ATHANASIU, P. 1027, 3833*	AVILA, L. 4735*
ARSENI, C. 3600*	ATHERLEY, G.R.C. 2754	AVIV, D. 4896*
ARTAMONOV, YU.P. 560*	ATIEYEH, M.N. 2753	AVIV, H. 3845
ARTHAUD, J.B. 4232*	ATKIN, N.B. 3338*, 4270*	AVRAMEAS, S. 4895*, 5365
ARTHES, F.G. 1922	ATKINS, L.M. 2363	AVRIN, E. 2010, 4240*
ARTHUR, K. 4327*	ATKINS, R. 3906	AVTANDILOV, G.G. 3989
ARTNER, J.	ATTARDI, D. 5347	AVTANDILOVA, L.I. 3989
	ATTARDI, G.	AVTSYN, A.P.

1606*
 AW, E.J.
 122
 AXEL, R.
 2489, 3774, 3803, 5810,
 5926
 AXELRAD, A.A.
 4533
 AXELROD, J.A.
 2198*
 AXELSON, C.
 5060*
 AXELSON, O.
 1691*, 1928
 AYA, T.
 1475*
 AYTAKOV, Z.H.
 1946*
 AZAMA, Y.
 2322
 AZARNOFF, D.L.
 3322*
 AZZOPARDI, J.G.
 1883
 BABA, K.
 4811
 BABA, N.
 948
 BABACA, P.
 2780*
 BABAI, F.
 6281*
 BABASHAYEV, B.S.
 6374*
 BABIN, PH.
 3626*
 BABINKOV, V.J.
 3916*
 BABINOV, B.N.
 2659*
 BABKOVA, O.V.
 1057, 1840
 BACACI, K.
 2424*
 BACARDI NOGUERA, R.
 4978*
 BACCICHETTI, F.
 2961
 BACH, H.
 633
 BACHENHEIMER, S.
 4548
 BACHMANN, A.E.
 1464*, 1800, 2202
 BACHMANN, K.D.
 5431
 BADAWY, S.
 1979
 BADEN, H.P.
 1031
 BADER, J.
 1737

BADER, J.P.
 2499, 4540
 BADGER, A.M.
 2693*
 BADIA SERRA, J.
 3635*
 BADMAEVA, V.V.
 6121
 BAGLEI, E.A.
 2435*
 BAGLEY, C.M., JR.
 3994
 BAGLIONI, C.
 4238*, 4997*
 BAGSHAW, K.D.
 1061, 4132*, 4770*
 BAHLEY, YE.A.
 4440
 BAIANU, I.
 5476*
 BAIDILA, P.G.
 1609*
 BAIKIE, A.G.
 6354*
 BAILAR, J.C., III
 206, 1304
 BAILEY, I.C.
 212*, 4839*
 BAILEY, J.M.
 4838*
 BAILEY, P.C.
 5991*
 BAINBRIDGE, D.R.
 4507
 BAIRD, W.K.
 653*
 BAIRD, W.M.
 1245, 2342
 BAKALOV, V.
 1192*
 BAKAY, L.
 61, 4290*
 BAKER, D.C., JR.
 1308*
 BAKER, H.W.
 3410*
 BAKER, J.
 1271
 BAKER, J.A.
 5479*
 BAKER, J.R.
 4522
 BAKER, M.B.
 3161, 3817
 BAKER, M.S.
 4394, 4437
 BAKER, R.E.
 3161, 3817
 BAKER, R.S.U.
 685, 4534
 BAKULINA, S.P.
 5177

BALA, YU.M.
 5439, 5873*
 BALABA, T.YA.
 1467*
 BALAGUERO LLADO, L.
 5595*
 BALAKRISHNAN, K.
 3932*
 BALAKRISHNAN, S.L.
 1317
 BALAKRISHNAN, V.
 3290*
 BALAPARAMESWARARAO, S.
 4872*
 BALARAMANNAIR, M.
 6200*
 BALASHEVA, I.I.
 3624*
 BALAZS, M.
 5355
 BALCI, S.
 1139*
 BALDA, B.R.
 270*, 5224, 6390*, 6391*
 BALDAUF, K.
 2784*, 6103*
 BALDUZZI, P.
 422
 BALDUZZI, P.C.
 2533
 BALDWIN, R.W.
 3170, 3899, 4678, 5332
 BALE, G.F.
 5572*
 BALE, W.F.
 2703*
 BALFOUR, I.C.
 5395*
 BALHORN, M.
 4087*
 BALHORN, R.
 2174*, 4087*, 5504*, 5506*
 BALINT, Z.
 3389*
 BALK, S.D.
 1623*
 BALL, C.R.
 4397, 4411
 BALL, J.J.
 5480*
 BALLARD, R.
 4889*
 BALNER, H.
 3727
 BALTIMORE, D.
 909, 1012, 1706, 4967*,
 5219, 5233
 BALUDA, M.A.
 2520, 5215
 BALZARINI, G.P.
 4675, 6145*
 BAMBURG, J.R.

- 45
BANATVALA, J.E.
5977
BANDINI, A.
5647*
BANDLOW, G.
3056
BANERJEE, A.K.
3105
BANEY, R.N.
935
BANFIELD, W.G.
2023*
BANGA, I.
1499*
BANI-HASHEMI, A.
3408*
BANK, A.
4025
BANKHURST, A.D.
5978
BANKOLE, R.O.
3856
BANKOWSKI, R.A.
3148*
BANKS, G.S.
1280*
BANKS, W.J.
4972*
BANKS, W.J., JR.
1415, 2152*
BANNA, P.
3567*
BANNASCH, P.
2406*, 4472*, 5855*, 5856*
BANNISTER, D.W.
1188*
BANOCZY, J.
2729*
BANSAL, D.P.
1423*
BANSAL, S.C.
723, 4612, 4649, 4671
BANZON, J.
2000
BARAHONA, H.H.
491*, 3757, 3781, 3822*,
3824*, 3832*, 5925
BARAJAS, L.
3372*
BARAN, L.A.
-3952*
BARANOVSKY, A.
6089*
BARANSKA, W.
1753
BARBA, R.C., LA
2685*
BARBANTI-BRODANO, G.
2235*
BARBANTI SILVA, C.
6061*
- BARBARESCHI, G.
4144*
BARBER, D.E.
2203
BARBER, G.D.
938
BARBERA, E.
6066*
BARBERA, V.
892*
BARBIROLI, B.
3504*
BARCAT, J.A.
6360*
BARCELLONA, P.S.
641
BARCLAY, D.L.
1140*, 1177*, 4914*
BARCLAY, M.
2172*
BARCLAY, T.H.C.
1881, 1920, 2649, 6082
BARDELL, D.
3150*
BARDIN, C.W.
2039*
BARESOVA, M.
3905, 5889
BARGE, J.
3664
BARGELLES, A.
3844
BARICALLA, R.
6056*
BARINSKII, I.F.
5289*
BARKER, A.D.
6308*
BARKER, C.
1788
BARKER, C.R.
5811
BARKER, E.A.
5150
BARKER, H.G.
3910*
BARKER, L.F.
3166
BARLATI, S.
5946*
BARLOW, J.J.
83*, 1414, 3477*, 5484*
BARNA, S.
5391*
BARNES, D.W.H.
1167*
BARNES, J.R.
1543
BARNES, R.D.
269*
BARNETT, J.M.
3549*
- BARNETT, J.W.
4611
BARON, S.
4553
BARONI, C.D.
2970
BARONI, M.
593*
BARR, K.J.
3941
BARRA, Y.
1948
BARRETT, H.
4809
BARRIE, J.
4236*
BARRILLIOT, L.
397
BARRON, N.A.
958
BARRY, D.H.
2331
BARRY, E.J.
4430
BARRY, M.M.
4808
BARSKI, G.
848, 1003, 4642
BARTASHCHUK, YE.I.
562*
BARTHEL, W.F.
4456*
BARTKO, D.
4118*
BARTKOWIAKOWA, A.
1099
BARTLETT, G.L.
4655, 4761*
BARTNIK, T.
2373*
BARTOLONI ST. OMER
5189*
BARTOLOTTA, B.
2890*
BARTON, B.P.
3928*
BARTSCH, H.
343, 5787
BARUFFI, I.
863*
BASA, G.F.
2762
BASERGA, A.
798*
BASERGA, R.
1209, 1884, 5535*, 6319*
BASHKAYEV, I.S.
5996*
BASILICO, C.
3055
BASKAR, J.F.
1328

BASMADZHYAN, M.E.
5693*

BASMANN, H.B.
4040

BASNIGHT, M.
731*

BASOMBRIQ, M.A.
4401, 5293, 5353

BASS, L.R.
3104

BASSIN, R.H.
1732, 1733, 3058, 3098,
3111, 3126, 3758, 5683*

BASSLEER, R.
2439*, 3536*

BASSO, M.
5112

BASSO RICCI, L.
1822

BASTEN, A.
2629

BASTIAN, F.O.
398

BASTOS, A.L.
6341*

BATAILLON, G.
441*

BATATA, M.
68

BATES, D.C.
1420*

BATES, H.A.
113, 3856

BATES, J.
5541*

BATKA, H.
5118, 5178, 5765

BATSAKIS, J.G.
2108*

BATTAGLINI, J.W.
959

BATTEMA, W.L.
6116

BATTIFORA, H.A.
4500*

BATZDORF, U.
1135*

BATZING, B.L.
4618

BAUCHART, J.
3414*

BAUER, D.H.
80*

BAUER, G.E.
5171

BAUER, H.
147*, 404, 2518, 2519, 3068,
4570, 5035*, 5046*, 5280*

BAUER, K.H.
2913*

BAUER, L.
5116

BAULDAUF, K.
5419

BAUM, M.
6280*

BAUM, S.G.
4527, 4543

BAUMAL, R.
1806, 4705*

BAUMINGER, S.
3224*

BAUMSLAG, N.
91*, 5184*

BAUSSERMAN, L.L.
349

BAUZ, R.
6049*

BAWAB, M.S.
5542*

BAXTER, J.D.
287*, 6127

BAYER, R.
4696, 5364

BAYLET, R.
203, 316*

BAYLIN, S.B.
2836

BAYON, N.
330*

BAZILIER, M.
5281*

BAZIN, H.
6010*, 6012*

BEABOUT, J.W.
5520*

BEALE, D.
50, 972*

BEALMEAR, P.
2689*

BEARD, D.
742*

BEARD, J.W.
742*, 3051, 3075

BEARD, P.
3818

BEATTIE, E.J., JR.
3031*

BEAVEN, M.A.
2836

BEAZLEY, R.M.
921*

BECK, C.
2839, 3927*

BECK, E.G.
3617

BECK, I.T.
3437*

BECK-PECCOZ, P.
5614*

BECKA, L.N.
2656*

BECKER, F.B.
113

BECKER, F.F.
3469*, 3656, 4402

BECKER, G.
2082*, 6384*

BECKER, R.F.
46

BECKER, T.
2736*

BECKER, Y.
402, 1744, 3611, 5262

BECKERS, A.
6010*, 6012*

BECKERS, J.P.
4135*

BECKLER, V.
2916*

BECKMAN, G.
424, 1952

BECKMAN, L.
424, 567*, 1952

BEDA, S.
3255, 4018

BEDFORD, J.
1292*

BEDNAR, T.W.
1612*

BEDOYA, M.
3551*

BEEBE, G.W.
1662, 3740

BEERMAN, H.
1961

BEGG, A.C.
1197*

BEGGS, J.
5469*

BEHLKE, J.
661*

BEIRLE, J.
4228*

BEISCHER, N.A.
2727*

BEISER, S.M.
2819

BEKESI, J.G.
1534, 2989, 4653, 4719*

BEKIERKUNST, A.
2330

BEKTERMIROV, T.A.
3418*

BELCHER, J.R.
3261

BELCHER, R.W.
5685*

BELEHRADEK, J., JR.
848, 4642

BELIKOVA, S.G.
5425

BELISARIO, J.C.
5702

BELITSKII, C.A.
5177

BELJANSKI, M.
1882

BELL, C.
833

BELL, D.
2541

BELL, T.M.
727*

BELLAMY, A.R.
1364*

BELLELLI, L.
172*

BELLETT, A.J.D.
1005

BELLI, J.A.
4650

BELLOMY, B.B.
1063

BELLONE, A.G.
3468*

BELLONE, C.
5561*

BELMAN, S.
4368

BELOKHVOSTOV, A.S.
3463*

BELOSHAPKO, A.A.
5059*, 5187*

BELOUSOV, A.P.
2156*, 6053

BELOUSOVA, A.K.
311*, 2052*, 4439

BELOUSOVA, O.I.
1671*

BELPOMME, D.
4306, 6129

BELSKY, J.L.
1660, 1687*

BELTRAN, G.
403, 6346*

BELUGINA, Z.T.
6149*

BELYAEV, D.K.
4037

BELYAEVA, M.I.
6351*

BELYAEVA, N.N.
5400

BELYAYEVA, N.N.
1468*

BELZER, F.O.
4276*

BEMIS, E.L.
4050*

BEN-BASSAT, H.
2735*, 2844, 2879, 3938

BEN-PORAT, T.
1717

BEN-SASSON, Z.
1774*

BEN, T.
2483, 2493

BENACERRAF, B.
1202, 2620, 3164

BENARDEAU, M.
1199*

BENDA, P.
5441

BENDER, E.
5885, 5931*

BENDER, M.A.
4019

BENDICH, A.
4400

BENDINELLI, M.
410, 4507, 5375*

BENDITT, E.P.
4227*

BENDIXEN, H.J.
1384

BENDLOVA, J.
1617*

BENEDICT, W.F.
4409, 4433

BENEKE, G.
777*, 2151*, 2387*, 3535*

BENEZRA, D.
481, 2031*

BENIASHVILI, D.SH.
6248*, 6270*

BENINI, G.
4105*

BENITEZ, M.H.
3588*

BENJAMIN, S.A.
5350

BENJAMIN, S.P.
4165*

BENNETT, B.
1231*

BENNETT, D.
2828

BENNETT, D.G.
1337

BENNETT, K.
3700

BENNETT, L.L., JR.
265*

BENNETT, M.
406

BENNETT, N.B.
3452*

BENNETT, P.
5200

BENNETT, R.C.
6342*

BENNETT, S.J.
4625

BENNINGHOFF, D.L.
620*, 1679*

BENSAHEL, H.
3349*

BENSCH, K.
3424*

BENSCH, K.G.
3959*, 4216*

BENSO, L.
5998*

BENTINCK, B.R.
2165*

BENTVELZEN, P.
738*, 4305, 4309

BENTWICH, Z.
4620

BENYESH-MELNICK, M.
1015, 1360*, 1716, 1721, 1973, 5951*

BER, A.
2758

BERARD, C.W.
4630

BERARDET, M.
2680*

BERCEA, I.
5639*

BERCEANU, S.
1862*, 5394*

BEREBBI, M.
3694, 5299, 5433

BERENBLUM, I.
4392

BERENCSEI, C.
2639

BEREND, M.
2840

BERENDES, U.
1136*, 4140*, 4175*

BEREZKIN, D.P.
3479*

BEREZOV, T.T.
1416*, 4147*

BERG, J.W.
2211, 4436

BERG, P.
5278*, 5895

BERGEL'SON, L.D.
5671*

BERGELSON, L.D.
6373*

BERGEON, J.J.
3174

BERGER, H.
1078*

BERGER, R.
565*, 4177*

BERGER, R.L.
2824

BERGHE, H. VAN DEN
1872*

BERGHOFFER, B.
5157

BERGLUND, F.
1605*

BERGOEND, H.
5564*

BERGOLITS, V.M.

445*
 BERGS, M.
 4544
 BERGS, V.
 4614
 BERGS, V.V.
 3069, 3800, 4544
 BERGSAGEL, D.E.
 1448*
 BERGSJO, P.
 5039*
 BERGSTRAND, A.
 6113
 BERKA, L.
 875*
 BERKE, G.
 4616, 4688, 5307
 BERKELEY, J.S.
 2633
 BERMAN, L.D.
 5329
 BERMAN, R.S.
 3163
 BERN, H.A.
 1189*, 4799*
 BERNADOU, A.
 5062*
 BERNARD, C.
 3065
 BERNARD, J.
 899*, 4176*
 BERNARD, P.
 3247
 BERNARD, PH.A.
 2739*
 BERNHARD, W.
 2585*, 4568
 BERNHEIM, J.L.
 2710*
 BERNHEIM, N.J.
 5871*
 BERNLOHR, R.W.
 4900*
 BERNIS, A.J.M.
 3495*
 BERNIS, K.I.
 3072
 BERNSTEIN, R.
 4996*
 BERRY, C.G.
 5755*
 BERRY, C.Z.
 213*
 BERRY, R.
 1804
 BERSI, M.
 577*
 BERTALANFFY, F.D.
 5632*, 5797
 BERTAZZOLI, C.
 2343
 BERTELL, SISTER R.

6084
 BERTIN, P.
 2050*
 BERTINI, B.
 2758
 BERTINO, J.R.
 3325*
 BERTOGLIO, J.
 6036*
 BERTOLOTTI, A.
 6259*
 BERTOLOTTI, R.
 4190*, 4849
 BERTRAMS, J.
 5760*, 6040*
 BERTRAND, E.
 3255, 4018
 BESKA, F.
 3288*
 BESKID, M.
 4874*
 BESKROVNII, A.M.
 3667
 BESSER, G.M.
 6365*
 BESSIS, M.C.
 1874*
 BESSOT, M.
 3305
 BEST, J.M.
 5977
 BETHLENFALVAY, N.C.
 764
 BETSKII, B.A.
 5425
 BETTAME, M.
 1859*
 BETTENS, G.
 3517*
 BETTS, T.E.
 3645
 BEURTON, D.
 3613, 3614
 BEVAN, M.J.
 5374*
 BEVERLEY, P.C.L.
 2603, 5979
 BEVERLY, P.
 1509
 BHAGAT, B.
 3357*
 BHAGWANDEEN, S.B.
 6302*
 BHALLA, P.R.
 383*
 BHAMARAPRAVATI, N.
 3008, 4418
 BHARADWAJ, V.P.
 672*
 BHARDWAJ, S.D.
 870*
 BHARGAVA, K.N.

870*
 BHARGAVA, P.M.
 2988
 BHATHENA, D.
 3961*
 BHATNAGAR, M.K.
 238, 2152*, 4727*, 4972*
 BHATTACHARAYA, M.
 4692, 5361
 BHATTY, R.S.
 1137*
 BHIDE, S.V.
 187, 667*, 793*, 981*, 2988,
 5114
 BHOOPALAM, N.
 773*, 4765*, 4766*
 BHORJEE, J.S.
 6124
 BIANCHI, A.
 4814
 BIANCIFIORI, C.
 4476*
 BIAS, W.B.
 5304
 BIBERFELD, P.
 3435*
 BICHEL, P.
 527*, 831
 BICHLER, K.H.
 6047*
 BICKERT, C.
 1905*
 BICZOWA, B.
 1430
 BICZYSKO, W.
 2029*
 BIELKA, H.
 1429
 BIELSCHOWSKY, M.
 5498*
 BIENTZ, M.
 5817*
 BIERME, R.
 6144*
 BIERNACKA, B.
 3519*
 BIERWOLF, D.
 5342, 5963
 BIEZUNSKI, N.
 5359
 BIGGS, P.M.
 3152*
 BIGHETTI, S.
 863*
 BIGNER, D.D.
 735*, 5277
 BIKOFF, E.
 5608*
 BILDER, J.
 3496*
 BILGER, L.
 4434

BILL, A.H.
10*
BILLIAU, A.
1220*, 1872*
BILLINGS, R.E.
2302
BILLITERI, A.
4119*
BILLITTERI, A.
3915*
BILSKI-PASQUIER, G.
5062*, 6163*
BINAZZI, M.
1764*
BINH, N.Q.
802*
BIOZZI, G.
1573
BIQUARD, J.-M.
2555
BIRBECK, M.S.C.
5959
BIRD, C.
3691, 5762
BIRD, C.C.
1569, 5799
BIRD, C.E.
4854
BIRD, E.S.
3082
BIRG, F.
5964
BIRKMAYER, G.D.
270*, 5224, 6390*, 6391*
BIRO, L.
177*
BIRYULINA, T.I.
126, 2532
BISBY, R.H.
2465*
BISCALDI, G.P.
4473*
BISCHEL, M.D.
4801*
BISCHOF, L.
1239*
BISCHOFF, F.
3642*
BISERTE, G.
775*, 3348*
BISHAI, I.S.M.
53
BISHOP, D.H.L.
1343
BISHOP, J.M.
425, 686, 1746, 2553, 3086,
3110, 3115, 3778
BISHOP, Y.
352, 975*, 4366
BISKIS, B.O.
4515
BISKUPSKA-WIECKO, J.

3576*
BISSEL, M.J.
1412
BISSELL, D.M.
3401*
BISSELL, M.J.
4558
BISTONI, F.
5984*
BISWAL, N.
1015, 1716, 1721, 2542
BISWAS, S.
2829
BITTAR, E.S.
1427
BITTE, L.
4994*
BITTERSLOH, G.
2800*, 3284*
BITTNER, J.
4956*
BJERKNES, R.
3957*
BJOERLIN, G.
4983*
BLACHE, R.
4163*
BLACK, L.M.
1362*, 4609*, 5249
BLACK, M.M.
675*, 1881, 2649
BLACK, O., JR.
1579
BLACK, P.H.
3063, 3088, 3686
BLACKBURN, G.M.
2364*
BLACKER, J.H.
2404*
BLACKLEDGE, A.
6293*
BLACKMAN, K.
151, 2655*
BLACKMORE, M.
1273
BLACKWELL, R.
4383
BLAESE, M.R.
4757*
BLAESE, R.M.
4756*
BLAIR, C.D.
3129
BLAIR, D.G.R.
3992, 6289*
BLAIR, P.B.
1341, 3857, 4681
BLAKE, W.O.
5729*
BLAMEY, R.W.
3198, 3911*
BLANCHARD, J.W.

2404*
BLANGY, D.
1772*
BLANKENSHIP, W.
719, 852
BLASCHECK, J.A.
1655*
BLASKOVIC, D.
3114
BLATON, O.
591*
BLAU, H.-J.
4263*
BLAU, H.J.
5960, 5999*
BLAUSTEIN, J.
2651*
BLAZEK, J.
3035
BLEIBERG, I.
4238*
BLENNERHASSETT, J.B.
1474*
BLICHARSKI, J.
18*
BLINOVA, G.A.
4787
BLINOVA, L.I.
5289*
BLOCK, J.
4659
BLOCK-SHTACHER, N.
4038
BLOEMENDAL, H.
3136, 3495*
BLOMGREN, H.
3226*
BLONDEL, P.
6129
BLONDIN, J.
3433*
BLOOM, B.R.
1231*, 5351
BLOOM, E.T.
4669
BLOOM, G.E.
3302
BLUESTELN, H.G.
1202
BLUMBERG, B.S.
1834
BLUMBERG, P.M.
2810
BLUMEL, G.
4113*
BLUMENSON, L.E.
828*, 5584*
BLUMER, W.
6098*
BLUMING, A.Z.
400, 781*, 2027*, 4657,
4786, 4789

BLUNCK, J.M.	3091, 5281*	BOONE, C.
1559, 5100	BOJINOV, S.	151
BLUMKIN, V.N.	1154*, 3548*	BOONE, C.W.
1219*	BOKESCH, C.	2655*, 3882, 3903
BOARD, J.A.	1788	BOORMAN, G.A.
3393*	BOKHMAN, YA.Y.	5686*
BOBORY, J.	6055*	BOOT, L.M.
2856	BOLANDE, R.P.	2942
BOBROW, S.N.	19*	BOOTH, A.D.
5906	BOLCK, F.	1169*
BOCHAROV, A.F.	4080*, 4272*	BOOTHE, A.D.
5289*, 5997*	BOLDEN, A.	3737
BOCK, F.	680, 1958, 5220, 6286*	BORAM, L.H.
4113*	BOLIN, M.G.	5463*
BOCK, F.G.	4927*	BORBERG, H.
651*, 3687, 4408	BOLIS, G.B.	2371*
BOCKMAN, D.E.	6158*	BORDIN, G.M.
6283*	BOLL, I.	6296*
BOCTOR, A.	6139*	BORDWELL, J.
1963, 1964	BOLLA, M.	2174*
BODELET, B.	2912*	BORECKY, L.
5408*	BOLLENGIER, W.E.	1765*
BODEY, G.P.	4373	BOREK, C.
1395	BOLOGNESI, D.P.	3936, 5599*
BODEY, G.P., SR.	147*, 404, 2487, 2518, 2519,	BOREK, Z.
5360, 5966	4570, 5035*, 5280*	623*, 803*
BODMER, J.G.	BOLONINA, N.i.	BORELLA, L.
2677*	1604*	700, 4680
BODMER, W.	BOLUND, L.	BOREN, H.
2865	1808	4394
BODMER, W.F.	BOMFORD, R.	BORENSTEIN, C.
2677*	767, 3772	3470*
BOEHLANDT, D.	BOMIRSKI, A.	BORENSTEIN, D.
1030	2889*	3182
BOEHM, G.	BONAFOS, M.	BORGAONKAR, D.S.
1857*	1421*, 2801*	6362*
BOEHM, O.R.	BONANNI, F.	BORLAND, R.
1788	4487*	4398
BOEHME, U.	BONAR, R.A.	BORLE, W.O.
3222*	3051	989*
BOEHMER, E.	BOND, L.F.	BORNAND, Y.E.
5364	1095	315*
BOERYD, B.	BONDERMAN, D.P.	BORNSTEIN, R.S.
3300	647*	5473*
BOGDANOV, I.S.	BONELLI, G.	BOROS, B.
6073	205	6359*
BOGDEN, A.E.	BONILLA-MUSOLES, F.	BOROSS, L.
3156, 4522	4253*, 5681*, 6059*	2668*
BOGOVSKII, S.P.	BONK, U.	BORSOS, T.
5850*	319*	1074*
BOHN, E.W.	BONNAY, M.	BORUM, K.
6288*	2095*	2601*, 5324
BOHUNICKA, E.	BONNEAU, H.	BORUN, T.W.
2422*, 6019*, 6371*	3235, 3557*	4997*
BOHUNICKY, L.	BONNEAU, H.P.	BOS, C.J.
857*	1512, 3557*	1128, 3450*, 6112
BOHUON, C.	BONNET, H.	BOSCH, D.A.
2095*, 3556*	5397*	5078
BOIOCCHI, M.	BONT, W.S.	BOSCO, I.
4456*	4393, 5166	5037*
BOIRON, M.	BOOHER, J.	BOSE, H.R.
339, 899*, 2488, 2496, 3065,	5696*	3127

BOSHKOV, A.N.	899*	1730
3484*	BOUSSER, J.	BRAGG, K.U.
BOSKOVIC, D.	5062*, 6143*, 6163*	2774*
2044*	BOUTHILLIER, Y.	BRAI, M.
BOSMA, M.	1573	4363
4739*	BOUTSELIS, J.G.	BRAMBILLA, G.
BOSMAN, H.B.	6325*	3662
5878	BOUTWELL, R.K.	BRANCA, M.
BOSMANN, H.B.	653*, 1245, 2342	1776*
1624*, 1741, 1989, 4552,	BOVA, D.	BRAND, I.
5947*	2592*, 3875	995, 4790, 5404
BOSSI, G.	BOVER, G.G.	BRAND, K.G.
1898*	840	995, 4790, 5404
BOTELLA LLUSIA	BOWDON, B.J.	BRANDCHAFT, P.R.
4146*	2368*	3903
BOTHAM, S.K.	BOWEN, J.M.	BRANDEN, C.I.
81*	129, 688, 4514, 4611	3057
BOTHOREL, P.	BOWIE, E.J.W.	BRANDER, W.
2428*, 2429*	4242*	5129
BOTS, G.T.A.M.	BOWLES, N.D.	BRANDESKY, G.
3436*	4046	5428*
BOTSMAN, N.E.	BOYD, C.B.	BRANDNER, G.
4396	4218*, 4910*	1030
BOTTERO, A.	BOYD, V.A.L.	BRANDSCHAFT, P.
4184*	5206	151
BOTTEX, C.	BOYERS, R.C.	BRAS, G.
5179	4096*, 5438	3253, 6082
BOTTICELLI, A.	BOYES, D.A.	BRATANOV, BR.TS.
6061*	5794	6095*
BOTTOMLEY, R.H.	BOYLAND, E.	BRATIANU, A.
247	2437*	5391*
BOTTURA, C.	BOYLE, W.F.	BRATLID, D.
273*, 3317, 4125*	1497*	6334*
BOUCOT, K.R.	BOYSE, E.A.	BRAUDE, V.I.
1942*	20*, 1841, 5336	1899*
BOUDIAF, A.	BOZZI, A.	BRAUEROVA, J.
2801*	2830	3101
BOULANGER, P.A.	BRADA, Z.	BRAUN, D.D.
1036*	4461*	37
BOULOS, B.M.	BRADLEY, C.F.	BRAUN-FALCO, O.
3322*	1620*	1880, 5224
BOURALI, M.-F.	BRADLEY, M.N.	BRAUN, J.
2574*	6283*	4729*
BOURALI-MAURY, C.	BRADSHAW, E.	BRAUN, M.
3341*	2755, 2756, 2759	2202
BOUREAU, M.	BRADSHAW, R.A.	BRAUNSBURG, H.
3349*	6329*	6339*
BOURGAREL, P.	BRADVAROVA, I.	BRAUNSCHWEIGER, P.G.
1882	6159*	5443
BOURGAUX, P.	BRADY, C.L.	BRAUNSTEINER, H.
436, 1758, 2482, 3827*	5566*	255*, 912*, 2125*, 3507*
BOURGAUX-RAMOISY, D.	BRADY, J.	BRAWERMAN, G.
436, 1758, 2482, 3139	6074	286*, 1974
BOURGEOIS, C.H.	BRADY, L.W.	BRAWN, R.J.
1276*, 1613*	490*	2605
BOURGOIN, J.J.	BRADY, R.	BRAY, D.M., III
6036*	1032	3948
BOURLIOUX, P.	BRADY, R.O.	BRAYLAN, R.C.
3202	1315, 1351	1803, 3733*
BOURLOND, A.	BRAEUNIG, C.	BRAYTON, C.
2038*	2740*	3739, 5936*
BOUSQUET, R.	BRAGDON, J.	BREBOROWICZ, J.

594*, 6274*
 BRECCIA, P.
 5626*
 BREGULA, U.
 1386, 5695*
 BREHM, K.
 6246*
 BREISTEIN, L.S.
 4370
 BREITNER, J.C.S.
 2629
 BREMER, A.
 4160*
 BREMNER, T.
 5258
 BRENK, H.A.S. VAN DEN
 6336*
 BRENNAN, P.J.
 3129
 BRENNER, R.R.
 4206*
 BRENNHOVD, I.
 883*
 BRENT, T.P.
 2353
 BRESNICK, E.
 1579, 1580, 2534
 BRETAUDEAU, J.
 2430*
 BRETTON, R.
 4568
 BREWEN, J.G.
 2477*
 BREWSTER, T.C.
 3621, 3650
 BRICKER, L.A.
 1968
 BRIDGE, M.F.
 5454
 BRIDGER, G.P.
 4945*
 BRIDSON, W.E.
 295*
 BRIEF, D.K.
 5616*
 BRIEF, R.S.
 2404*
 BRIENT, B.W.
 2611, 3175
 BRIER, A.M.
 1810
 BRIERE, N.
 370*, 992*, 5131
 BRIEUX DE SALUM, S.
 1116
 BRIGGS, E.M.
 4085*
 BRIGGS, G.M.
 185, 1243, 2932, 4606*
 BRIGGS, P.M.
 5273
 BRIGGS, W.A.

5337
 BRILES, W.E.
 1324
 BRILL, E.
 1247, 1248
 BRINCKER, H.
 4209*, 5379*
 BRINKLEY, B.R.
 2878
 BRINKLEY, D.
 529*
 BRINKMAN, G.L.
 2200*
 BRISCOE, W.T.
 4083*
 BRISTOL, R.
 4416
 BRITTINGER, B.
 2260*
 BRITTINGER, G.
 6005*
 BRITTON, S.
 5726*
 BROCHIER, J.
 3843
 BROCK, N.
 4
 BROCKHAUS, A.
 3617
 BROCKWELL, P.J.
 5601*
 BRODETSKY, A.F.
 3941
 BRODEY, R.S.
 405
 BRODIN, A.
 2087*
 BRODOVSKY, H.S.
 2166*
 BRODSKIY, R.A.
 494*
 BRODSKY, I.
 6338*
 BRODY, J.I.
 5975
 BROMFIELD, E.
 1012
 BROMOWICZ, J.
 4815
 BRONSON, D.L.
 1716, 1721
 BROOKES, P.
 1565, 1575
 BROOKS, R.E.
 1132
 BROOKS, W.F., JR.
 5513*
 BROOKS, W.H.
 5422
 BROOME, J.
 4023
 BROSS, I.D.J.

828*, 1422*, 6084
 BROTCHI, J.
 4264*
 BROWN, B.W.
 2115*, 4673
 BROWN, C.H.
 5384*
 BROWN, D.Q.
 5081
 BROWN, E.R.
 5896
 BROWN, G.B.
 2972
 BROWN, H.D.
 364, 3321*
 BROWN, J.
 1135*
 BROWN, J.C.
 1407*, 2868
 BROWN, J.S.
 6320*
 BROWN, M.
 4559
 BROWN, N.R.
 2499
 BROWN, R.R.
 305, 5124
 BROWN, W.J.
 3372*
 BROWNE, R.M.
 2728*, 5566*
 BROWNIE, A.C.
 3500*
 BROWNLEE, G.G.
 4189*
 BROWNSTEIN, M.H.
 2862
 BROWNSTEIN, W.E.
 5692*
 BROYN, T.
 5487*
 BROZMANOVA, E.
 3530*
 BRUCCHIERI, A.
 3915*, 4119*
 BRUCE, B.J.
 3359*
 BRUCHER, J.M.
 236, 1491*
 BRUCHHAUSEN, F.V.
 2377*
 BRUES, A.M.
 993, 1001*
 BRUGERE, J.
 6228*
 BRULE, G.
 835
 BRUMMERSTEDT, E.
 1384
 BRUNET, M.R.
 5998*
 BRUNI, J.E.

4846
BRUNNER, K.T.
5310
BRUNNING, R.D.
4937*
BRUNS, G.
1545
BRUSQUET, Y.
1221*
BRUX, J. DE
1908*
BRUX, J. DE
2918*, 2947
BRUYAKO, E.T.
1913*, 5938*
BRUZZONE, S.
190
BRYAN, G.T.
32*, 305, 634, 4387
BRYAN, R.J.
59, 3703
BRYANS, J.T.
2542
BRYANT, J.I.
500*
BRYLINSKI, D.
2765
BUBENIK, J.
3905, 5889
BUCCIARELLI, E.
2238*, 4371
BUCCINO, R.J.
1579
BUCH, H.G.
4909*
BUCH, L.
2022
BUCHAMANN, E.
2741*
BUCHELER, J.
5146
BUCHSBAUM, D.J.
2701*, 2703*
BUCHSBAUM, R.
5924
BUCK, C.
74
BUCK, P.
4221*
BUCKLE, R.M.
6366*
BUCKLEY, P.M.
5264
BUCKTON, K.E.
836
BUECHNER, T.
564*
BUEHRING, G.C.
4885*
BUERKI, K.
1580
BUERKLE, G.

517*, 5851*
BUERKLE, V.
517*
BUESEN, W.
2519
BUETTI, E.
2560
BUETTNER, H.H.
6197*
BUFFE, D.
290*, 551
BUHL, S.N.
4496*, 4963*
BUISINE, J.
2805*
BUKHNY, A.F.
6239*
BUKHTOYAROVA, Z.M.
5865
BUKHVALOV, I.B.
6236*
BULAN, M.B.
6306*
BULBA, S.
4461*
BULBROOK, R.D.
789, 2636
BULGIN, M.S.
101
BULKLEY, B.H.
2635
BULL, J.M.
4033
BULL, J.M.C.
4172*
BULLIVANT, S.
1364*
BULLON RAMIREZ, A.
4284*
BULLON SOPELANA, A.
4284*
BULLOUGH, W.S.
2073*, 5707
BUNDREN, J.C.
4736*
BUNTSER, Y.A.M.
3313
BUOEN, L.C.
995, 4790, 5404
BUONOCORE, F.
5662*
BUONOCUORE, B.
770
BURATTI, C.
3486*
BURBANK, F.
4436, 5413, 5415
BURCH, J.C.
1250, 4449*
BURCHARTH, F.
5060*
BURDEA, M.

5391*
BURDETTE, W.J.
317*, 3350*
BURDICK, J.F.
608
BURG, C.
5317
BURGE, B.W.
2559
BURGER, D.
3761
BURGER, D.R.
1393
BURGER, H.G.
2839, 3927*
BURGER, J.
1030
BURGER, M.M.
132, 433, 5914
BURGESS, F.
2110*
BURGESS, W.A.
983*
BURGHOUTS, J.T.H.M.
3136
BURGIO, G.R.
5396*
BURKE, J.
1184*
BURKE, P.J.
5304
BURKHALTER, A.
671*, 963
BURKI, H.R.
2020, 4573
BURKIN, A.A.
487*
BURKITT, D.P.
533*, 903, 1208
BURLINGHAM, B.T.
704
BURMESTER, B.R.
5282*
BURNETT, J.P.
128
BURNETT, W.
4837*
BURNETT, W.S.
83*
BURNS, D.T.
1647*
BURNS, E.R.
267*
BURNS, F.J.
4434, 5200
BURNS, J.
6316*
BURNS, W.A.
1690*
BURNY, A.
1352*
BUROBINA, S.S.

1416*	BYKOVSKIY, A.F.	CALENDI, E.
BURSTEIN, N.A.	5270	2390*
469	BYRD, B.F.	CALENEI, E.
BURTIN, P.	1250	2314
475, 551, 3628*, 4624,	BYRD, B.F., JR.	CALI, A.
4755*	4449*	4561
BURTON, G.J.	BYRD, R.B.	CALLAN, E.A.O.
1369*	214*	2505
BUSBEE, D.L.	BYRNE, G.E.	CALLE, R.
5121	4560	4137*
BUSCH, H.	BYRNE, M.J.	CALLENDER, M.E.
244, 1064, 1249, 2813, 2848,	5568*	1066*
2875, 3358*, 4070*, 4084*,	CABALLERO, R.G.	CALNEK, B.W.
4617, 4944*, 5529*, 6379*	2808*	1006
BUSCH, R.K.	CABANNE, F.	CALUSER, I.
1064, 4617	5718*	1889
BUSCHECK, F.T.	CABRAL, J.R.	CALVIN, M.
1011	5814*	639
BUSELMAIER, W.	CABRAL, Y.R.	CAMAIN, R.
2410*	40	5, 203
BUSHUEV, YU.I.	CABRINI, R.L.	CAMARRI, E.
4121*	5649*	3949
BUSSOLATI, G.	CACCAVELLI, L.	CAMERON, A.M.
5618*	6060*	2817
BUSTAD, L.K.	CACCIARI, P.	CAMERON, H.M.
1320, 1686*	2726*	3876
BUTCHER, F.R.	CACHIN, Y.	CAMIEL, M.R.
4161*, 4178*, 4271*	3344*, 3421*, 4138*	620*, 1681*
BUTEL, J.S.	CADEMARTIRI, G.	CAMILLERI, J.P.
431, 3755, 4509, 5206	4806*	2303, 3664
BUTENKO, Z.A.	CADENELLI, G.P.	CAMPBELL, J.A.
5210	6171*	3815
BUTLER, B.B.	CADIQU-GUILLERM, M.	CAMPHAUSEN, G.
4228*	6143*	2126*
BUTLER, L.K.	CADY, B.	CAMPION, E.C.
128	4855	5386*
BUTLER, R.E.	CAEN, J.-L.	CAMPOS, J.L.
4069*	3344*, 3421*	1921, 1944*
BUTLER, W.H.	CAFFIER, H.	CANAANI, E.
1266, 1635*, 2411*, 4398	1332	426, 1739, 5207
BUTT, W.R.	CAGOSI, M.	CANDELA, R.B.
6111	4204*	840
BUTTERSTEIN, G.M.	CAIN, W.A.	CANELLOS, G.P.
5847*	4736*	4021
BUTTERY, B.W.	CAJAL, N.	CANEVARI, S.
2727*	3830*	4675
BUTTNER, H.	CALABRESE, L.	CANFIELD, R.
5151	5496*	1040
BUTZLER, W.	CALABRESI, P.	CANIVET, M.
5032	4662	2488, 3091
BUU-HOI, N.P.	CALABRIA, S.I.	CANLAS, M.
3699	4821	2762
BUZHURINA, I.M.	CALAFAT, J.	CANNAT, A.
5177	3767	2485
BYALIK, V.L.	CALAMAI, R.	CANNELIER, R. LE
6245*	956	2801*
BYE, A.	CALCAGNO, E.J.	CANTARANO, G.
306	4819, 4821	4255*
BYFIELD, J.	CALCUTT, G.	CANTOR, C.R.
3919*	4485*	3705
BYKOVSKII, A.F.	CALDWELL, I.C.	CANTRELL, E.G.
5883	3336*	1924

CANTRELL, E.T. 1579, 5121	CARMICHAEL, L.E. 1720	810
CAPDEVILA-TORRA, J. 5624*, 5680*	CARMONA, A. 3219*, 3842	CASCINELLI, N. 1227*
CAPPA, A.P.M. 205, 3267, 3978*	CARNAHAN, W.J. 1942*	CASEY, H.W. 390*
CAPPARELL, N.J. 5990*	CARNEGIE, P. 1187*	CASHMORE, A.R. 3325*
CAPPELAERE, P. 2035*	CAROLINE, N.L. 5979	CASIROLA, G. 1902*
CAPPELLINI, A. 1288*	CARP, R.I. 1346	CASONI, T. 2661*
CAPPS, M.J. 5122	CARPENTER, C.B. 2515	CASPARY, E.A. 1050, 1187*, 1408*, 4734*, 5383*
CAPRA, J.D. 4754*	CARPENTER, R.G. 529*	CASSELL, E. 830
CAPRON, A. 5301	CARR, A.J. 2722	CASSINGENA, R. 2574*, 5205
CAPRON, M. 5301	CARR, D.T. 214*	CASTANERA, T.J. 4491
CAPUTO, A. 654*, 4903*	CARR, J.G. 1188*	CASTEL, Y. 1199*
CAPUTO, R. 3468*	CARRATELLI, G. 618*	CASTELLANOS, H. 3822*
CARACENI, C.E. 3662	CARENDO, A.J. 1331	CASTILLO, J.R. DEL 3596*
CARBILET, J. 6305*	CARRERA, G. 1350	CASTLEMAN, B. 3383*, 4934*
CARBONARA, A.O. 1879*	CARRERAS RUIZ, O. 3979*	CASTO, B.C. 2523
CARBONE, G. 2622	CARROLL, R. 3205	CASTOLDI, G.L. 4275*
CARBONE, P.P. 4021, 4033, 4172*, 4786	CARRUTHERS, C. 4692, 5361	CASTON, J.C. 1420*
CARBONELL, C.C. 3596*	CARSTENS, H.B. 4054*	CASTORIANO, I.M. 3728
CARCATZOWLIS, S. 3568*, 3569*	CARSTENS, P.H.B. 3354*	CASTRO, A. 1350
CARDAMONE, J.M. 6299*	CARSWELL, E.A. 5239	CASTRO, E.B. 5642*
CARDINI, G. 577*	CARTAS, M. 2501	CASTRO, EL B. 2138*
CARDOSO, S. 4863	CARTER, A.E. 1183*	CASTRUP, H.J. 3459*
CARDOTTE, M. 919*	CARTER, D. 4928*	CATALANO, G. 2239*
CARES, H.L. 4290*	CARTER, L.P. 5469*	CATALANO, L.W., JR. 462, 2538, 2650
CARL, P. 4952*	CARTER, R.L. 38, 958, 3680, 4666, 5097, 5773, 5959	CATALONIA, W.J. 1443
CARLASSARE, F. 2961	CARTER, W.S. 917*, 2790*	CATCHPOLE, W.M. 86*, 1506
CARLENS, E. 1848*	CARUBELLI, R. 2357, 4736*	CATE, C.C. 1271
CARLSON, D.H. 4060*	CARUSO, C. 810	CATER, D.B. 1072*, 1082*, 4711*
CARLSSON, S.-A. 1808	CARVALHO, A.R.L. 5043*	CATOVSKY, D. 1454*, 1966, 2017, 4641, 5486*, 5652*, 6117
CARLTON, W.W. 4193*	CASALOTS, J. 4978*	CATOVSKY, K. 1855*
CARMEL, A. 4366	CASCIALLI, M.	CATTAN, A.

2270*	676*	3227*
CATTANACH, B.M.	CENTIFANTO, Y.M.	CHAN, S.P.
344, 1644*	216*	1374
CATTANEO, C.	CEPPELINI, R.	CHAN, T.C.
4106*	1879*	6312*
CATTAROSSO, E.	CERIANI, R.L.	CHANANA, A.D.
4288*	4173*	4013
CATTERALL, W.A.	CERILLI, J.	CHANCE, B.
280*	4700	1487*, 3340*
CATTI, A.	CERILLO, A.	CHANDAVIMOL, P.
1525*	2096*	1276*
CAUCHI, M.N.	CERNA, H.	CHANDLER, F.W., JR.
1659	125, 3810	5519*
CAUCHY, L.	CERNY, J.	CHANDLEY, A.C.
2597*	1785	1301, 2461*
CAUL, E.O.	CERNY, L.	CHANDRA, P.
4063*	3197, 3937	66, 2093*, 2504, 3787
CAULET, T.	CERNY, V.	CHANG, C.F.
3664, 5101, 6071*	857*	5778
CAULIN, CH.	CEROTTINI, J.C.	CHANG, D.C.
4295*	5310	3230
CAVALIERI, E.	CERVOS-NAVARRO, J.	CHANG, N.-K.
639, 3025*	2081*	1797
CAVALLARI, A.	CESARINI, J.P.	CHANG, P.W.
810	3235, 3557*, 4564	4506
CAVALLARO, A.	CESTARI, R.	CHANG, R.
6261*	5626*	306
CAVANNA, M.	CHABAL, J.	CHANG, R.S.
3662	521*	719, 852, 2869
CAVASONZA, G.	CHABANAS, A.	CHANG, S.
1941*	5672*	2610, 2670*
CAVIA, E.	CHABOT, J.	CHANG, S.H.
5620*	3075	794*
CAWLEY, J.	CHAFFEY, J.T.	CHANTLER, S.
3785	3734*	6017*
CAWLEY, L.P.	CHAKI, F.	CHAPEL, J.F.
4059*	4748*	90*, 5137
CAYLA, J.	CHAKRABARTI, S.	CHAPLAIN, M.
4136*	4229*	2056*
CAYOLLA DA MOTTA, L.	CHALKLEY, R.	CHAPMAN, W.H.
4490	2174*, 4087*, 5504*, 5506*	3162
CEBALLOS, R.	CHAMBERS, V.C.	CHAPPLE, M.F.
6283*	2673*	3272
CECCARINI, C.	CHAMEAUD, J.	CHAPUIS, G.
1115	3028, 5197	2744*
CECILIONI, V.A.	CHAMLOU, I.	CHARBIT, A.
4823, 5414	3349*	493, 3725
CEDERQVIST, C.	CHAMNESS, G.C.	CHARDON, V.
384*	2872	5564*
CEDROLA, G.C.	CHAMORRO, A.	CHARDONNET, Y.
2096*	3765	397, 3828*
CEFIS, F.	CHAMPOUX, J.J.	CHARLES, A.H.
2312, 2582*	1965	4170*
CEGLOWSKI, W.S.	CHAN, B.W.B.	CHARLES, R.T.
478, 1009, 1375, 1785, 4574	226, 545, 4213*	4456*, 5791
CEGRELL, L.	CHAN, D.P.S.	CHARNEY, J.
1196*	6342*	1501
CELADA, F.	CHAN, P.	CHARREL, J.
1877*	5861	2596*
CELER, V.	CHAN, P.C.	CHARY, K.K.N.
3197	3668	3210
CENKOVA, V.	CHAN, P.L.	CHASSAGNE, D.

2840
CHATAIGNEAU, P.
824*
CHATTOPADHYAY, S.K.
364, 3321*
CHAUDHRY, A.P.
4100*
CHAUVERGNE, J.
1216*, 3625*
CHAVAN, B.G.
5114
CHAVANEL, G.
4755*
CHAVAUDRA, N.
3725
CHAVELET, F.
4176*
CHAVES, E.
6363*
CHAYOTH, R.
5806
CHECHIK, B.E.
461, 2658*
CHECK, J.H.
490*
CHEDD, G.
3622*
CHEERS, C.
4666
CHEEVER, A.W.
3944
CHELIBONOVA-LORER, H.
5499*, 5500*
CHELLO, P.L.
3325*
CHEMAMA, R.
4390
CHEN, C.-H.
3926*
CHEN, H.-C.
1049, 1087, 1431
CHEN, H.W.
4034, 5316
CHEN, J.
5451
CHEN, K.P.
1927, 2540
CHEN, L.
472
CHEN, L.-T.
1969
CHENG-MINODA, K.
3352*
CHENG, W.C.
809
CHEONG, M.P.
1767*
CHERISTANIDIS, I.
6221*
CHERNOV, V.A.
2182*, 5096
CHERNUKHIN, A.A.

2094*
CHERRICK, H.M.
1086
CHERRY, C.P.
351, 2923, 2952, 3007
CHERVENICK, P.A.
2815, 5507*
CHESEBRO, B.
1870*
CHESNEY, C.F.
4169*
CHESTERMAN, F.C.
418, 421
CHEUNG, W.H.
2860
CHEVREL, B.
5001
CHEVREL, J.P.
5001
CHI, C.H.
2778*
CHIAK, R.W.
1660
CHIANG, R.W.
2366*
CHIANG, T.C.
1927
CHIARUGI, V.P.
6292*
CHIECO-BIANCHI, L.
112, 3572*
CHIELI, T.
2343
CHIEN, T.C.
1152*
CHIFAN, M.
5594*
CHIGA, M.
1287*, 1652*
CHIKATA, E.
1257, 5793
CHILDS, T.C.
490*
CHILLER, J.M.
2653*
CHIN, C.-K.
3928*
CHIOU, J.F.
2540
CHIPMAN, P.J.
5713
CHIR, M.
4355*
CHIRIGOS, M.A.
2549, 3064, 3102, 3119
CHISALE, E.
6156*
CHISARI, F.V.
1385
CHISCON, M.O.
3188
CHISLEAG, G.

2142*
CHITALE, A.R.
4300*
CHITIYO, M.
6079
CHITKARA, Y.K.
2244*, 2245*
CHIU, S.F.H.
1685*
CHIVERS, B.R.
4367
CHO, H.Y.
3703, 3756, 4537
CHO, S.H.
2026*
CHOI, H.U.
293*
CHOI, N.W.
3265
CHOIE, D.D.
2446*
CHOKSI, S.K.
4834*
CHONE, B.
3573*
CHOPPRA, H.
3750
CHOPRA, H.C.
138*, 1693, 1694, 1734,
3099, 3800, 4522, 4550,
4556, 4600*, 5877
CHOPRA, P.K.
4960*
CHOPRA, S.
814
CHOQUET, C.
4041
CHORDI, A.
488*
CHORZELSKI, T.
1856*
CHOU, T.C.
2047*
CHOUROULINKOV, I.
1570, 2432*
CHRETIEN, J.
5006, 5197
CHRETIEN, P.B.
454, 854, 1041, 3907
CHRIST, M.L.
1411
CHRIST, T.F.
4062*
CHRISTENSEN, W.R.
1104
CHRISTIAN, C.D.
4044
CHRISTIAN, E.C.
5690*
CHRISTIAN, R.T.
2545
CHRISTIANI, A.

1218*
 CHRISTIE, B.
 2369*
 CHRISTINE, B.
 809, 1920, 4809
 CHRISTINE, B.W.
 1947*, 3272, 5429*
 CHRISTMAN, J.
 1318
 CHRISTOFFERSEN, T.
 5125
 CHRISTOPHERS, E.
 1880
 CHRISTOPHERSON, W.M.
 3467*, 4220*
 CHRISTOV, K.
 2718, 3735*, 5087, 5170
 CHU, C.T.
 1049
 CHU, E.W.
 5683*
 CHU, S.-H.
 3926*
 CHU, S.Y.
 3336*
 CHU, T.M.
 3846, 4737*, 5992*
 CHUAH, C.-C.
 1611*
 CHUANG, J.
 4737*
 CHUAT, J.C.
 3065
 CHUBAROVA, N.V.
 6070*
 CHUDECKI, B.
 2469*, 4499*
 CHUDINA, A.P.
 6219*
 CHUDINOVA, I.A.
 4845
 CHUMAKOVA, L.P.
 3538*
 CHUNG, E.B.
 4742*
 CHUNG, L.W.K.
 1299*, 1476*
 CHUNG, S.O.
 6102*
 CHURCHILL, W.H.
 2162*, 4650
 CHURG, J.
 3601, 5782
 CHUTE, R.N.
 1302
 CHUTKOV, N.A.
 5874*, 5928*
 CHVAPIL, M.
 4461*
 CHYLE, M.
 4588*
 CHYLE, P.

4588*
 CIAMPOR, F.
 1779*
 CICALI, F.
 6202*
 CIESIELSKI-TRESKA, J.
 2171*
 CIESLUK, S.
 5290, 5326
 CIHAK, A.
 4466*
 CIHAK, R.W.
 2219, 3412*
 CIKES, M.
 409, 1400
 CINTORINO, M.
 5460*
 CIOLI, V.
 252, 641
 CIRIOTTI, G.
 5477*
 CIRNU-GEORGIAN, L.
 4164*
 CISNEROS, L.
 2804*
 CITARELLA, R.
 6286*
 CITOLER, P.
 3724*
 CITTADINI, A.
 1487*, 3340*
 CITTADINI, G.F.
 1490*
 CIVIDALLI, G.
 2031*, 4098*
 CIZKOVA, J.
 5679*
 CLAPP, N.K.
 4618, 5418
 CLARK, A.F.
 4854
 CLARK, H.F.
 2584*, 3138
 CLARK, J.
 830
 CLARK, R.B.
 1904*
 CLARK, S.D.
 1544
 CLARK, W.R.
 131
 CLARKE, S.
 4965*
 CLARKSON, B.D.
 1427, 1447*
 CLASSEN, M.
 6376*
 CLAUDIO, F.
 4185*
 CLAUVEL, J.P.
 1873*
 CLAVEL, B.

2289*
 CLAVIER, M.
 1199*
 CLAVIN, M.
 3025*
 CLAY, A.
 775*, 4349*
 CLAYSON, D.B.
 617*
 CLAYTON, D.A.
 2865
 CLEMENS, J.A.
 2929, 4455*
 CLEMENTE, S.
 4145*
 CLERCQ, E. DE
 2497
 CLERICI, E.
 1075*
 CLEVELAND, B.R.
 2122*
 CLEVELAND, G.
 3230
 CLIFFORD, P.
 3876, 3942, 4690
 CLIFTON, K.H.
 2003, 4493
 CLINE, M.J.
 839, 3180, 3853, 5667*
 CLIVE, D.
 5871*
 CLOT, J.
 5397*
 CLOUT, I.
 6106*
 CLOUTIER, G.
 1281*
 COBB, L.M.
 4733*
 COBO, A.
 4243*
 COCCIA, P.F.
 5402
 COCHRAN, A.
 4027
 COCHRAN, A.J.
 262*, 1510, 3897
 CODINGTON, J.F.
 746, 4764*
 CODY, R.
 471
 COE, E.L.
 5435
 COE, J.E.
 5260
 COETZEE, M.L.
 1484*, 5451
 COEZY, E.
 340, 4390
 COFFEY, D.S.
 1299*, 1476*
 COFFIN, D.

4366
COFFIN, D.L.
5803
COFFIN, J.M.
1745, 2556, 3040, 4518
COFFINO, P.
180*, 4705*
COFFMAN, R.L.
4760*
COGGIN, J.H.
717
COGGIN, J.H., JR.
1042, 1063, 3204
COHAN, M.
5557*
COHAN, Y.L.
2450*
COHEN, A.B.
663*
COHEN, A.K.
2170*
COHEN, A.M.
608, 757, 787, 2076*, 3935*,
4703
COHEN, B.
1259
COHEN, D.
1878*, 6104*
COHEN, E.
4737*
COHEN, G.
5448
COHEN, G.H.
3059
COHEN, H.J.
2161*
COHEN, I.
4620
COHEN, J.L.
596*
COHEN, M.M.
2584*, 5456
COHEN, M.N.
4996*
COHEN, N.
959
COHEN, S.
3849
COHEN, S.M.
634
COHN, N.K.
4493
COHN, Z.
1850*
COHNEN, G.
2260*, 6005*
COLE, C.A.
950
COLE, G.A.
1854*
COLE, P.
78, 1508, 2763, 3266, 3971,

6078
COLE, R.D.
1189*, 4799*
COLEMAN, M.
3394*
COLEMAN, R.
5838*
COLEY, G.M.
4979*
COLIGAN, J.E.
4648, 4689, 5976
COLIN, G.
3414*
COLLAVO, D.
112, 3572*
COLLEY, V.B.
120
COLLIMEDAGLIA, P.
4288*
COLLINS, C.J.
5269
COLLINS, G.B.
4456*
COLLINS, J.
2480*
COLLINS, M.J.
5283*
COLLIS, C.H.
1583, 4825*
COLLOMB, H.
1945*
COLMERAUER, M.E.M.
1800, 1803, 3733*
COLNAGHI, M.I.
1610*, 2326
COLOMBIES, P.
6144*
COMBEMALE, B.
3514*
COMBES, P.F.
3725
COMBS, L.
1843*
COMI, P.
5583*
COMMERFORD, L.S.
4034
COMMONER, B.
2366*
COMPANS, R.W.
1747, 5933*
COMSTOCK, G.W.
1781
CONDAMINE, H.
2874
CONDIT, P.T.
247
CONE, C.D., JR.
224
CONESA, L.C.G. DE
2202
CONGDON, C.C.

4530, 5202
CONKLIN, D.J.
113
CONNELLY, R.
806, 4809
CONNER, R.
3043
CONNEY, A.H.
306, 1566, 5133
CONRAD, E.
2978, 3704, 5156
CONSIGLI, R.A.
3046
CONSTANS, J.P.
4640, 5962, 6216*
CONSTANTINESCU, A.
3472*
CONTESSÉ, G.
4346*
CONTESSO, G.
6195*
CONTESSO, G.P.
4173*
CONZELMAN, G.M., JR.
4469*, 5092
COOK, K.B.
179*
COOK, M.L.
729*
COOK, P.
3277, 4825*
COOK, P.J.
1583
COOKE, W.T.
1835
COOKSON, P.J.
5548*
COOMBS, R.R.A.
1878*
COONEY, L.M., JR.
3269
COOPER, D.A.
1942*
COOPER, E.H.
883*, 3326*, 6328*
COOPER, G.M.
3540*
COOPER, H.L.
4443
COOPER, I.A.
4166*
COOPER, J.R.
3324*
COOPER, M.A.
4853
COOPER, M.D.
6283*
COOPER, N.R.
1832
COOPER, R.W.
1028, 4524
COOPER, T.W.

4009	3939	2059*, 4067*
COOPERBAND, S.R.	COUREY, N.G.	CRATERI, P.T.
2637, 2693*, 5990*	1225*	866*
COOPERMAN, J.M.	COURSON, B.	CRATHORN, A.R.
3503*	1945*	2353
COPPEY, J.	COURTENAY, V.D.	CRAVIOTO, H.
1777*, 3092	4168*	3457*, 3700
COPPOC, G.L.	COURTNEY, R.J.	CRAWFORD, A.M.
5516*	1360*	1569
CORAGGIO, F.	COUTELLE, C.	CREAGAN, E.T.
2239*	319*	5421
CORBERAND, J.	COUTELLE, R.	CREASY, B.
3561*, 6144*	319*, 3593*	2315
CORK, A.	COUTINHO, V.	CREGER, W.P.
3360*, 4514	273*, 3317, 4125*	1664
CORNELIUS, E.A.	COUTINHO, W.G.	CREMER, N.E.
3206, 3209, 5228, 5246	4769*	1771*, 4513
CORNELL, G.N.	COUTURAUD, M.	CREMISI, CH.
3526*, 5573*	4136*	5205
CORNEO, G.	COVELLI, I.	CREPALDI, G.
1479*	5444, 5669*	4921*
CORRADI, G.	COWAN, D.H.	CREUTZFELDT, C.
6278*	4726*, 5582*	2149*
CORREA, P.	COWAN, M.A.	CREUTZFELDT, W.
23*	34	2149*
CORTESE, A.F.	COWAN, N.J.	CRICHLow, R.W.
3526*, 5573*	5550*	3966
CORY, J.G.	COWDELL, R.H.	CRIFO, C.
1331, 4212*	2751	2830
COSCIA-PORRAZZI, L.	COWLING, D.C.	CRILE, G., JR.
4561	5811	841, 895*, 3191
COSTA, C.	COX, B.J.	CRISALLI, M.
4921*	4947*	3315
COSTANZI, G.	COX, C.B.	CRISPEN, R.G.
774*	2811	6007*
COSTANZO, F.	COX, J.D.	CRISS, W.E.
1344, 2539	5574*	5538*
COSTEA, N.	CRABTREE, G.W.	CRIST, W.
4766*	291*	4352*
COSTIN, C.	CRABTREE, G.W.C.	CRITCHLEY, D.
3254, 3967, 3970	850	1738
COSTLOW, C.C.	CRADDOCK, V.M.	CRITTENDEN, L.B.
1112	355, 966, 1267, 1585, 4862	1324
COTCHIN, E.	CRAGG, J.	CROCKER, D.
4268*	1096	4062*
COTO, V.	CRAIG, A.W.	CROCKER, J.F.S.
2239*	5122	1885
COTROPIA, J.	CRAIG, J.M.	CROCKER, T.T.
1816	4226*	4362, 5835*
COTTI, L.	CRAIG, N.	CROFT, C.J.
5815*	1118	3097
COTTIER, H.	CRAIGE, B.	CROISSANT, O.
3391*	3035	5881
COUDERT, A.	CRALLEY, L.J.	CROISY, A.
2666*	1458*	39
COUDERT, F.	CRAMER, H.-J.	CROIZAT, H.
2597*	4111*	3225*
COUKELL, A.	CRAMER, R.	CROMEANS, T.L.
2677*	4567, 5911	2599*
COULBOIS, J.	CRAMP, W.A.	CRONIN, A.P.
1215*	2480*	1532
COUPEZ, F.	CRARY, D.D.	CRONIN, J.

27*
 CRONKITE, E.P.
 3391*, 4013
 CROOK, R.B.
 5688*
 CROOKE, S.T.
 4084*
 CROSS, M.E.
 1129
 CROUCH, N.A.
 1205, 3141
 CROUCH, R.
 5892
 CROVERI, G.
 3376*
 CROVETTI, A.J.
 634
 CRUICKSHANK, A.H.
 1555
 CRUMPACKER, C.S.
 707
 CRUSE, J.M.
 4668
 CSIBA, A.
 2729*
 CSUKA, O.
 6054*
 CUATRECASAS, P.
 294*
 CUCCURULLO, L.
 2239*, 2313
 CUDKOWICZ, G.
 2665*
 CUDNEY, T.L.
 753
 CUKIER, J.
 3613, 3614
 CULLEN, T.H.
 5553*
 CULLITON, B.J.
 3615, 4610*
 CULP, L.A.
 716, 721, 1349, 2514
 CULP, T.W.
 2891*
 CUMAR, F.A.
 1032
 CUNDALL, R.B.
 2465*
 CUNEO, J.M.
 4328*
 CUNNINGHAM, C.
 4822
 CUNNINGHAM, P.J.
 2122*
 CUPRAK, L.J.
 5655*
 CUREA, I.
 2780*
 CURRIE, A.R.
 4414, 5020
 CURRIE, G.A.

168*, 3873, 4336*
 CURRIE, J.M.
 1110*
 CURTIS, H.J.
 3732
 CURUTCHET, H.P.
 1972
 CUSTER, R.P.
 2874
 CUTLER, S.J.
 1881, 1920, 2649
 CUTRONEO, K.R.
 6331*
 CUTTNER, J.
 5580*
 CUZIN, F.
 1772*, 5026
 CYKALEWICZ, Z.
 4447
 CYMBALISTA, S.
 5359
 CYSEWSKI, S.J.
 3649
 CZACHOR, M.
 4446
 CZARNOMSKA, A.
 5593*
 CZECHOWICZ, W.
 6277*
 CZERNOBILSKY, B.
 1967
 D'ACUNTO, A.
 2239*
 D'AGOSTINO, M.A.
 4022
 D'ANGELO, E.
 3564*, 3565*
 D'ARMIENTO, M.
 3308
 D'ATH, E.F.
 5498*
 D'ERRICO, G.
 1217*
 D'HOOGHE, M.
 2035*
 D'OLIVEIRA, J.J.G.
 3982*
 DA COSTA, M.
 4969*
 DA SILVA HORTA, J.
 4490
 DA SILVA RODRIGUES, J.
 5043*
 DAAMS, J.H.
 1043, 4305
 DABBOUS, M.K.
 5600*, 5604*
 DABICH, L.
 764, 5402
 DABROWSKI, J.
 2029*, 3793
 DACIE, J.V.

489*
 DACRE, J.C.
 2986
 DAEHNFELDT, J.L.
 5664*
 DAFTARY, D.K.
 200, 4407, 4834*
 DAGNA-BRICCARELLI, F.
 3315
 DAGNA, F.
 4357*
 DAHLEN, R.F.
 213*
 DAHLGREN, S.
 2199*
 DAHLIN, D.C.
 4093*, 5520*
 DAIBER, A.
 3219*, 3842
 DAILY, N.H.
 1793
 DAKIN, A.R.
 505*
 DALES, S.
 1004
 DALEZIOS, J.I.
 5153
 DALFORNO, S.
 6173*
 DALGARD, D.W.
 35
 DALHAMM, T.
 2939
 DALLENBACH-HELLWEG, G.
 971*, 5399
 DALTON, A.J.
 3783, 4334*, 6291*
 DALTON, T.
 1648*
 DAMJANOV, I.
 263*, 3462*
 DAMLE, S.R.
 867*, 4298*
 DAMMACCO, F.
 4738*
 DAMME, D. VAN
 1759
 DAN, V.
 823*
 DANESHBOO, K.
 4990*
 DANIEL, B.G.
 933, 3675, 3697
 DANIEL, M.D.
 491*, 3757, 3781, 3822*,
 3824*, 3832*, 5925
 DANIEL, R.W.
 3034
 DANIELS, J.C.
 1683*
 DANIELSSON, M.
 109*

DANISOVA, J. 4118*	DAVID, J.R. 2696*, 4650	DAWOOD, M.Y. 1987
DANKO, I.M. 5393*	DAVID, S.S. 4332*	DAWSON, G. 237
DANNA, K. 1752	DAVIDOVA, S.YA. 4845	DAWSON, P.J. 743*
DANNA, K.J. 3741, 3776	DAVIDSOHN, I. 1056, 2632	DAY, E.D. 3841, 5330
DANNEEL, R. 4807	DAVIDSON, C.S. 511	DAY, N. 221*, 350, 4456*, 5791
DANNENBERG, H. 2407*, 5076	DAVIDSON, E.A. 4750*	DAY, N.E. 3744, 6082
DANO, K. 1995	DAVIDSON, J.K. 4444	DE ALMEIDA SOARES, H. 5043*
DANON, F. 1873*	DAVIDSON, N. 1124	DE ANTONI, A. 4921*
DAO, T.L. 1295*, 2133*	DAVIE, J. 3521*, 5576*	DE ANTONI, E. 5662*
DAQUST, R. 669*, 956, 3654, 4780	DAVIE, J.M. 2835	DE BARBIERI, A. 3850
DAPKUS, D.C. 5238	DAVIES, A.J.S. 4666	DE BOER, W.G.R.M. 1659
DARBY, N.B., JR. 3770	DAVIES, D.J. 1868*	DE BRUX, J. 3939
DARDACHTI, D. 2034*, 3379*	DAVIES, D.R. 6021*	DE CHIRICO, T. 4184*
DARGAN, E.L. 2824	DAVIES, J.N.P. 6074	DE CLERCQ, E. 417
DARGENT, M. 314*, 6036*	DAVIES, R. 3023*	DE ESTABLE-PUIG, J.F. 380*
DARIDON, F. 1199*	DAVIES, R.F. 2375*	DE ESTABLE-PUIG, R.F. 380*
DARMAWAN, S. 2757	DAVIES, S. 1175*	DE GAETANI, C.F. 6061*
DARNELL, J.E. 430	DAVIES, S.W. 2747	DE GIORGI, L.S. 4225*, 4927*
DARZYNKIEWICZ, Z. 2467*, 3731	DAVIS, A.M. 4793	DE HALLEUX, F. 4502
DAS, M.M. 4322*	DAVIS, D. 5924	DE HARVEN, E. 1047, 5944*
DASKAL, Y. 1064, 1249, 4617	DAVIS, G. 4739*	DE JONG, U.W. 6082
DAT-XUONG, N. 2957	DAVIS, H.J. 3895	DE JOURNETT, R. 695
DATE, A. 736*	DAVIS, K.D. 2841, 3449*	DE KASTNER, M.R.Q. 4878*
DAUCHEL, J. 258*	DAVIS, N.L. 5907	DE KOCK, D.H. 4457*
DAUCHY, S. 316*	DAVIS, R.H. 392*, 2158*	DE LANDAZURI, M.O. 4621
DAUGUET, C. 5881	DAVIS, R.L. 5479*	DE LIGNIERES, B. 5034*
DAUM, R. 4045	DAVIS, W.D. 580*	DE LUCA, C. 3997
DAUNE, M. 5825*	DAVREMONT, G. 3545*	DE LUCA, D. 1837
DAUSSET, J. 1048, 1204, 1403*	DAVYDOVA, S.YA. 6182*	DE LUCA, L. 4487*, 5846*
DAVE, J.K. 898*	DAW, E. 2782*	DE LUSTIG, E.S. 67
DAVID, D. 5275	DAWKINS, R.L. 5568*	DE MAEYER-GUIGNARD, J. 3834*

DE MICCO, C.
4564
DE MICCO, M.
5496*
DE MICCO, PH.
3694, 5433
DE MORENTIN, Y.M.
374*
DE NARDO, G.L.
2071*
DE NECHAUD, B.
762, 5300
DE OCAMPO, G.
4326*
DE OLIVOS, N.L.
4821
DE OME, K.B.
120, 185, 1243, 4606*
DE OSQUALE, A.
843
DE PETRIS, S.
1776*
DE SAINT-MAUR, P.
4136*
DE SALLE, L.
5605*
DE SANCTIS, C.
5477*
DE SANTIS, U.
6260*
DE SCHRYVER, A.
3876
DE SERRES, F.J.
4468*, 4483*
DE-THE, G.
166, 221*, 2594*, 3402*
DE THE, G.
4347*, 4663
DE VAUX ST. CYR, C.
5349
DE VEGA, V.M.
1191*
DE VITA, V.T.
4021
DE WYS, W.
3306
DEAL, D.R.
1385
DEAN, G.
3335*
DEAN, P.N.
5872*
DEASY, P.F.
3205
DEBOV, S.S.
2182*, 4840
DEBRAY, C.
1275*
DECHAMBRE, R.P.
502*, 1469*
DECHAUME, Y.P.
518*

DECKER, J.
1837
DECKERS, C.
4732*, 6010*, 6012*
DECKERS, P.J.
745, 1389, 3160
DECKNER, K.
2082*
DECKNER, K.
6384*
DECLEVE, A.
4502
DECLITRE, F.
2301
DECONOMOU, A.
530*
DECREUSEFOND, C.
1573
DEDKOV, I.P.
5983*
DEELEY, T.J.
2902
DEFENDI, V.
148*, 312*, 432, 1751, 3124, 3138
DEFENDINI, R.
1451*
DEGOS, L.
1048
DEGOWIN, R.L.
1903*
DEGTARENKO, V.I.
3167, 3200
DEGURSE, P.E.
45
DEHARVEN, E.
5256
DEHLINGER, H.
181*
DEHNEN, W.
3617
DEHNER, L.P.
5571*, 5650*
DEICHMANN, W.B.
1248, 5741*
DEINGS, P.
3505*
DEINHARDT, F.
1320, 1339, 2336, 3153*, 3806, 3823*, 4532, 4572, 5282*, 6279*
DEKEGEL, D.
2526
DEL AMO, L.L.
320*
DEL BUONO, I.
1719
DEL GIACCO, G.S.
6030*, 6031*, 6033*
DEL GIACO, G.S.
4712*
DEL RIO MARCO, F.
6160*

DEL VECCHIO, M.
2096*
DEL VILLANO, B.
4750*
DELAIN, E.
3100, 3117
DELAITRE, B.
4162*
DELAMORE, I.W.
82*
DELANEY, V.B.
1614*
DELANEY, W.E.
233
DELARUE, J.
2303, 3664
DELARUE, N.C.
3607
DELAUNAY, J.
2175*
DELBEBE, M.J.
3545*, 6130
DELFOR PODESTA, L.
4819, 4821
DELFS, E.
3307
DELGADO-PARTIDA, P.
6297*
DEHANTY, J.D.A.
1031
DELIMBETOVA, G.A.
5289*
DELIUS, H.
5279*
DELL'ACQUA, A.
5496*
DELLA CUNA, G.R.
4473*
DELLA PORTA, G.
40, 1610*, 4569
DELLA TORRE, G.
4569
DELMEZ, J.A.
959
DELMON, G.
3626*
DELORIMIER, A.A.
4276*
DELSOL, G.
3561*
DELUCA, C.
5456
DEMAILLE, A.
251, 3241*, 6285*
DEMAN, J.
853
DEMANY, M.A.
4075*
DEMETRIOUS, J.
3697
DEMINATTI, M.

804*
 DEMOISE, C.F.
 3756, 4537
 DEMPO, K.
 2299, 2300, 3714
 DENISIEWICZ, R.
 394*
 DENK, H.
 4684
 DENLINGER, R.H.
 5789
 DENNIS, A.J.
 6308*
 DENT, P.B.
 3120, 4646
 DENYS, A.
 6125
 DEODHAR, L.P.
 4909*
 DEODHAR, S.D.
 841, 895*, 1069*, 3191,
 5384*
 DEOL, J.U.R.
 2073*
 DEPIEDS, R.
 3218*
 DEPLANO, A.
 3285*, 4203*
 DERASSE, A.R.
 490*
 DERGE, J.G.
 2517
 DERIZHAN, A.
 1192*
 DERIZHANOVA, I.S.
 6069*
 DEROUT, J.
 1908*, 2947
 DERR, I.
 1816
 DES ROCHES, G.
 5308
 DESAIVE, C.
 3536*
 DESCHAUX, P.
 5179
 DESCHNER, E.E.
 3239
 DESFOSSSES, B.
 5769
 DESHPANDE, V.A.
 534*
 DESMAZES, J.-P.
 2428*, 2429*
 DESPREZ-CURELY, J.P.
 899*
 DESSELBERGER, U.
 5266
 DESSELBERGER, W.
 5956*
 ETTER, J.
 4243*

DEUTSCHLAENDER, N.
 6193*
 DEV, V.G.
 3473*, 5599*
 DEVINE, K.D.
 880*
 DEVINE, R.L.
 1000*
 DEVITA, V.T., JR.
 3994
 DEWEY, W.C.
 1309*
 DHAR, P.
 1869*
 DHARAMADHACH, A.
 5401
 DHOM, G.
 1526*
 DHRU, R.
 4988*
 DI FRANCO, E.
 3886
 DI GARZIA, L.
 4345*
 DI LUZIO, N.R.
 5298
 DI MARCO, A.
 321*
 DI MARCO, A.T.
 3921*
 DI PAOLO, J.A.
 640, 1535, 1591, 1661, 2823,
 3646, 5770
 DI SAIA, P.J.
 1401
 DIA, A.
 323*
 DIALLO, N.
 825*
 DIAMANDOPOULOS, G.T.
 5321
 DIAMOND, L.
 2311, 2991
 DIAZ-FLORES, L.
 257*, 6146*
 DIAZ, M.
 4207*
 DICK, F.R.
 6009*
 DICKINSON, V.A.
 4063*
 DICKSON, A.
 5653*
 DIDDLE, A.W.
 2160*
 DIDIER-FICHET, M.-L.
 2594*
 DIDISHEIM, P.
 4242*
 DIEBOLD, J.
 2303, 3664, 4079*, 6165*
 DIEBOLT, G.

3157
 DIEHL, V.
 5908
 DIENER, S.
 1147*
 DIETZ, M.
 4645
 DIETZ, M.H.
 964
 DIETZ, W.
 6064*
 DIETZMAN, R.H.
 677*
 DIETZSCHOLD, B.
 5940*
 DIJKSTRA, J.
 1561, 3688
 DIJONG, I.
 1351
 DILLARD, P.H.
 5484*
 DILLARD, R.D.
 5077
 DILLER, I.C.
 5479*
 DILLER, R.F.B.
 4454*
 DIMITROV, N.V.
 2631, 2846, 2890*, 5988*
 DINAKAR, I.
 4872*
 DINCOL, G.
 974*, 2976
 DINCOL, K.
 974*, 2976
 DINTSMAN, M.
 4982*, 6357*
 DION, A.S.
 5953*
 DIOP, B.
 520*, 825*
 DIOP, D.
 2796*
 DIOP, S.
 316*
 DIOT, M.-N.
 3556*
 DIPERT, M.H.
 5601*
 DIPPLE, A.
 2414*, 3671, 4410
 DIRINGER, H.
 4549
 DISCHLER, W.
 6388*
 DISTEFANO, H.S.
 5357
 DIVERTIE, M.B.
 214*
 DIXON, B.
 3682
 DIXON, F.J.

2013, 3852, 5308
DIXON, J.A.
3974
DIXON, J.R.
4403
DIYACHKOVA, L.V.
3597*
DLUHY, R.G.
1414
DMOCHOWSKI, L.
2909, 3784, 4611, 5212
DOANE, F.W.
2573*
DOBOS, M.
3417*
DOBRESKU, G.
5594*
DOBRJANSKY, A.
5631*
DOCHERTY, J.J.
2543, 4504, 4520
DOCIMO, R.
5660*
DODGE, O.G.
1918
DODONOVA, N.N.
2532
DODS, R.F.
2172*
DOELL, R.G.
1062
DOERDELMANN, P.
1160*
DOERFLER, W.
704, 4529
DOERR, R.C.
2321
DOHAN, C., JR.
5879
DOHERTY, D.G.
4413
DOI, T.
1020, 1059
DOIDA, Y.
1630*
DOIG, A.T.
4817
DOLAPCHIEV, L.
5499*
DOLGINTSEV, V.I.
1940*
DOLL, R.
610, 621*, 1600, 1924, 2209,
4824
DOLLARHIDE, N.E.
101
DOMAGALA, W.
2028*, 2157*, 2197*, 3497*,
5592*, 6207*
DOMBERNOWSKY, P.
5410
DOMBOS, L.
4575
DOMINICZAK, K.
2803*
DOMMASCH, M.
2992, 6289*
DOMNINA, L.V.
2825
DOMSCHKE, W.
2043*
DON, M.
3472*
DONATH, K.
4129*
DONCHEVA, N.
6095*
DONEGAN, W.L.
4822
DONNELLY, W.J.
556*, 6029*
DONNER, L.
3093, 5889
DONNER, M.
5317
DONOFF, R.B.
4877*
DONOSO, S.
3017*
DONOVAN, J.W.
2749, 2789*, 6087
DONOVAN, P.J.
640, 1535, 1591, 1661, 3646
DORE, J.-F.
2666*, 3201
DORFMAN, A.
237
DORFMAN, H.D.
2116*
DORFMAN, M.V.
5983*
DORFMAN, N.A.
3870
DORFMAN, R.F.
4932*
DORMANDY, T.L.
2447*
DORN, C.R.
799*, 5706
DOROGOKUPLYA, A.G.
5095
DORRINGTON, K.J.
178*, 4753*
DORSETT, B.
1567
DOSIK, H.
5668*
DOSKOCIL, J.
1765*
DOST, F.N.
664*
DOTSENKO, A.P.
3553*
DOUCHEZ, J.
3725
DOUGHERTY, R.M.
175*, 455, 2521, 5357
DOUGHERTY, T.F.
1104
DOUGLAS, S.D.
6005*
DOUMENC, J.
6164*
DOUNCE, A.L.
296*
DOURMASHKIN, R.R.
176*
DOVE, L.F.
64
DOVEY, H.
2865
DOW, D.
1450*
DOW, L.W.
4025
DOWD, J.E.
3968
DOWLING, M.D., JR.
1427
DOWN, W.H.
2437*
DOXEY, D.
243
DOYLE, D.
4906*
DOYLE, M.
3041
DRABKIN, D.L.
1251
DRACH, J.C.
3754
DRACOTT, B.N.
1801
DRAGOMERETSKII, V.D.
3167
DRAGONI, G.
3592*
DRAHOVSKY, D.
2371*
DRAKE, G.A.
997*
DRAKE, W.P.
2654*, 5306
DRAMPYAN, F.S.
3482*
DRAPANAS, T.
897*
DRAPER, G.J.
2471*, 4830*
DRASAR, B.S.
2188*
DRAYCOTT, C.
2483, 2493
DREESMAN, G.R.
1805
DREL', K.A.

3987	DUCKLER, L.	DUNN, E.L.
DRESDEN, M.H.	5586*, 5613*	5567*
3990	DUCOS, J.	DUNN, J.E., JR.
DRETCHEN, J.S.	1405*, 1871*	2774*, 3693
647*	DUCKIEWICZ, J.	DUNN, T.B.
DREWINKO, B.	2720	2346
3360*, 3492*, 4020	DUDLEY, B.M.	DUNNING, W.F.
DREWS, J.	4762*	3540*
3534*, 5503*	DUESBERG, P.	DUPERRAY, B.
DREYFUSS, F.	426, 1739, 5207	962, 3658
3969	DUESBERG, P.H.	DUPLAN, J.F.
DRIESENS, J.	1740	780*, 994, 6123
251, 362, 2205, 3241*,	DUFF, R.	DUPREZ, A.
4139*	710, 3043, 4083*, 5918	3305
DRIESENS, Y.	DUFF, R.G.	DUPUY, J.M.
775*	5890	5352
DRIZE, O. B.	DUFFY, P.E.	DUPUY, P.
5398	1451*	1215*
DROBNICA, L.	DUFOUR, D.	DUQUESNOY, R.J.
4246*	2391*	3229*
DROBNIK, J.	DUFOUR, M.	DURAN-REYNALS, M.L.
3101	92*, 2444*, 3699, 6071*	1319, 2486, 3121
DROGENDIJK, A.C.	DUFOURMENTEL, C.	DURAND, G.
6096*	2738*	6143*
DROHAN, W.N.	DUGUID, C.	DURKOVSKY, J.
5215	961	796*, 6311*
DROLET, Y.	DUH, F.G.	DURNOV, L.A.
1048	3756, 4537	6239*
DRONOVA, O.M.	DUHAMEL, G.	DUROCHER, J.
4181*	678*	1522*
DROZDOVA, V.N.	DUHAMEL, J.	DURSI, J.F.
6148*	802*	1498*
DRUCKREY, H.	DUHEILLE, J.	DUTCHER, R.M.
345, 5103	2675*	119
DU PASQUIER, P.	DULAK, M.	DUTTERA, M.J.
5028	4446	4172*
DU PLOOY, M.	DULBECCO, R.	DUTZ, W.
1561, 3688	132, 1033, 1965, 4541, 5235	1449*
DUBARRY, J.-J.	DULOS, E.	DUUREN, B.L. VAN
3287*	2428*, 2429*	2418*, 2981, 3002
DUBBS, D.R.	DUMAS, M.	DUVAL, C.
3060	1945*	290*
DUBE, D.K.	DUMONT, J.	DUVERNET-BATTESTI, FR.
4229*	900*	218*
DUBE, V.E.	DUNAWAY, G.A., JR.	DUX, A.
4488*	1367*	1727
DUBEN, J.	DUNCAN, M.E.	DVORAK, M.
3042	1565, 1575	3810
DUBERT, J.M.	DUNDAROV, S.	DWORAKOWSKI, M.
5637*	136*, 2598*	394*
DUBIEL-BIGAJ, M.	DUNEA, G.	DWORK, A.
116	876*	6074
DUBREUIL, R.	DUNGWORTH, D.L.	DWYER, A.C.
1824, 3886	101, 1493*, 4524, 5264	3823*
DUBURS, G.J.	DUNHAM, L.J.	DYACHKOVA, L.V.
3723*	4354*	6272*
DUBY, M.M.	DUNKEL, V.C.	DYADKOVA, A.M.
5628*	2882, 4654	4528
DUCHINI, L.	DUNLOP, N.	DYADJKOVA, A.M.
5189*	3986	1748
DUIC, S.	DUNN, A.R.	DYADKOVA, A.M.
1926, 1934*	3108, 4593*	3044

DYATLOVITSKAYA, E.V.
5671*, 6373*
DYSHLEVAYA, L.N.
3313
DYUMIN, O.V.
3167
DZAGNIDZE, L.I.
5159
DZHEMILEV, Z.A.
692
DZIGOWSKA, A.
18*
EADE, O.E.
1195*
EAGEN, M.
3690
EAGLE, H.
1115
EARLE, J.
4715*
EARLE, K.M.
6204*
EASON, R.
1348
EBBESEN, P.
4048
EBELS, E.J.
5078
EBENHOEH, M.
5857*
EBERLE, B.J.
5240
EBERT, A.
6045*
EBERT, J.D.
423
EBERT, P.
3102
EBERT, P.S.
3119
EBONG, W.W.
1095
EBY, L.S.
3410*
ECHAVE LLANDOS, J.M.
2014, 4205*
ECKER, S.
832
ECKERSTORFER, R.
4684
ECKERT, H.
1590
ECKHART, W.
132
ECKMANN, L.
5067*
ECKNER, R.J.
406, 440*
EDDINGTON, G.M.
1392
EDDY, A.A.
5544*

EDDY, B.
5932*
EDELSTEIN, L.
585*
EDERER, F.
77
EDGEHILL, W.
1133
EDGERTON, B.W.
745
EDGINGTON, T.S.
4241*
EDLAND, R.W.
3386*
EDLOW, D.W.
5542*
EDLOW, J.B.
6309*
EDMOND, E.
2593*
EDMONDS, M.
542
EDSON, J.R.
6299*
EDWARDS, A.J.
758, 760, 782*
EDWARDS, G.S.
3673, 5174
EDWARDS, J.G.
5905
EDWARDS, M.H.
2636
EDWARDS, R.L.
6111
EDYNAK, E.
1695
EDYNAK, E.M.
1786, 5323
EELLS, R.W.
2470*
EFFLER, D.B.
4165*
EGAN, M.L.
4648, 4689, 5327
EGBRING, R.
3506*
EGE, T.
1808
EGGE, H.
5552*
EGGLESTON, J.C.
5406*
EGMOND, H. VAN
3517*
EGOZCUE, E.
3779
EHLERS, G.
1900*
EIBERGEN, R.
6038*
EIBY, J.R.
1441

EICHBERG, J.
1194*
EICHELBAUM, M.
2369*
EICKE, J.
1678*
EIDSON, C.S.
451
EINHORN, M.H.
5917
EINSTEIN, A.B., JR.
1819
EISEMAN, B.
3906
EISEN, H.N.
665*, 3158, 4677, 4702,
4751*
EISENBERG, H.
1304
EISENFELD, A.J.
4373
EKARAPHANICH, S.
4959*
EKELUND, L.
1286*
EL-AASER, A.B.A.
1640*
EL-BOLKAINY, M.N.
4057*
EL-DOMEIRI, A.
1911*
EL-DOMEIRI, A.A.
3031*
EL-FIKY, S.M.
1470*, 2030*, 2062*, 4604*,
5457*, 5458*, 5459*
EL KHODARY, A.F.
1311*
EL-LABBAN, N.
2734*
EL-MERZABANI, M.M.
1640*
EL MISHAD, A.M.
414
ELEFTERIADIS, K.
6221*
ELEKES, E.
3212
ELGJO, K.
1133, 5125
ELGORT, D.A.
4723*
ELING, W.
114
ELIOT, H.M.
2812
ELLEGAARD, J.
2631, 2846, 5988*
ELLER, L.L.
668*
ELLIOTT, S.C.
3791

ELLIS, H.
 5636*
 ELLIS, L.D.
 2815
 ELLIS, V.L.
 3061, 5238
 ELLMAN, L.
 1202, 1852*, 2620, 2835,
 3164
 ELMES, P.C.
 1103
 ELMUND, G.K.
 3621
 ELQUEZABAL, A.
 3333*
 ELSSAESSER, E.
 4952*
 ELSAMMA, Y.E.
 1311*
 ELSON, L.A.
 3645
 ELVEBACK, L.R.
 4820
 EMANOIL-RAVICOVITCH, R.
 3794
 EMBERGER, J.M.
 5397*
 EMBLETON, M.J.
 2316, 3881
 EMEL'YANOV, B.A.
 5289*
 EMILIA, G.
 843
 EMMELLOT, P.
 1128, 2323, 3450*, 3715*,
 4393, 5166, 6112, 6115
 EMMONS, R.W.
 3823*
 ENDERS, J.F.
 5879
 ENDO, H.
 1551, 4248*, 4482*
 ENDO, M.
 5677*
 ENEROTH, C.-M.
 3529*, 5581*
 ENG, C.P.
 3885, 4727*
 ENGELBRECHT, J.C.
 2959
 ENGELMAN, K.
 1443
 ENGELSE, L.D.
 2285*, 2323
 ENGELSE, L.DEN
 2997
 ENGSETH, A.
 484*, 883*
 ENGSTH, A.
 1053
 ENGELDT, B.
 109*
 ENGLAND, J.J.
 6307*
 ENGLE, G.C.
 119
 ENGSMINGER, W.D.
 5717
 ENGZELL, U.
 2080*
 ENOMOTO, M.
 2354
 ENRIQUEZ, P.
 4058*
 ENTWISTLE, D.W.
 3265
 ENZINGER, F.M.
 4219*, 5571*
 EPHRUSSI, B.
 2177*
 EPPINGER, S.
 4144*
 EPSTEIN, J.H.
 1305, 3641*, 5862
 EPSTEIN, M.A.
 2, 3107, 4320
 EPSTEIN, S.
 5806
 EPSTEIN, S.M.
 3717*, 5772
 EPSTEIN, S.S.
 4366
 EPSTEIN, W.L.
 1305, 1668, 4652
 ERDEM, S.
 974*, 2976
 ERHAN, S.
 2503
 ERHARD, P.
 5285*
 ERICKSON, R.R.
 3712
 ERICSON, U.
 5437
 ERIKSON, E.
 690, 2563*
 ERIKSON, R.L.
 690, 2563*
 ERLANDSON, R.A.
 2135*, 3323*, 3354*, 3385*,
 4054*, 5463*
 ERLANGER, B.F.
 2819
 ERNBERG, I.
 448, 466
 EROZAN, Y.S.
 4928*
 ERTL, N.
 3589*, 6381*
 ERTUEK, E.
 4387
 ERTUERK, E.
 634
 ERYU, Y.
 2079*
 ESBER, H.J.
 3156, 4522
 ESCALONA ZAPATA, G.
 3570*
 ESCH, W.
 6172*
 ESCHBACH, W.
 1894, 6065*
 ESCHENBACH, C.
 2120*
 ESCHWEGE, M.F.
 5408*
 ESIRI, M.M.
 3123
 ESKA, T.
 280*
 ESKELAND, T.
 464, 1380
 ESPANA, C.
 2040*
 ESPMARK, A.
 1848*
 ESPOSTI, P.L.
 2080*
 ESSELSTYN, C.B., JR.
 3191
 ESSEX, M.
 1013, 2612, 3036
 ESSNER, E.
 48, 1567, 2172*
 ESTELIN, R.
 4138*
 ESTENSEN, R.D.
 3510*
 ESTES, J.D.
 684
 ESTES, L.W.
 363
 ESTES, M.K.
 3809
 ESTES, P.C.
 3947
 ESTRADA, H.G.
 391*
 ESTRADA, R.
 2391*
 ESTRADE, S.
 2574*
 ETCHEVERRY, R.B.
 3017*
 EULDERINK, F.
 4489
 EUSEBI, V.
 774*
 EVANS, A.S.
 913*
 EVANS, B.
 425
 EVANS, C.A.
 5395*
 EVANS, D.J.

1883
 EVANS, D.L.
 1394, 4611
 EVANS, D.M.D.
 3198, 3911*
 EVANS, E.
 1167*
 EVANS, E.P.
 4501*
 EVANS, H.J.
 836, 1658
 EVANS, I.A.
 938
 EVANS, V.J.
 553, 4976*
 EVANS, W.C.
 937
 EVERITT, E.
 1713
 EVERSOLE, L.R.
 1086
 EVJY, J.T.
 585*
 EWEN, S.W.B.
 3396*
 EWERS, D.D.
 208
 EWING, M.R.
 2100*
 EXLEY, R.W.
 5803
 EXTON, L.A.
 250
 EYAL, O.
 4620
 EYDEL'MAN, F.M.
 1901*
 EYRE, J.
 797*
 EZZELL, R.
 1837
 FABER, A.J.
 3480*
 FABIANI, A.
 2121*, 3014*, 3376*
 FABRICIUS, E.-M.
 2131*
 FABRIKANT, J.I.
 6077
 FABRIS, C.
 5477*
 FADEEVA, L.L.
 3753
 FADEI, L.
 2032*, 2146*, 3475*, 3563*,
 4802*
 FAGERBERG, S.-E.
 1636*
 FAGLIA, G.
 5614*
 FAGRAEUS, A.
 5069*

FAHEY, J.L.
 1819
 FAHMY, M.J.
 2340, 5164, 5780
 FAHMY, D.G.
 2340, 5164, 5780
 FAHMY, T.Y.
 1470*, 2030*, 5457*, 5458*
 FAILLE, A.
 678*
 FAIOLA, R.
 5987*
 FAIRLEY, G.H.
 8*, 168*, 2212, 5319
 FAIS, D.
 1494*
 FAIS, D.A.
 5440
 FAJARDO, L.F.
 4964*
 FALCAO, R.P.
 3317
 FALCETTI, E.
 4255*
 FALK, J.
 1053
 FALK, L.A.
 1339, 3806
 FALKE, D.
 318*
 FALOR, W.H.
 245
 FAMILIARI, G.
 2582*
 FANELLI, A.R.
 2830, 5987*
 FANSHIER, L.
 425, 3115
 FANTERIA, E.
 3949
 FANTOLI, U.
 4106*
 FARAS, A.J.
 2553, 3110
 FARBER, E.
 342, 363, 935, 1117, 1297*,
 3717*, 4417
 FARBER, J.
 1884
 FARBER, J.L.
 5535*
 FARBISZEWSKI, R.
 859*, 3471*, 5450
 FAREED, G.C.
 5231
 FARMER, R.G.
 583*
 FARR, H.W.
 4327*
 FARRER-BROWN, B.
 2948
 FARRON, F.

4004
 FARROW, G.M.
 4014, 5579*
 FASAL, E.
 1097
 FASS, L.
 4605*, 4759*, 4789
 FASTOVSKIY, V.L.
 3369*
 FAULKIN, L.J., JR.
 2817
 FAULKNER, C.S., II
 4962*
 FAUSTO, N.
 5630*
 FAUVET, J.
 5816*
 FAVINO, A.
 4473*
 FAYN, S.N.
 6148*
 FEAGLER, J.R.
 5843*
 FEBVRE, H.
 3085, 4640, 5962, 6216*
 FECHNER, R.E.
 922*, 2165*, 2721, 4064*,
 4217*, 4429, 4450*
 FEDOROV, N.A.
 6070*
 FEDOROVA, YU.B.
 3418*
 FEDOROVSKA, M.I.
 5348
 FEDOTOVA, M.I.
 1671*
 FEEMSTER, J.
 4192*
 FEFER, A.
 1783, 4605*, 4687, 4759*
 FEGERTY, P.
 2948
 FEINERMAN, L.K.
 6155*
 FEINGOLD, N.
 2687*
 FELDMAN, D.G.
 1131
 FELDMAN, G.B.
 3963*
 FELDMAN, P.S.
 4931*
 FELICETTI, D.
 319*
 FELLER, U.
 2521
 FELLER, W.
 2483
 FELLER, W.F.
 17*, 1693
 FELLOUS, M.
 1998

FELSENFELD, H.W.	FETTER, D.	5587*
3424*	1788	FINKLESTEIN, J.Z.
FENN, A.S.	FETTIG, O.	3919*
736*	4287*	FINLAYSON, A.
FENN, M.E.	FEURER, F.	3270
1413	3453*	FINLAYSON, N.D.C.
FENOGLIO, J.	FEURLE, G.	248
3962*	2149*	FINLEY, T.N.
FENWICK, R.G.	FIALA, A.E.	663*
2364*	3682	FINOGENOVA, I.A.
FENYO, E.M.	FIALA, S.	4130*
1386, 1784, 1823	3682	FINSTER, M.
FEORINO, P.	FIALKOW, P.J.	306
3747	500*, 3942, 4243*	FIRAT, D.
FEORINO, P.M.	FICHIDJAN, B.S.	2000
5973	3831*	FIRKET, H.
FERENCZY, A.	FIDDLER, W.	6003*
1462*, 3413*, 3962*	2321	FIROUZ-ABADI, A.
FERGUSON, E.	FIDLER, I.J.	5755*
2691*	2691*	FIRSOVA, V.I.
FERNANDEZ, A.	FIELD, E.J.	6188*
4819	1050, 1187*, 1408*, 4734*,	FIRUSIAN, N.
FERNANDEZ-BRITTO RODRIGUEZ,	5383*	6386*
J.E4142*	FIELD, J.B.	FISCHBERG, M.
FERNANDEZ CABALEIRO, J.L.	5806	3934*
5659*	FIELDS, J.F.	FISCHER, E.
FERNANDEZ-CRUZ, L.	4668	1960
3361*, 5680*	FIELDSTEEL, A.H.	FISCHER, E.R.
FERNBACH, D.J.	743*	3533*
1068*, 1399	FIGGE, F.H.J.	FISCHER, H.
FEROLDI, CH.	1531	3038
3828*	FILATOVA, A.S.	FISCHER, J.D.
FERON, V.J.	3720*	1626*
1574	FILEV, L.V.	FISCHER, W.
FERRANTE, W.A.	4101*	5657*
580*	FILIPEK, A.	FISCHINGER, P.J.
FERRARA, G.B.	2794*	419, 1327, 1732, 1733, 2487,
2678*	FILIPEK-WENDER, H.	3058, 3111, 3758, 4521
FERRARI, C.	6170*	FISHER, B.
5614*	FILIPPOVA, N.A.	3859, 6280*
FERRARI, S.	3950, 6236*	FISHER, D.E.
2295*	FILIPPOVA, V.N.	4488*
FERRELL, H.W.	561*	FISHER, E.R.
3637*	FINA, S.	192*, 3859, 5407*
FERRELL, R.L.	2293*	FISHER, J.C.
917*, 2790*	FINCH, M.D.	2637
FERRER, J.F.	3901	FISHER, M.YE.
1008, 4651, 4735*	FINCH, R.R.	3369*
FERRERA, S.	1891	FISHER, R.J.
3567*	FINE, B.S.	4364
FERRERI, A.M.	4076*	FISHKIN, B.G.
1261	FINE, D.L.	4699
FERRES, R.	2571*, 2572*, 3134, 5877	FISHMAN, M.
5681*	FINGERLAND, A.	2705*
FERRI, G.	1617*	FISHMAN, W.H.
6211*	FINK, M.A.	486*
FERRY, A.P.	5979	FISHZON-RYSS, YU.I.
6326*	FINKEL, M.P.	3297
FERTAKIS, A.	2484, 4515	FITZ-HUGH, G.S.
5390*	FINKELSTEIN, J.Z.	1090*
FETHERSTON, W.C.	4321, 4958*	FITZGERALD, P.H.
3610	FINKLE, H.I.	1441

FIUMARA, A. 5682*	FOGARTY, W.A. 1497*	FORTIS, P.A. 4159*
FIUMICELLI, A. 1490*	FOGH, J. 1756, 2826	FORTNER, J.G. 914*
FJELDE, A. 3122	FOLDS, J.D. 3478*	FORTUNE, D.W. 2727*
FLAKS, B. 5169	FOLKMAN, J. 93*, 1895	FORTUNY, I. 6009*
FLAMM, W.G. 5871*	FOMIN, P.D. 1609*	FOSSATI, A. 4357*
FLANAGAN, V.D. 1193*	FONDIMARE, A. 290*	FOSSATI, G. 4675
FLANDERS, L.E. 5092	FONG, Y.Y. 2319	FOSTER, F.H. 6082
FLANDRIN, G. 4716*	FONSECA, N.M. 3347*	FOUGERE, C. 2177*
FLANNERY, J.T. 1947*, 5429*	FONT, R.L. 4076*, 5643*	FOURCADE, A. 3081
FLAX, H. 5129	FONTAINE, S.A. 4827*	FOURIE, H.O. 105*
FLAXMAN, B.A. 964, 3234, 4940*	FONTALIN, L.N. 5968	FOUSSARD-BLANPIN, O. 2430*, 4149*
FLEISCHMANN, T. 2558, 3309, 6110	FONTANA, L. 3016*	FOUTS, J.R. 657*, 1650*, 5720*
FLEISHMAN, YE.V. 4182*	FONTANGES, R. 5179	FOWLER, A. 1007
FLEISSNER, E. 1708, 3144	FOOTE, F.W., JR. 2138*, 2181*, 4006, 5646*	FOWLER, A.K. 2098*, 2667*, 5250
FLEMANS, R. 3785	FORBES, I.J. 4777*	FOWLER, M. 1493*, 3454*
FLESHER, J.W. 4365	FORBES, J.F. 1060, 1229*, 3891	FOX, E. 2162*
FLESHMAN, D.G. 996*	FORBES, J.T. 4668	FOX, J.A.E. 3437*
FLETCHER, D.E. 1111*	FORD, C.E. 4501*	FOX, J.E. 2180*
FLETCHER, F. 162	FORD, L. 3268	FOX, R.A. 46
FLETCHER, J.C. 1093*	FOREMAN, C. 2592*	FOX, R.I. 4527
FLETCHER, O.J. 451	FOREMAN, J.K. 1583	FOX, R.R. 2059*, 4067*
FLETCHER, O.J., JR. 5519*	FORGUE, A.P. 5595*	FOXWORTHY, D. 1093*
FLETCHER, T.L. 950	FORMAN, B.H. 1185*	FRABLE, W.J. 3637*
FLOQUET, J. 1200*	FORMICOLA, R. 6202*	FRAENKEL-CONRAT, H. 2449*
FLORIDI, A. 654*, 5047*	FORNATTO, L. 2121*, 3376*, 4459*	FRALEY, E.E. 28*, 832, 2358
FLORIS, C. 6030*	FORNI, A. 593*, 2987	FRANCES, J. 3371*
FLUEGEL, R.M. 3073	FORNI, A.M. 1288*	FRANCESCHI, C. 2308, 3921*
FOA, L. 1344, 2236*	FORREST, A.P.M. 284*	FRANCESCHI, G. 321*
FOA, P.P. 5640*	FORSBERG, J.-G. 4370, 4464*	FRANCESCHINI, P. 5477*
FODOR, I. 2425*	FORSBERG, J.G. 5039*	FRANCHI, G. 2361, 4806*
FOEDISCH, J. 6035*	FORT, L. 236	FRANCIS, D. 269*

FRANCIS, T.I.	FRAZIER, J.A.	FRIDMAN-MANDUZIO, A.
1392, 4351*, 4813	3152*	1674*
FRANCKE, U.	FREDERIC, F.	FRIDMAN, W.H.
5308	340	1998
FRANCOIS, D.	FREDERICQ, E.	FRIEBERG, S., JR.
3085	3481*	409
FRANGAKIS, E.K.	FREDERIKSEN, S.	FRIED, J.
276*	5436	1427, 1447*
FRANGIONE, B.	FREDRICKSON, T.N.	FRIEDEL, G.H.
171*, 2674*, 4738*	3070	2360, 2763, 5124
FRANK, A.L.	FREED, D.L.J.	FRIEDMAN, B.
3382*	2621	2054*
FRANK, H.	FREEDMAN, L.B.	FRIEDMAN, H.
2487, 5280*	5310	1009, 1375, 1785, 4574
FRANK, M.M.	FREEDMAN, L.S.	FRIEDMAN-KIEN, A.E.
3184	4023	1038*
FRANKEL, H.H.	FREEDMAN, M.H.	FRIEDMAN, L.
969	442*, 4767*	4379
FRANKEL, J.W.	FREEDMAN, S.I.	FRIEDMAN, M.A.
3762	5570*	975*
FRANKFURT, O.S.	FREEDMAN, S.O.	FRIEDMAN, N.B.
3644	483*	3328*
FRANKLIN, E.C.	FREEMAN, A.E.	FRIEDMAN, R.M.
784*, 2674*, 4738*	59, 1581, 3080, 3713	420
FRANKLIN, E.W.	FREEMAN, A.I.	FRIEDMAN, R.P.
2770	4230*	213*
FRANKLIN, R.M.	FREER, J.A.	FRIEDMANN, T.
3057	761	1768*, 5275
FRANKO, E.A.	FREI, E., III	FRIEDRICH, E.G., JR.
2503	1179*	3329*
FRANKS, L.M.	FREI, J.A.	FRIEDRICH-FREKSA, M.
4009, 6335*	658*	3715*
FRANKSSON, C.	FREI, J.V.	FRIEDRICHS, K.H.
6113	359, 968, 2934	3586*, 5135
FRANTZ, I.D., JR.	FREIREICH, E.J.	FRIEND, C.
77	1179*, 1395, 5360, 5966	412, 1366*, 5944*
FRANZ, H.	FREISKORN, R.	FRIESEN, S.R.
5963	3444*	4798*
FRANZE-FERNANDEZ, M.T.	FRENKEL, J.K.	ERIIS, R.R.
6109	3729	1707, 3778
FRANZEN, S.	FRENKEL, K.	FRINDEL, E.
5478*	3002	3225*
FRAPPA, J.	FRENKEL, N.	FRITHIOF, L.
5179	1365*	4785
FRASER, C.E.O.	FRENSTER, J.H.	FRITZ, R.B.
491*, 3757, 3781, 3822*,	652*	742*
5925	FRENYEO, E.M.	FRITZ, R.E.
FRASER, H.	2569*	1000*
1186*	FRETZIN, D.	FRITZ, W.
FRASER, M.J.	666*	5148
6312*	FREYCHET, P.	FROEHLICH, C.
FRATI, L.	2814	2042*, 2155*, 2885*
5444, 5669*	FREZDULS, G.	FROEHLICH, J.E.
FRAUMENI, J.F., JR.	4554	6303*
2589*, 2998, 3251, 5413,	FRIERG, S., JR.	FROEHLICH, K.H.
5421	3851, 3858, 3874	3362*
FRAUMENI, J., JR.	FRICH, J.C.	FROHBERG, H.
5412	584*	2409*
FRAYSSINET, C.	FRICK, T.	FROLOV, A.F.
5130	3149*	4396
FRAZER, J.W.	FRIDLENDER, B.	FROLZOVA, A.E.
3726	680, 1958, 3766	1285*

FRONT, R.L.
 5571*
 FROST, J.K.
 4928*, 6362*
 FRY, M.
 1958, 6286*
 FRY, R.J.M.
 934, 1244, 5084, 5115,
 5601*
 FRYDENBERG, H.
 6342*
 FU, Y.-S.
 3381*, 3958*
 FUCHIMOTO, T.
 2897*
 FUCHISIG, P.
 1238*
 FUCHS, R.
 4344*, 5825*
 FUCHSBERGER, N.
 1765*
 FUDENBERG, M.H.
 170*, 2695*, 6017*
 FURSTENBERGER, G.
 5853*
 FUJIHARA, E.
 235, 1174*, 4852
 FUJII, G.
 2683*, 2684*
 FUJII, K.
 2861
 FUJII, M.
 2897*
 FUJII, S.
 3502*
 FUJIMURA, S.
 984*, 1293*
 FUJINAGA, K.
 697, 1714
 FUJINO, H.
 3522*, 4051*
 FUJIOKA, S.
 543, 849, 4590*
 FUJISAKI, H.
 6166*
 FUJISAKI, S.
 2716
 FUJISAWA, T.
 3696
 FUJITA, SH.
 3575*
 FUJITA, T.
 2627
 FUJIWARA, M.
 4497*
 FUJIWARA, Y.
 4975*
 FUKUDA, A.
 135*
 FUKUDA, S.
 4419
 FUKUHARA, M.

4494
 FUKUI, H.
 3811, 5286*
 FUKUI, M.
 5849*
 FUKUNISHI, R.
 5119, 5781, 5783
 FUKUYAMA, K.
 1305, 1668, 4652
 FUNAKOSHI, I.
 5534*
 FUNSHTEYN, L.V.
 3585*
 FURCHNER, J.E.
 997*
 FURFARO, M.
 6056*
 FURIHATA, R.
 510
 FURMANSKI, P.
 2896*
 FURTADO DIAS, M.T.
 575*
 FURTH, J.
 587*, 1982, 2134*, 4965*
 FURTSEVA, L.N.
 1467*
 FURUN, I.
 5863
 FURUSAWA, M.
 1831
 FUSCALDO, K.E.
 490*
 FUSENIG, N.E.
 5859*
 FUSHIMI, K.
 3707
 FUXE, K.
 4023
 GABALDON, M.
 942
 GABBIANI, G.
 1461*, 3958*
 GABRIEL, R.
 4762*
 GABRIELIDIS, C.G.
 3577*
 GABRILOVE, J.L.
 4893*
 GACHES, C.
 1184*
 GAD, C.
 4826*
 GADDONI, G.
 2092*
 GADELHA, N.
 6363*
 GADGH, R.K.
 827*
 GADOMSKA, H.
 1098, 6097*
 GADRAT, J.

3561*
 GADSDEN, R.H.
 2363
 GAERTNER, H.J.
 6220*
 GAERTNER, H.V.
 4282*
 GAETA, J.
 4230*
 GAGNI, G. DI
 6229*
 GAILLARD, J.
 2739*
 GAITSKHOKI, V.S.
 2128*
 GAJDUSEK, D.C.
 731*, 3750
 GALANKIN, V.N.
 3554*
 GALARCE, J.A.
 2786*
 GALASKO, C.S.B.
 3489*
 GALATIOTO, S.
 2092*
 GALE, G.R.
 2363
 GALEOTA, G.
 2239*
 GALEOTTI, T.
 3340*, 3423*
 GALERA, H.
 6146*
 GALIAN, A.
 4295*
 GALIL-OGLY, G.A.
 6138*
 GALLAGER, H.S.
 1692, 1802, 4171*, 4307
 GALLAGHER, R.E.
 4603*, 5629*
 GALLIMORE, P.H.
 4593*
 GALLMEIER, W.M.
 2405*, 3222*, 6040*
 GALLO MORANDO, G.
 6360*
 GALLO, R.C.
 160, 543, 609, 631, 688,
 3742, 3790, 3799, 3802,
 4590*, 4603*, 5445, 5629*,
 5906, 5921
 GALTON, D.A.G.
 2017, 4641
 GAMMARROTA, V.
 6266*
 GANGADHARAN, P.
 526*, 1930, 3264, 6086
 GANGAL, S.G.
 612
 GANGOLLI, S.D.
 1601, 2374*

GANTT, R. 3106	GARG, B. 1655*	6337*
GANTT, R.R. 1709, 4977*, 5265	GARG, B.D. 2034*	GEARY, C.G. 82*
GARAPIN, A.-C. 3086, 3115	GARGIULO, E.A. 4100*	GEBERT, R. 5810
GARATTINI, S. 2361, 4806*	GARGUS, J.L. 33	GEBHART, W. 3370*
GARAY, G.L. 2063*	GARIBDZHANIYAN, B.T. 6001*	GEDEON, E.M. 2776*
GARBE, E. 2791*	GARLAND, M.R. 1437	GEDER, L. 711
GARBE, L. 605	GARNER, A. 1886	GEDIGK, P. 5401
GARBIT, F. 5637*	GARNER, F.M. 324*, 1992	GEERING, G. 2561*
GARCIA ALBERTO, M.E. 575*	GARNER, J.V. 2412*	GEHIN, A.-M. 2805*
GARCIA BRAGADO, F. 6160*	GARNER, R.C. 2412*, 4386	GEIGER, CH. 2254*
GARCIA, F.G. 3781, 3822*, 5925	GARON, C.F. 5231	GEJVALL, T. 4428
GARCIA, H. 2969, 3708, 4405, 5080, 5142	GARRIDO, S. 4146*	GELB, A.F. 259*, 1185*
GARCIA, J. 6090*	GARRY, V.F. 1652*	GELB, L.D. 413, 5915
GARCIA, L. 4145*	GART, J.J. 227	GELBOIN, H.V. 348, 2928, 2991, 3678, 4443
GARCIA, N.L. 2806*	GARTMANN, H. 6247*	GELDERBLOM, H. 2518, 4570, 5035*, 5280*
GARCIA PARTIDA, P. 144*	GARVIE, W.H.H. 253	GELDERMAN, A.H. 698
GARCIA TORRE, J. 5659*	GASCON, A.L. 1281*	GELFAND, I.M. 281*, 2825
GARCOVICH, A. 1898*	GASPARINI, C. 577*	GELFANT, S. 4919*
GARDE, A. 2225*, 3558*	GASSER, G. 1237*	GELFON, I.A. 3367*
GARDIKAS, C. 2143*	GATAULLIN, K.D. 3951*	GENDRE, P. 3174
GARDINER, G.R. 2476*	GATERMANN, B. 564*	GENDRE, PH. 3914*
GARDIOL, D. 1166*	GATES, O. 674	GENGOZIAN, N. 2477*
GARDIPEE, C. 2774*	GATTI, R.A. 24*	GENIN, J. 3214, 3344*, 6195*, 6228*
GARDNER, B. 1077*	GAUDIN, D. 1536, 5139	GENTIL, A. 1260, 1570
GARDNER, D. 4434	GAYE, P. 323*	GENTRY, G.A. 3087
GARDNER, D.A. 4913*	GAZDAR, A. 5952*	GEOGII, A. 5955*, 5956*
GARDNER, D.G. 6116	GAZDAR, A.F. 1734, 1853*, 3098, 3132, 3764, 4550, 4553, 4599*, 4600*, 5223, 5886	GEORGE, G. 728*
GARDNER, J. 706	GAZZERA, G. 2903	GEORGE, R.P., JR. 1664
GARDNER, M.B. 684, 695, 1002, 1328, 2495, 3076, 3703	GAZZOLO, L. 682, 689, 2562*, 3402*, 5241, 5749*	GEORGE, S.L. 1179*
GARDNER, W.U. 4373	GEAR, M.W.L.	GEORGESCU, I. 2780*
		GEORGI, M. 254
		GEORGIADIS, J.

2239*, 4339*
 GEORGIEV, D.
 6037*
 GEORGII, A.
 5266, 6043*, 6393*
 GERALD, M.D.
 3276
 GERARD, A.
 628*
 GERARD, G.F.
 5922
 GERARD-MARCHANT, R.
 3344*, 3421*, 4138*, 5598*
 GERBER, G.B.
 4374
 GERBER, M.A.
 2087*
 GERBER, M.J.
 5896
 GERBER, P.
 1385, 2512, 4590*, 5387*
 GERFO, P.L.
 470, 4729*, 4775*
 GERGELY, J.
 1838, 2668*
 GERGELY, L.
 448, 466, 1045
 GERGELY, M.
 507*
 GERGELY, Z.
 4157*
 GERICKE, D.
 66, 2093*, 3787, 5031*
 GERLIER, D.
 6036*
 GERMAIN, D.
 6142*
 GERMAN, A.
 3202
 GERMANOV, A.B.
 3753
 GEROUANOS, S.
 6206*
 GERRARD, G.
 5735*
 GERRARD, M.E.
 4414
 GERRITS, P.O.
 5078
 GERRON, G.G.
 646*
 GERSCHENSON, L.E.
 2823
 GERSHBEIN, L.L.
 1557
 GERSHON, R.K.
 452
 GERSTLEY, B.J.S.
 1834
 GERSTON, K.
 3409*
 GERTNER, H.R.

3907
 GERTNER, H.R., JR.
 454
 GERWIN, B.I.
 5683*, 5900
 GESER, A.
 221*
 GESTELAND, R.F.
 3140
 GESTELAND, R.Y.
 5263
 GETTI, B.
 2096*
 GETZ, M.J.
 6375*
 GEVAUDAN, M.-J.
 2596*
 GEVAUDAN, P.
 2596*
 GEVORKYAN, S.K.
 5693*
 GEYER, M.
 5767
 GFDOLLER, A.
 2125*
 GHADIALLY, F.N.
 2141*
 GHANTA, V.K.
 4758*
 GHAZALI, S.
 6199*
 GHERMAN, GR.
 5589*
 GHETTI, G.
 2987
 GHILEZAN, M.
 5589*
 GHOBRIAL, H.K.G.
 5404
 GHOOI, A.M.
 616*
 GHOSE, N.
 4267*
 GHOSH, A.K.
 5622*
 GIACOMELLI, G.
 4013
 GIAO, N.B.
 55
 GIBB, L.E.
 5544*
 GIBBARD, S.
 1542
 GIBBS, C.J., JR.
 731*, 3750, 4556
 GIBEL, W.
 991*, 1550, 5420
 GIBLAK, R.E.
 1309*
 GIBLETT, E.R.
 4243*
 GIBSON, A.A.M.

3270
 GIBSON, J.B.
 2767
 GIBSON, M.H.L.
 5632*
 GIBSON, P.E.
 727*
 GIBSON, R.
 3968, 6084
 GIBSON, R.W.
 2779*
 GIBSON, W.R.
 5077
 GIELDANOWSKI, J.
 2615
 GIELEN, J.E.
 1241, 1252, 4433
 GIELEN, W.
 563*
 GIELKENS, A.L.J.
 3136
 GIGNOUX, B.
 3247
 GIGNOUX, M.
 3247
 GILBERT-DREYFUS
 5747*
 GILBERT, P.J.
 6116
 GILBERT, S.
 3334*
 GILBERT, T.T.
 585*
 GILCHRIST, G.S.
 4321
 GILDEN, R.
 3903
 GILDEN, R.V.
 3602, 3875, 3902, 4565,
 5919
 GILEAD, Z.
 1760
 GILL, D.
 3154*
 GILL, P.
 4960*
 GILLESPIE, C.
 3161
 GILLESPIE, C.A.
 3817
 GILLESPIE, D.
 3802, 5921
 GILLESPIE, D.M.
 4016
 GILLESPIE, G.Y.
 4668
 GILLETTE, E.L.
 4188*
 GILLIES, S.
 1364*
 GILLISSEN, G.
 2938

ILLMAN, T.
4941*, 5163
ILMAN, A.G.
2866
ILSON, J.C.
386*, 3616
INELLI, E.
1479*
INN, F.L.
1182*
INSBERG, H.S.
683
IOELI, R.P.
3997
IORDANO, A.
2582*
IORDANO, F.
4105*
IARD, C.
5961
IARD, M.
2229*
IARD-MARCHANT, R.
5574*
IARD, P.-L.
1945*
IARDET, R.E.
1077*
IAUD-DOZIAS, C.
2430*, 4149*
IAUDO CONESA, L.C.
1464*, 1800, 4049*
RI, C.P.
667*
THENS, J.H.
3232
TLIN, D.
2640
TLIN, G.M.
2640
TLITS, A.
5377*
TZELMANN, R.
241
VOL, D.
665*
ZIS, F.
888*
ORGOV, A.
2795*, 6076
ADE, P.R.
2511
ASER, O.G.
87*
ASER, R.
3043, 3053, 4536, 5890
ASGOW, L.A.
2208
ASS, A.G.
811
ASS, D.N.
3023*

GLASS, E.M.
1248
GLASS, J.L.
2129*
GLASS, N.
1077*
GLASS, R.M.
4732*
GLATHE, H.
6065*
GLATON, D.A.G.
1966
GLATSTEIN, E.J.
3208
GLAUDEMANS, C.P.J.
3190
GLAVES, D.
3170, 3899, 4678
GLAVES, P.
5332
GLAZ, E.
353
GLAZER, D.
540
GLEESON, M.H.
4622
GLEICHMANN, E.
4628, 6039*
GLEICHMANN, H.
4628
GLEW, D.H.
4697
GLINSKA, H.
3217*, 6276*
GLINSKI, W.
765, 772*
GLITZ, D.G.
5929*
GLOBER, G.
6337*
GLOBER, G.A.
1924
GLOMSKI, C.A.
5443
GLOVER, E.L.
2967
GLUCKSMANN, A.
351, 2923, 2952, 3007
GLUZMAN, D.F.
5210, 5943*
GLUZMAN, D.R.
2191*
GLYNN, J.P.
4687
GOCHO, Y.
6134*
GOCIU, M.
1862*
GODARD, CH.
339
GODDARD, P.
611, 5182

GODRICK, E.A.
4074*
GOEBEL, D.
3364*
GOEBEL, H.H.
3457*
GOECKE, H.
6218*
GOEKAY, E.
3918*
GOEPP, C.E.
2166*
GOERLICH, M.
2007
GOERTTLER, K.
254, 266*, 633, 5779
GOESSENS, G.
2439*, 3536*
GOETTSCHING, CH.
2298*
GOETZ, A.
2504, 3787
GOETZ, H.
6041*, 6042*
GOETZ, I.E.
5455
GOETZ, O.
141*
GOFFINET, D.R.
3208
GOFMAN, A.M.
6148*, 6150*
GOFMAN, J.W.
107*
GOGGINS, J.F.
4508
GOGICHADZE, G.K.
2578*, 5927*
GOGL, A.
5355
GOH, K.
501*
GOH, K.O.
103
GOLBERG, L.
1601
GOLBERT, Z.V.
6244*
GOLD, P.
483*, 4697, 5710, 5972
GOLD, R.H.
2114*
GOLD, V.
1135*
GOLDBERG, R.J.
3033, 4520
GOLDBLUM, N.
2712*, 5359
GOLDEN, A.
2483
GOLDENBERG, D.M.
2630, 3407*, 6014*

GOLDENBERG, H. 833	GOMENIUK, I.P. 4262*	6057*
GOLDFARB, S. 4851	GOMEZ, S.C. 3560*	GORDEN, P. 2814
GOLDFEDER, A. 5792, 5833*	GOMI, M. 6323*	GORDIENKO, S.P. 5965
GOLDIN, A. 4679	GOMMI, B. 5133	GORDON, A.S. 1849*, 3070
GOLDMAN, J.M. 161, 2538	GOMPEL, C. 886*, 4245*	GORDON, D.E. 5237
GOLDMAN, M. 1686*, 3814	GONANO, F. 1957	GORDON, D.S. 1719
GOLDMAN, P.M. 5259	GONDER, M.J. 2626, 3177	GORDON, E.D., JR. 3447*
GOLDMAN, R. 1078*	GONDIM, F.C.P. 863*	GORDON, H.G. 1819
GOLDMAN, R.L. 4898*, 5587*	GONDOS, B. 2041*	GORDON, H.W. 5663*
GOLDROSEN, M.H. 4767*	GONG, J.K. 1669, 5443	GORDON, J.E. 2768, 3008, 4418
GOLDSCHMIDT, B.M. 3002, 3647	GONICK, H.C. 1078*	GORDON, R.J. 59, 3703
GOLDSTEIN, A.L. 5549*	GONZALEZ-CRUSSI, F. 3332*	GORDON, S. 1850*
GOLDSTEIN, D.A. 1763	GONZALEZ GONZALEZ, D. 5033*	GOREN, E.N. 1459*
GOLDSTEIN, D.J. 2656*	GONZALEZ, S. 144*	GORET, P. 1871*
GOLDSTEIN, G. 1045	GOOCH, W.M., III 1399	GORIN, N.C. 4079*
GOLDSTEIN, H.S. 5654*	GOOD, R.A. 24*, 118, 769, 3120, 4512, 5340	GORISHEK, W.M. 3974
GOLDSTEIN, M. 4023	GOODALL, C.M. 5498*	GORKA, C. 2595*
GOLDSTEIN, M.N. 6329*	GOODBAN, J. 4411	GORKIN, V.Z. 1416*, 5700*
GOLDSTEIN, M.S. 1820	GOODHEART, C.R. 2523	GORKOVA, N.P. 6373*
GOLDWEITZ, J. 4074*	GOODMAN, J. 1185*	GORLIN, R.J. 4291*
GOLEBIEWSKA, D. 4251*	GOODMAN, J.I. 2979	GORNY, M. 6274*
GOLOSOVA, T.V. 3538*, 4180*, 6070*	GOODMAN, J.R. 259*	GORODETSKII, S.I. 5398
GOLOVIN, K.I. 926*	GOODMAN, M.L. 161	GOROZHANSKAYA, E.G. 4845
GOLSTEIN, P. 3226*	GOODMAN, N.C. 1704	GORSKI, G. 6275*
GOLUB, E.S. 3188	GOODMAN, P.G. 2473*	GORTER, H. 4690
GOLUB, N.I. 5818*	GOPAL, M.G. 566*	GORUYKHINA, T.A. 2127*
GOLUB, S.H. 3888, 4623, 4685	GOPALAKRISHNAN, A. 5616*	GOSALVEZ, M. 3423*
GOLUBEV, A.M. 2094*	GORIKOVA, N.P. 5671*	GOSSE, C. 502*, 1469*
GOLUBEV, D.B. 5981*, 5982*	GORBACH, P.D. 4830*	GOTH, R. 5172, 5854*
GOLUBSKA, B. 173*	GORCZYNSKI, R.M. 3176	GOTHOSKAR, B. 4575, 4660
GOMARD, E. 3196, 5920	GORDELADZE, A.S.	GOTO, A. 2256*
		GOTO, K.

4721*
 GOTO, M.
 4721*, 5489*
 GOTO, S.
 2683*
 GOTO, T.
 838
 GOTOH, A.
 1049
 GOTOHDA, E.
 4505, 5136
 GOTTLIEB, A.A.
 3074
 GOTTLIEB, C.F.
 5338
 GOUBIN, G.
 2557
 GOUGH, N.G.
 2728*
 GOULD, D.
 1493*
 GOULD, N.S.
 4227*
 GOULD, V.E.
 63, 2973, 4227*
 GOUTAREL, R.
 2957
 GOVORCHENKO, V.I.
 2944
 GOWIN, R.L. DE
 3515*
 GOYKHBERG, M.I.
 6152*
 GRABOWSKA, B.
 2462*
 GRACE, J.T., JR.
 2857
 GRAEVSKAYA, N.A.
 5945*
 GRAF, TH.
 5035*
 GRAF, W.
 661*
 GRAFF, R.J.
 754, 4677, 4751*
 GRAFFI, A.
 980*, 2618, 5885, 5931*
 GRAFFI, I.
 5885, 5931*
 GRAFFTE, G.
 835
 GRAHAM, B.J.
 1716, 1721
 GRAHAM, C.E.
 60, 1620*
 GRAHAM, C.K.
 3649
 GRAHAM, J.B.
 3268
 GRAHAM, S.
 2779*, 3268, 3968, 4837*,
 5424

GRAHAM, W.P., III
 1507
 GRAHAME, R.E.
 5797
 GRAHNE, B.
 568*
 GRALNICK, H.R.
 4970*
 GRAMPA, G.
 915*
 GRANBERG, I.
 1950, 3546*
 GRANDGENETT, D.P.
 5922
 GRANDJON, D.
 6129
 GRANGE, J.
 2562*, 5241
 GRANNER, D.
 2174*, 5504*, 5506*
 GRANNER, D.K.
 2168*
 GRANOFF, A.
 3759, 4343*, 5737*
 GRANT, C.K.
 3873
 GRANT, D.W.
 1556, 3650
 GRANT, G.F.
 6023*
 GRANT, R.M.
 253
 GRANTHAM, F.H.
 5157
 GRANTHAM, P.H.
 4732*
 GRANZOW, C.
 2169*
 GRASMUK, H.
 3534*, 5503*
 GRASSO, G.
 5682*, 5691*
 GRASSO, P.
 1601, 2374*
 GRATTAROLA, R.
 4858
 GRAVELL, M.
 2599*
 GRAY, E.W.
 278*
 GRAY, L.A.
 4220*
 GRAYEVSKAYA, N.A.
 5939*
 GREALLY, J.
 6009*
 GREBE, W.
 2154*
 GRECO, T.
 5941*
 GREEN, G.M.
 1291*

GREEN, I.
 1202, 1852*, 2620, 2835,
 3164, 3179, 3184
 GREEN, J.A.
 2693*
 GREEN, M.
 3602, 3745, 3782, 4311,
 5347, 5922
 GREEN, M.H.
 395
 GREEN, S.
 486*, 2816, 5631*
 GREENAWALD, K.A.
 2139*
 GREENBERG, M.
 2773*
 GREENBERG, M.L.
 4013
 GREENBERG, P.B.
 2839
 GREENBERG, S.D.
 6314*
 GREENBERG, W.V.
 1134*
 GREENBLATT, M.
 2951, 2966, 2978, 3653
 GREENBURG, J.R.
 851
 GREENE, H.J.
 5482*
 GREENGARD, O.
 5515*
 GREENWALD, P.
 83*, 6074
 GREENWOOD, N.
 6315*
 GREENWOOD, S.M.
 259*, 1185*
 GREER, J.
 3906
 GREER, S.
 3540*
 GREGG, R.S.
 1536, 5139
 GREGOR, O.
 209*
 GREGORY, L.
 6301*
 GRENEY, F.
 576*
 GRENEY, H.
 576*, 4116*
 GRENIER, J.F.
 258*
 GRESSER, I.
 3341*, 3995
 GREWAL, M.S.
 3473*
 GREY, H.M.
 771*, 1376
 GRICE, H.C.
 5531*

GRIEBL, G. 2431*	3272	3705
GRIEBLE, H.G. 6029*	GROFOVA, M. 737*	GRUNDMANN, E. 2339, 2914*
GRIEDER, A. 1471*	GROHSMAN, J. 5303	GRUNDNER, G. 1386, 1784, 2569*
GRIFFIN, A.C. 3359*, 4083*	GROMEK, A. 5664*	GRUNDY, G.W. 4486*
GRIFFIN, C. 1966, 2017	GRONOW, M. 643, 5800	GRUNTENKO, E.V. 4037
GRIFFITHS, D.M. 385*	GROS, F. 4346*	GRUPP, H.J. 6382*
GRIFONI, V. 4712*, 6030*, 6031*, 6032*, 6033*	GROSS, H.J. 5076	GRUSHINA, A.A. 5096
GRIGOLETTI, E. 6278*	GROSS, J. 878*	GRUSOVIN, G.D. 4275*
GRIGOR, M.R. 4237*	GROSS, L. 325*, 904, 1055, 1131, 4337*, 5724*	GRUZDEV, G.P. 1672*
GRIGORI'YAN-KOVALEVA, V.L. 487*	GROSS, M.D. 5640*	GRZEBIELUCH, M. 3438*, 3439*, 6027*
GRIGOROVICH, N.A. 5813*	GROSS, S.K. 3796	GSELL, O.R. 1418
GRIGORYAN, E.G. 3482*	GROSSI-PAOLETTI, E. 3014*	GUARINI, G. 5998*
GRILLI, S. 1261	GROSSMAN, A. 1963, 1964	GUAZZI, G.C. 2096*
GRILLO, A. 1095	GROSSMANN, H. 5211, 5305	GUBAREVA, A.V. 5201, 6058*
GRIMAUD, R. 5408*	GROTE, J. 3581*, 4115*	GUBELADZE, D.A. 3200
GRIMELIUS, L. 2199*	GROTH, C.G. 5728*	GUBERN SALISACHS, L. 6162*
GRIMES, W.J. 716	GROTH, U. 4427, 5798	GUBERNPI, L. 5442
GRIMLEY, P.M. 5880	GROTSKY, H.W. 2511	GUBETTA, L. 3566*, 6173*
GRIMONT, P. 5028	GROULS, V. 3584*	GUBLELADZE, D.A. 692
GRINDELAND, R.E. 587*	GROUPE, V. 3762	GUCCION, J.G. 4219*
GRINDEY, G.B. 2392*	GROVER, P.L. 62, 1533, 2304, 2984, 3709, 4445, 5774	GUDAT, F.G. 1851*
GRINEV, M.V. 6350*	GROVER, S. 5409	GUDIM-LEVKOVICH, K.A. 5785
GRISARD-FISZMAN, F. 2895*	GROVES, C.M. 588*	GUDJONSDOTTIR, . 2130*
GRISS, P. 1084	GROVES, J.N. 4187*	GUELF, J. 3623*
GRISVARD, J. 1120	GROVES, L.K. 4165*	GUELSTEIN, V.L. 281*
GRISWOLD, D.E. 4662	GROZDEA, J. 6144*	GUENTHER, H. 3581*, 4115*
GRISWOLD, D.P. 2704*	GRUBE, D.C. 993, 1001*	GUERCI, O. 2675*
GRIVES, B. LE 2428*, 2429*	GRUBE, F.O. 3598*	GUERIN, C. 6372*
GROB, H.U. 5134	GRUENSTEIN, M. 377*	GUERINOT, F. 2095*
GROB, P.J. 5354	GRUMET, F.C. 1782, 4670	GUERIS, J. 4295*
GROFF, W.H.	GRUNBERGER, D.	GUEST, G.B. 119
		GUETTNER, J.

1545
 GUGANIG, M.E.
 673
 GUHA, A.
 5549*
 GUIBAUD, S.
 2072*
 GUIBBERT, D.
 962
 GUIBERT, D.
 3658
 GUIDI, G.
 473
 GUIGLIA, S.F.
 2904
 GUILLE, E.
 1120
 GUILLEMAIN, B.
 339
 GUINAN, P.
 4737*
 GUINDON, A.
 1824
 GULATI, S.C.
 3803, 5926
 GULEVSKAYA, M.R.
 6099*
 GULI, E.P.G.
 1846*, 1867*, 1868*
 GULLINO, P.M.
 1130, 5157, 5158, 6290*
 GULLOTTA, F.
 4908*
 GULYAKIN, M.F.
 5602*
 GUMBANN, M.R.
 42
 GUMBRECK, L.G.
 2039*
 GUMINA, I.I.
 5939*
 GUMINSKA, M.
 5255
 GUMMEL, H.
 2228*
 GUNTHER, H.
 3582*
 GUNVEN, P.
 1046
 GUNZ, F.W.
 811
 GUPTA, M.
 96*
 GUPTA, M.L.
 870*
 GUPTA, P.C.
 200, 4407, 4834*
 GUPTA, P.K.
 4273*
 GUPTA, S.C.
 1181*
 GURALNICK, W.C.

4877*
 GURDA, M.
 558*
 GUREVICH, M.A.
 970*
 GURGO, C.
 3782
 GURNER, B.W.
 1878*
 GURNEY, E.G.
 5787
 GURTSEVICH, V.E.
 4631
 GURVIN, I.
 2453
 GUSBERG, S.B.
 1820, 1896, 3681
 GUSEINOVA, F.
 6070*
 GUSELNIKOVA, N.A.
 6099*
 GUSEV, V.A.
 4147*
 GUSTAFSSON, T.
 3309
 GUTHRIE, J.
 1547
 GUTIEREZ ESTARLI, E.
 4142*
 GUTMANN, H.R.
 3712, 4430
 GUTTERMAN, J.
 3384*
 GUTTERMAN, J.U.
 4749*, 5360, 5966
 GUY, J.T.
 5839*
 GUZMAN, N.A.
 6331*
 GUZMAN, N.G.
 515
 GYDE, A.M.
 536
 GYDERGY, E.
 4946*
 GYORKEY, F.
 244, 1428, 3358*, 6314*
 GYORKEY, P.
 244, 3358*
 HAAG, D.
 5779
 HAAM, E. VON
 948
 HAAPALA, D.K.
 1327, 1732, 1733, 3058,
 3111, 3132, 5683*
 HAAS, J.E.
 3960*
 HAAS, M.
 5235
 HAAS, P.
 6258*

HAAS, R.
 6399*
 HABEEB, A.Y.
 1311*
 HABER, M.
 4416
 HABERMAN, H.F.
 2055*
 HABIBI, A.
 220*
 HABICHT, G.S.
 2653*
 HACH, B.
 1639*
 HACKER, B.
 3155*
 HACKETT, A.J.
 117, 3137, 3770, 4597*
 HACKETT, R.L.
 4377
 HACKNEY, J.F.
 50
 HADARAG, E.
 5639*
 HADFIELD, E.H.
 1270, 4360*
 HADFIELD, M.G.
 4911*, 5471*
 HADJI-AZIMI, I.
 3934*
 HADJIOLOV, D.
 967, 2996, 3711
 HADJIOLOV, D.C.
 987*
 HADJIYANNAKIS, M.J.
 2666*, 3201
 HADLER, H.I.
 933, 3675, 3697
 HADLOW, W.J.
 5612*
 HAEHNEL, P.
 258*
 HAEHNEL, R.
 1959, 2159*
 HAEKKINEN, I.
 150
 HAEMMERLI, G.
 549
 HAENNINEN, O.
 5832*
 HAENSZEL, W.
 23*, 6075
 HAENZEL, W.
 5416
 HAERLE, E.
 1033
 HAFERKAMP, O.
 283*
 HAGA, J.J.
 90*, 5137
 HAGAN, M.
 5689*

HAGEL, F. 4141*	857*	HAMLIN, J.A. 3328*
HAGEMAN, P.C. 1043, 3767	HALL, B.V. 1066*	HAMLIN, N.M. 4758*
HAGEMANN, R.F. 1105	HALL, F.F. 2891*	HAMMER, J.E., III 4477*
HAGERUP, L. 1637*	HALL-JONES, J. 4875*	HAMMOND, E.C. 3601
HAGGERTY, D. 4206*	HALL, M.G., JR. 4742*	HAMMOND, J.M. 295*
HAGHBIN, M. 1317	HALL, T.C. 5513*	HAMMOND, W.G. 1443
HAGHIGHI, P. 2761	HALLERAKER, B. 2051*, 2607	HAMMONS, A.S. 1265
HAGLID, K.G. 4258*, 5088	HALLEUX, F. DE 2526	HAMPAR, B. 693, 2517, 2551
HAGSTROM, R.M. 2859	HALLIDAY, W.J. 2662*, 5974	HAMPE, J.F. 4268*
HAGUENAU, F. 3085	HALLOWES, R.C. 418, 421, 1284*, 4941*, 5163	HAMPERL, H. 1515, 3956*, 6241*
HAGUENAUER, J.P. 2739*	HALMI, N.S. 5694*	HAN, T. 2246*, 3165
HAHN, E.C. 428, 3752	HALONEN, P. 150	HANAFUSA, H. 1326, 1749, 3743, 5220, 5233, 5533*
HAHNLOSER, P. 6206*	HALPEREN, S. 732*	HANAFUSA, T. 1326, 5220
HAIMOVICH, J. 665*, 3175	HALPERN, M.S. 4760*	HANAICHI, T. 5204, 5904
HAINES, M. 3499*	HALPERN, R.M. 2022	HANANIA, N. 2292*
HAJDU, S. 5521*	HALPIN, Z.T. 4681	HANAOKA, H. 2054*
HAJDU, S.I. 2181*, 3323*, 4006, 4224*, 4244*, 5463*	HALTER, H.M. 3684	HANAOKA, M. 5302
HAJDUKIEWIEZ, Z. 4112*	HALTERMAN, R. 3908	HANCOCK, B.D. 217*
HAJRA, A.K. 300*	HALTERMAN, R.H. 1083*, 4643, 4674, 6008*	HANCOCK, R.L. 1483*, 5126
HAKALA, M.T. 1996	HALTIA, K. 456	HANDLEMAN, S.L. 4976*, 5265
HAKAMA, M. 513	HAMADA, T. 5699*	HANDLER, E.E. 1969, 3541*, 4186*
HAKANSSON, C.H. 2558, 3309, 6110	HAMAJIMA, K. 1049	HANDLER, E.S. 1969, 3541*, 4186*
HAKOMORI, S. 437	HAMANAKA, N. 2416*	HANDSCHUMACHER, R.E. 2047*
HAKOMORI, S.-I. 4773*	HAMAOKA, T. 3863, 5368*	HANEY, A. 4479*
HALAMA, J. 4199*	HAMAZAKI, Y. .3807	HANKEY, B.F. 1881
HALAZUN, J.F. 2137*	HAMBURG, V.P. 1285*	HANKS, C.T. 4100*
HALBERG, F. 4863	HAMBURGER, J.I. 1688*, 1689*	HANNA, M.G. 5388*
HALEVI, H.S. 3969	HAMEED, K. 3330*, 5611*	HANNA, M.G., JR. 3204, 4413, 4618
HALGAS, W. 4278*	HAMEL, D. 4162*	HANNESTAD, K. 4702
HALGRIMSON, C.G. 5728*	HAMEL, S. 3421*	HANSEN, A.R. 657*, 1650*
HALKO, J. 2629	HAMILTON, J. 2629	HANSEN, D.

3955*
 HANSEN, H.H.
 4888*
 HANSEN, H.J.
 470, 2630, 3846, 3910*,
 4729*, 6014*
 HANSON, R.S.
 2412*
 HANSZ, J.
 2890*
 HAPALKOV, N.P.
 3618
 HARADA, T.
 2627
 HARAN-GHERA, N.
 751, 768, 3775, 4089*, 5272
 HARANGHY, L.
 4946*
 HARCOURT, A.G.
 1546
 HARD, G.C.
 1266, 1542, 2411*, 2759,
 4398
 HARDAS, U.D.
 5409
 HARDISTY, R.M.
 1795, 1825
 HARDMAN, J.M.
 6204*
 HARDY, D.
 1081*
 HARDY, G.J.
 2057*
 HARDY, M.A.
 5549*
 HARDY, P.C.
 1939*
 HARDY, W.
 2561*
 HARDY, W.D., JR.
 405
 HARE, J.D.
 3771
 HAREL, J.
 3777, 4554
 HAREL, L.
 4554
 HAREF, A.
 5006
 HARGIS, B.J.
 3866
 HARGREAVES, R.
 4649
 HARIBHAKTI, P.B.
 5497*
 HARIDAS, K.P.
 3398*
 HARINGTON, J.S.
 386*, 2755, 2756
 HARLAN, W.L.
 622*
 HARLEY, E.H.

2183*
 HARLOZINSKA, A.
 602, 1796, 2619, 5378*
 HARM, K.
 1455*
 HARMAN, C.E.
 2568*
 HARMS, D.
 2154*
 HARDEN, D.G.
 2834
 HARRIS, A.J.
 881*
 HARRIS, A.W.
 3853, 4667
 HARRIS, C.C.
 3685, 4394, 4437
 HARRIS, D.
 2376*
 HARRIS, E.D., JR.
 4962*
 HARRIS, G.S.
 337
 HARRIS, H.
 1386, 1784, 3858, 4027
 HARRIS, J.R.
 3170
 HARRIS, M.
 2025*
 HARRIS, P.N.
 5077
 HARRIS, R.
 4622
 HARRIS, S.
 1851*
 HARRIS, T.N.
 1851*
 HARRISON, R.F.
 4495*
 HARRISON, S.C.
 3057
 HARRISON, T.M.
 4189*
 HARRISS, E.B.
 1107
 HARROLD, J.
 1013
 HARROLD, J.B.
 2612
 HARSHMAN, S.
 2679*
 HART, J.
 1919
 HART, J.S.
 1179*
 HART, W.R.
 2111*
 HARTENSTEIN, R.
 347, 1560
 HARTER, D.H.
 2650
 HARTING, M.C.

3216*
 HARTJE, J.
 2123*
 HARTLEY, J.W.
 407, 1018, 5258, 5265, 5331
 HARTMAN, P.A.
 1858*
 HARTMANN, G.
 2740*
 HARTMANN, J.R.
 5843*
 HARTMANN, N.R.
 5410
 HARTVEIT, F.
 1082*, 2051*, 2607, 6201*
 HARTWICH, G.
 1513, 4286*, 5032*
 HARTWICK, A.
 2794*
 HARVEN, E.D.
 1366*
 HARVEN, E.DE
 3142
 HARVEY, J.J.
 1776*
 HARVEY, R.G.
 961
 HARWELL, L.
 5320
 HASEGAWA, H.
 3773, 4595*, 4974*
 HASEGAWA, K.
 438
 HASEGAWA, T.
 2350
 HASEGAWA, Y.
 5518*
 HASEKURA, H.
 2104*, 2669*
 HASENCLEVER, H.F.
 4086*
 HASHIMOTO, K.
 3531*, 5517*, 5572*, 5600*,
 5604*
 HASHIMOTO, T.
 3502*
 HASHIMOTO, Y.
 2634, 4470*
 HASHINOTSUME, M.
 4010, 4922*, 5505*
 HASHOLT, L.
 1995
 HASLAM, S.
 416, 1340
 HASPEL, O.
 5262
 HASSAR, S. EL
 3514*
 HASSOUN, J.
 605
 HASUE, M.
 3429*

HATANAKA, M.	113	5673*
121, 1114, 1698, 2495, 2505,	HAYAKAWA, M.	HECKER, E.
5952*	949	343, 1651*, 2927, 3680,
HATFIELD, P.M.	HAYAMI, M.	5758*, 5773, 5853*
4933*	135*, 5923	HEDINGER, C.
HATHAWAY, W.E.	HAYASAKI, N.	1482*
3232	2945	HEGEDUS, S.I.
HATIE, C.	HAYASHI, F.	5665*
1412, 4558	5555*	HEGGLIN, J.
HATTORI, S.	HAYASHI, S.	5676*
5403	2719	HEHLMANN, R.
HATZFELD, A.	HAYASHI, Y.	3131
1949, 5716	2350, 5367*, 5385*	HEIDELBERGER, C.
HATZIOANNOU, J.	HAYAT, M.	62, 2304, 2316, 3672, 3709,
2143*	2792*	3881, 4424, 4445, 5173,
HAUCH-GRANOTH, R.	HAYATSU, H.	5774
5272	2334	HEIDRICK, M.L.
HAUCK-GRANOTH, R.	HAYBITTLE, J.L.	856
4089*	529*	HEILMAN, S.A.
HAUGHTON, C.	HAYE, C.	3990
1203	4137*	HEIM, F.
HAUGHTON, D.	HAYHOE, F.G.J.	1639*
471	1213*, 1495*, 3785	HEIMANN, R.
HAUKKAMAA, M.	HAYMAKER, W.	637, 1563, 1990, 4117*
2818	4498*	HEIMPEL, H.
HAUPT, R.	HAYMAN, J.A.	3964*
497*	6105*	HEINE, J.W.
HAUS, E.	HAYNIE, T.P.	3821
4863	5609*	HEINE, U.
HAUSBRANDT, F.	HAYS, E.F.	741*, 1337, 3151*, 6291*
2283*	1780, 3751, 4658	HEINE, U.I.
HAUSCHKA, T.S.	HAYWARD, A.F.	4007
753	5491*	HEINE, W.-D.
HAUSEN, H. ZUR	HAYWARD, J.L.	3242*
5908	789	HEINEMAN, S.
HAUSEN, P.	HAYWOOD, G.R.	881*
2519	164	HEINIGER, H.J.
HAUSER, G.	HAZLEWOOD, C.F.	4034, 5316
1194*	3230	HEINONEN, O.P.
HAUSER, J.	HAZRA, D.K.	261*
268*	1423*	HEINZ, E.
HAUST, M.D.	HAZRA, T.A.	3432*
599*	5542*	HEINZE, R.
HAUT, M.J.	HEAD, K.W.	246
5582*	1478*	HEISE, E.
HAUTEFEVILLE, P.	HEALD, R.J.	2007
4295*	4355*	HEISLER, J.G.
HAVEMANN, K.	HEALEY, P.	6314*
3506*	2331	HEISTMEYER, H.
HAWK, W.A.	HEATH, C.W.	2124*
583*	1100	HELBICH, P.
HAWKS, A.	HEATH, C.W., JR.	3905
342, 4417	6090*	HELD, B.
HAWKSWORTH, G.	HEATH, J.C.	216*
2188*	3702	HELENA TAVARES, M.
HAWKSWORTH, G.M.	HEBBORN, P.	4490
2380*	1769*	HELLEINER, C.W.
HAWTREY, A.O.	HEBERLING, R.L.	2170*
2953	1212*, 3825*	HELLER, A.
HAY, J.B.	HEBY, O.	2037*, 3508*
1874*	4870	HELLER, P.
HAY, L.	HECKER, D.	773*, 4765*, 4766*

HELLER, R.F. 876*	HENNEY, C.S. 1811	4749*, 5360, 5966
HELLER-SCHOECH, G. 3986	HENNING, D. 2875	HERTENSTEIN, C. 2405*
HELLMAN, A. 1007, 2098*, 2667*, 4413, 5250	HENRIKSEN, E. 817*	HERTER, F. 3910*
HELLMAN, S. 749, 3237, 3734*, 3963*	HENRY, C.J. 709, 1054	HERTER, F.P. 4625, 4729*
HELLSTROEM, I. 11*, 453, 1787, 1828, 3162, 4638, 4671, 4698, 5923	HENRY, M. 1701, 1728, 3632*	HERTING, W. 971*
HELLSTROEM, K.E. 11*, 453, 1787, 1828, 3162, 4638, 4671, 4698, 5923	HENRY, P.H. 707, 2812	HERZFELD, A. 4791, 5515*, 5641*
HELLUNG-LARSEN, P. 5436	HENSCHKE, U.K. 4827*	HESHMAT, M.Y. 3276
HELM, K.V.D. 426, 1739	HENSELEIT, E. 5853*	HESSEK, F. 3573*
HELM, R.M. 3791	HENSON, E. 3865	HESSELGREN, R.D. 108*
HELMER, F. 5428*	HEPNER, H. 1200*	HESSLER, C. 6398*
HELMICH, C. 416, 1340	HEPPNER, G. 2605	HESTER, R.B. 4668
HELPAP, B. 3584*	HEPPNER, G.H. 3879, 4662	HESTON, W.E. 4577
ELTIANU, C. 3472*	HERBERMAN, R. 3184, 5952*	HETHERINGTON, N.H. 1686*
ELTING, T. 2178*	HERBERMAN, R.B. 485*, 724, 752, 3835, 3871, 3880, 4621, 4643, 4674, 4697, 5325, 6022*	HETTICHE, H.O. 2408*
ELWIG, E.B. 2862	HERBEUVAL, R. 2675*	HEUCHERT, M.D. 2992
EMPHILL, F.M. 108*	HERBST, A.L. 2345	HEUSON, J.C. 637, 1563, 1990
EMPLING, H.G. 4186*	HEREMANS, J.F. 6010*, 6012*	HEUSON, J.-C. 2993
EMS, G. 1916	HERMAN, J.R. 4831*	HEWER, A. 1533
ENDERSON, B.E. 3744	HERMANOVA, E. 2827	HEWETSON, J.F. 3888, 4623, 4660, 4685
ENDERSON, E.S. 1298*, 4086*	HERMETET, J.C. 2171*	HEWETT, W.J. 3477*
ENDERSON, J.F. 291*, 850, 3336*	HERNANDEZ, F. 374*, 1633*	HEWITT, R.L. 897*
ENDERSON, W.R. 4652	HERNDON, R.M. 4517	HEYMER, B. 283*
ENDLER, S. 395	HEROLD, H.J. 3286*, 5420	HIASA, Y. 1554, 2402*, 3695, 4372, 4385, 5183
ENDRICK, D.J. 2084*	HERRERA, F.M. 3790	HIBBS, J.B., JR. 1799, 3839, 4984*
ENKART, P.A. 5976	HERRERA, I. 4146*	HICKEY, R.C. 4171*
ENKEL, H. 5428*	HERRERA, M.I. 5596*	HICKIE, R.A. 1137*
ENLE, G. 110, 456, 1848*, 2516, 3744, 3876, 4654, 5041*, 5913	HERRMANN, E.C., JR. 3786	HICKS, J.J. 5537*
ENLE, W. 110, 456, 1848*, 2516, 3744, 3876, 4654, 5041*, 5738*, 5913	HERRMANN, J.B. 1690*	HICKS, R.M. 4431
	HERRMANN, W.P. 779*	HIDAJATKUSUMAWIDJAJA 2757
	HERSH, E.M. 1395, 2397*, 2641, 3878,	HIEN, D.-P. 635, 2444*
		HIERARDT-HIEBSCH, CH. 4289*

HIEZABITROWSKI, A.	5182	1049, 1052, 1927, 2540
115	HILL, R.F.	HIRAYAMA, Y.
HIGA, E.	2456	2256*
3521*, 3525*, 5575*, 5576*	HILL, R.S.	HIRONAKA, Y.
HIGASHI, N.	5652*	4154*
235, 1174*, 4852, 4985*	HILLCOAT, B.L.	HIRONO, I.
HIGASHI, T.	4646	3707, 5091
3491*	HILLEMANN, M.R.	HIRSCH, A.
HIGASHINAKAGAWA, T.	131, 415	5006
4925*	HILLOVA, J.	HIRSCH, A.H.
HIGASHINO, K.	2557, 3813	1459*
4010, 4922*, 5505*	HILLYARD, L.A.	HIRSCH-KAUFFMANN, M.
HIGGINS, G.R.	6052	4529
4958*	HILSCHER, W.	HIRSCH, M.S.
HIGGINS, E.S.	3586*	1379, 1776*, 2515, 3686
1415	HILZ, H.	HIRSCHHAEUSER, C.
HIGGINS, I.T.T.	861*, 1455*	6047*
3246	HINES, C., JR.	HIRSCHMAN, S.Z.
HIGGINSON, J.	580*	2198*
221*, 272*	HINGLAIS, H.	HIRSHAUT, Y.
HIGINBOTHAM, N.	815*	2511, 2628
3736*	HINGLAIS, M.	HIRUMI, H.
HIGINBOTHAM, N.L.	815*	1369*, 1759
1303	HINKLE, P.M.	HISAMATSU, T.
HIGURASHI, M.	3351*	4420
2008	HINO, S.	HISAZUMI, H.
HIKI, T.	4589*, 5244	1492*
1929	HINS, C.	HITCHENS, E.M.
HILDEBRAND, J.	4160*	3327*
1962	HINSHAW, H.T.	HITOTSUMACHI, S.
HILDEBRANDT, R.J.	4853	2002, 2337, 3683
216*	HINUMA, Y.	HIZAWA, K.
HILF, R.	1010, 2609, 2672*, 3062	1491*
833, 959, 5513*	HINZE, H.C.	HJERPE, A.
HILFRICH, J.	2536, 3143, 3151*, 5713	2720
5155, 5858*	HIRAI, H.	HJERTMAN, L.
HILGARD, P.	2602, 3320	3529*, 5581*
3427*, 6310*	HIRAI, K.	HLINIAR, A.
HILGARTH, M.	1751, 3124	6275*
4287*	HIRAKI, K.	HLOAZNEK, I.
HILGERS, J.	3773, 4595*, 4974*	5916
1726, 2561*, 3784	HIRAKI, S.	HNILICA, L.S.
HILGERT, I.	2215, 2974	588*, 589*
492*, 3894	HIRAMATSU, T.	HO, H.C.
HILL, A.G.S.	947	822*, 3402*
1292*	HIRAMOTO, R.	HO, S.W.
HILL, D.L.	6343*	1049, 2540
265*, 3660	HIRAMOTO, R.N.	HO, Y.C.
HILL, G.	4758*	2859
3906	HIRANO, H.	HOAGLAND, H.C.
HILL, G.B.	4915*	896*
2750	HIRANO, M.	HOAK, J.C.
HILL, G.J.	1434	1903*, 3515*
2709*	HIRANO, S.	HOBBS, J.
HILL, G.S.	1375	396
5406*	HIRAO, F.	HOBBS, J.R.
HILL, H.F.H.	3696, 4384	5129
1292*	HIRAO, K.	HOCHBERG, K.
HILL, M.	4385	979*, 6168*
2557, 3813	HIRATA, S.	HOCHGESAND, P.
HILL, M.J.	1929	6174*
611, 1101, 2188*, 2380*,	HIRAYAMA, T.	HOCHHOLZER, L.

3383*
CHMAN, A.
481, 2031*
D, I.
183, 4634
DGE, L.D.
2586*
DGETT, J.
3303
DGINS, D.S.
4861
EFFEL, F.
2221*
EG, K.
883*
EKSTRA, J.
2336, 3806, 4572
EL, D.G.
4999*
ELZER, D.
1107
ENSCH, H.
1528*
ERNI, B.
1216*, 3625*
ERTNAGL, H.
6035*
EVEN, R.R. VAN
6115
FER, K.G.
2643
FBRAND, A.V.
1966
FMAN, D.
4478*
FMAN, G.C.
5557*
FMAN, M.
3715*
FMANN, D.
2901, 3604
FMANN, M.
356
MANN, E.
1170*
MANN, P.
6263*
MANN, W.D.
5065*
SCHNEIDER, P.H.
3068
STRAND, H.J.
4757*
AN, B.
6293*
G, R.E.
865*
GAN, M.D.
4525
BACH, M.
1526*
MANN, P.

1189*, 4799*, 5504*
HOKAMA, Y.
4768*, 5532*
HOKARI, S.
2945
HOLBOROW, E.J.
1407*, 3860, 5319, 5739*
HOLCZINGER, L.
3389*
HOLDEN, H.T.
4531
HOLDRIDGE, B.A.
753
HOLLAND, E.
5666*
HOLLAND, J.F.
4091*, 4653
HOLLAND J.F.
4719*
HOLLAND, J.G.
412
HOLLAND, J.J.
2832, 3041
HOLLANDE, E.
1701, 3632*
HOLLANDER, C.F.
272*, 4883*, 5686*
HOLLANDER, D.H.
6362*
HOLLANDER, N.
998*
HOLLANDER, V.P.
998*, 1144*, 2829
HOLLEY, R.W.
1791, 5016
HOLLINS, B.
5511*
HOLLINSHEAD, A.
2644, 4710*, 5372*
HOLLINSHEAD, A.C.
4697
HOLLMANN, K.H.
3606, 5015
HOLLMANN, K.-H.
5040*
HOLLMANN, M.K.H.
5025
HOLMAN, L.
3710
HOLMES, A.W.
3823*
HOLSTEIN, B.A.
2415*
HOLT, P.F.
81*
HOLT, P.J.L.
1855*, 4641, 5486*
HOLTON, C.P.
5493*
HOLTWICK, E.S.
58, 1805
HOLTZ, F.

2180*
HOLYOKE, D.
4737*, 5992*
HOLYOKE, E.D.
1770*, 2133*, 3382*
HOLZNER, H.
1235*
HOLZNER, J.H.
1552, 4249*, 4684
HOM, P.H.
3693
HOMBURGER, F.
2318, 2921*, 2925
HONDA, T.
2443*
HONIG, G.R.
6128
HONJO, I.
4892*
HONOHAN, T.
5072
HOOKS, J.
3750
HOOKS, J.J.
4556
HOOPER, R.
5481*
HOOPER, S.B.
3441*
HOOSON, J.
1601, 2374*
HOOVER, E.A.
5292
HOOVER, R.
2763, 3266
HOPFNER, C.
5101, 6071*
HOPKINS, T.
3702
HOPP, M.L.
4376
HOPWOOD, L.E.
2463*
HOPWOOD, W.J.
1625*
HORAI, T.
5403
HORAKOVA, K.
6370*
HORI, C.G.
1302
HORI, J.M.
2242*
HORI, Y.
6208*
HORIBATA, K.
6023*
HORIE, A.
5180, 5555*
HORIKAWA, M.
4494
HORIO, T.

2949, 4223*
HORN, J.
5857*
HORN, M.
1545
HORN, R.C.
495*
HORNOVA, J.
191*, 3496*
HORNSELETH, A.
3864
HORNUNG, G.
2082*
HORNUNG, M.O.
2702*
HOROWITZ, S.A.
1839
HORST, H.
5860*
HORTON, B.J.
2963, 4782
HORVAT, B.
5407*
HORVATH, A.E.
420
HORVATH, E.
51, 976*, 4931*
HORVATH, T.
1857*
HORWITZ, M.S.
1334, 2419*, 3739, 5936*
HORWITZ, O.
1923
HORWITZ, S.B.
2419*
HOSHINO, H.
2334
HOSHINO, K.
1993, 4463*
HOSHINO, M.
1438
HOSINO, M.
6322*
HOSOI, K.
4223*
HOSOKAWA, M.
2570*, 4505, 5136
HOSOKAWA, T.
1023, 1065*, 1833
HOSS, H.E.
5236
HOSSFELD, D.K.
6380*
HOSSMANN, K.-A.
2070*
HOTTA, S.
1833
HOU-JENSEN, K.
2179*, 3244*
HOURI, M.
5334
HOWARD, B.V.

4838*
HOWARD, C.H.
646*, 5511*
HOWARD, R.J.
677*
HOWE, D.M.
4039
HOWELL, R.S.
1404*
HOWES, A.E.
3492*
HOWITZ, M.S.
4543
HOWLAND, R.D.
671*, 963
HOYBYE, G.
973*
HOYER, B.
4548
HOYT, W.F.
4200*
HOZOC, M.
1037*
HOZUMI, M.
3840, 4092*
HOZUMI, N.
5623*
HRABOE, M.
2067*
HRGOVCIC, M.
2115*, 5432
HRNCIR, Z.
6020*
HRNCIROVA, L.
6020*
HROMADA, J.
3288*
HRSK, I.
167*
HRUBAN, Z.
1986, 3403*
HSIE, A.W.
1246
HSIEH, D.P.H.
94*
HSIEH, M.W.
719, 852
HSIEH, S.-H.
1383
HSIUNG, G.D.
1722
HSU, C.C.S.
3181
HSU, H.H.T.
4004
HSU, K.C.
2650, 2819
HSU, M.M.
1049, 1383, 1927
HSU, S.M.
5195*
HSU, T.C.

4884*
HSUEH, S.-S.
2318, 2925
HU, F.
1436, 4088*
HUANG, A.S.
4967*
HUANG, B.L.
2824
HUANG, C.C.
3812
HUANG, E.-S.
3809, 4516
HUANG, G.-F.
2983
HUANG, H.L.
3087
HUANG, J.
2765
HUANG, W.Y.
3307
HUBER, C.
2125*
HUBER, H.
2125*, 3507*
HUBERMAN, E.
62, 2304, 3646, 3709, 4424,
4445
HUBERMAN, T.E.
5774
HUCKAUF, H.
2399*
HUDSON, J.B.
3109, 5903, 5949*
HUEBER, G.
1480*
HUEBNER, G.
2019
HUEBNER, N.
6108
HUEBNER, R.J.
2964, 3703, 3902, 4665,
5254, 5316, 5331
HUELSE, D.F.
6389*
HUEMER, R.P.
1905*
HUEPER, G.
2518, 4570
HUEPER, W.C.
2281*, 2282*, 3620
HUETTEMANN, U.
2399*
HUFF, K.
2872
HUFF, S.D.
5264
HUG, O.
1678*
HUGGINS, C.
3375*, 5762
HUGHES, E.S.R.

1868*	3366*	IBATA, T.
HUGHES, W.L.	HUPPERT, J.	2627
2643	2292*	ICHIHARA, A.
HUGUES, A.	HUPRIKAR, S.V.	5474*
1216*	133*	ICHIKAWA, H.
HUHN, D.	HURAU, J.-M.	984*
3507*, 4153*	2259*	ICHINOSE, H.
HUI, Y.H.	HURD, C.M.	897*
185, 1243, 2932, 4606*	758, 760, 782*	IDA, S.
HUISMAN, H.	HUREZ, D.	2609
961	4716*	IDE, T.
HULKA, B.S.	HURLBERT, R.B.	2936, 3005
2772*	4005, 4028	IEVLEVA, E.S.
HULL, J.D.	HURST, L.	3870
5548*	2956, 2957, 5769	IFTIMOVICI, M.
HULL, R.N.	HURT, T.	1029
3823*	5877	IGIDBASHIAN, D.K.
HULTBORN, A.	HURTADO, R.	6278*
285*	4207*	IGNATI'YEV, A.S.
HULTEN, L.	HURWITZ, E.	1890
285*	665*	IGOT, J.P.
HULTIN, T.	HURWITZ, J.	1108*
5171	3047, 4551, 5876	II, Y.
HULU, N.	HUSAK, T.	5013
3231	1617*	IJUIN, M.
HUMBERT, J.-C.	HUSEBY, R.A.	947
2805*	5633*	IKAWA, Y.
HUMBERT, J.R.	HUSSA, R.O.	1831, 4600*, 5223, 5950*,
3232	3307	5952*
HUMMELER, K.	HUSZTIK, E.	IKEDA, S.
1851*	194*	6208*
HUMPHREY, G.B.	HUTCHISON, D.J.	IKEHARA, Y.
2581*, 3210	4008	1551
HUMPHREY, L.J.	HUTCHISON, G.	IKEMOTO, K.
1788	3638*	2575*
HUMPHREY, R.L.	HUTT, M.S.R.	IKEMURA, K.
2656*, 5304	511, 1918	3522*, 4051*
HUMPHREY, W., JR.	HUTTON, J.J.	IKEUCHI, T.
1813	2006, 5336	399
HUMPHREYS, S.	HUTTON, R.	IKONOPISOV, R.L.
2725*	2580*	3883, 5376*
HUMPHRIES, E.H.	HUVOS, A.G.	IKUTA, F.
4511	1303, 2138*, 3031*, 3385*,	1439
HUMPHRIES, K.R.	4244*, 5654*	IL'IN, M.I.
2851	HUVOS, A.J.	1876*
HUMPHRIES, K.C.	3736*	IL'IN, V.S.
4017	HUXLEY, M.	3998
HUNDEIKER, M.	2858	ILBERY, P.L.T.
2184*, 6246*	HUYNH, T.	1665
HUNG, Y.	3777	ILIEVSKI, V.
2587*	HUYNH, TH.	4522
HUNT, P.S.	3081	ILIN, K.V.
16*	HUYSTEE, R.B. VAN	5883
HUNT, R.D.	1684*, 2458	ILLUECA, E.
3822*, 4312, 5925	HWANG, D.S.	3371*
HUNTER, B.T.	4863	ILNITSKY, A.P.
5826*	HWANG DONG, H.	2441*, 2450*
HUNTER, G.R.	6102*	IMAGAWA, D.T.
4022	HYMAN, B.	3919*
HUNTER, L.	6355*	IMAI, M.T.
2708*	HYMAN, R.	2015
HUOT, J.	4615	IMAI, T.

199
 IMAIZUMI, T.
 2310, 3013
 IMAMOGU, I.
 4143*
 IMAMURA, A.
 5094
 IMAMURA, K.
 2104*, 2669*, 5539*, 6126
 IMAMURA, M.
 722
 IMASATO, K.
 1071*, 2711*
 IMBERT, M.C.
 6232*
 IMRE, J.
 507*
 INAGAKI, A.
 2848
 INANO, H.
 1977
 INBAR, M.
 2735*, 2844, 2879, 3938
 INBERG, M.V.
 4065*
 INCHLEY, M.P.
 5315
 INFANTE SANCHEZ, J.C.
 5061*
 INGLETON, P.M.
 2930
 INGLIS, N.R.
 486*
 INGRAM, A.J.
 2403*, 4467*
 INGRAM, J.D.
 730*
 INMAN, J.K.
 162
 INNIS, M.D.
 816*
 INNOCENTI, I.R-D
 2361
 INNOCENTI, I.R.-D.
 4806*
 INOMATA, M.
 1577, 2434*, 5141
 INOMATA, N.
 1439
 INOSE, M.
 4003
 INQUE, K.
 1402
 INQUE, M.
 464, 1052
 INQUE, S.
 6368*
 INUI, N.
 47, 1598, 2332, 3677
 IOACHIM, H.L.
 140*, 1567
 IOKAI, I.

2663*
 IOKI, Y.
 5094
 IONOV, I.D.
 487*
 IORIO, A.M.
 2699*
 IRD, YE.A.
 6250*
 IRIE, K.
 747
 IRIE, R.F.
 747, 2610, 3840, 3930*
 IRIKURA, T.
 5518*
 IRINO, S.
 3773
 IRIYA, K.
 947
 IRLIN, I.S.
 445*, 1210, 1762, 2532,
 3090, 3146*, 5175, 5209,
 5819*, 5887
 IRVINE, W.T.
 1183*
 IRVING, C.C.
 1283*, 1564, 2941, 3716*
 IRVING, D.N.
 3903
 ISAAC, J.-P.
 3912*
 ISAEV, N.M.
 6189*
 ISAGER, H.
 1637*
 ISAKA, H.
 2602
 ISBISTER, W.
 841, 895*
 ISHIBASHI, S.
 5495*
 ISHIBASHI, Y.
 1402, 2683*, 2684*, 2716,
 6208*
 ISHIBE, T.
 3544*
 ISHIDA, F.
 582*
 ISHIDA, K.
 5013
 ISHIDA, N.
 4747*
 ISHIDATE, M., JR.
 1628*
 ISHIGAMI, S.
 4713*
 ISHIHARA, K.
 6223*
 ISHII, T.
 2104*, 2669*
 ISHII, Y.
 3666

ISHIJIMA, Y.
 1174*, 4852
 ISHIKAKA, S.
 5523*
 ISHIKAWA, E.
 5524*
 ISHIKAWA, G.
 6317*
 ISHIKAWA, K.
 6210*
 ISHIKAWA, S.
 5526*
 ISHIKAWA, Y.
 5677*
 ISHIMOTO, A.
 1023, 1833, 2509, 5344
 ISHIZAKA, K.
 748
 ISHIZAKA, T.
 748
 ISHIZAKI, R.
 3051, 3075
 ISHIZAWA, M.
 1595, 4482*
 ISKANDER, S.G.
 4879*
 ISLAM, M.N.
 3353*
 ISMAILOV, B.I.
 6185*
 ISOBE, A.
 5776
 ISRAEL, L.
 2112*
 ISSELBACHER, K.J.
 759, 1757, 1842*, 1953,
 3640*
 ISSENBERG, H.J.
 3252
 ITAKURA, K.
 5336
 ITO, A.
 587*, 1982, 4965*
 ITO, E.
 271*
 ITO, H.
 2886*
 ITO, K.
 4279*
 ITO, M.
 2960, 2965, 4722*, 5089
 ITO, N.
 947, 1554, 2402*, 2945,
 3695, 4372, 4385, 4462*,
 5183
 ITO, S.
 4661
 ITO, T.I.
 3684
 ITO, Y.
 4453*, 5344
 ITO, Y.H.

2540
 OH, M.
 5674*
 ZE, L.
 4412
 DICELLO, P.
 5998*
 ANKHNO, G.I.
 2745*
 ANKOVIC, S.
 5108, 5144, 5162, 5812*
 ANKOVICH, S.
 2234*
 ANOV, B.
 136*, 2598*
 ANOVA, A.
 1154*, 3548*
 ANOVA, O.Y.
 2825
 ANOVIC, S.
 1615*
 ERSEN, O.H.
 4391
 INS, J.C.
 4093*, 5520*, 5565*
 A, N.
 1020
 NHARA, S.
 1278*
 NAGA, T.
 4987*
 NAMI, Y.
 4003
 SA, H.
 2104*, 2669*
 SAKI, T.
 2299, 2300
 TA, Y.
 5555*
 VLEVA, YE.S.
 445*
 E, P.T.
 3899
 K, G.
 4620
 RD, C.
 2432*
 MI, A.
 1961
 O, M.
 785
 O, M.J.
 2703*
 ARA, A.G.
 1546, 1643*, 4268*, 4364
 LCKOW, V.
 2470*
 LOKOW, V.R.
 6235*
 LON, S.
 1687*, 2481*
 LONSKA, S.

1856*, 3793
 JABRE, E.
 4136*
 JABUSCH, H.P.
 6067*
 JACKISCH, R.
 6349*
 JACKSON, A.H.
 5893
 JACKSON, C.D.
 3716*, 5848*
 JACKSON, D.A.
 5895
 JACKSON, E.W.
 1097
 JACKSON, F.E.
 3685
 JACKSON, J.L.
 4977*, 5265
 JACKSON, N.
 3115
 JACKSON, T.A.
 5612*
 JACOB, F.
 2725*
 JACOB, H.S.
 6299*
 JACOBS, A.J.
 4426
 JACOBS, B.B.
 5633*, 5989*
 JACOBS, D.
 5334
 JACOBS-LORENA, M.
 4997*
 JACOBS, P.H.
 2196*
 JACOBS, R.P.
 4756*
 JACOBS, S.A.
 3325*
 JACOBSON, M.
 306
 JACOBSON, S.J.
 2071*
 JACOBY, B.
 4132*, 4770*
 JACQUEMONT, B.
 682, 2562*, 5241
 JACQUIGNON, P.
 338, 387*, 2373*, 2433*,
 2444*, 3699
 JACQUOT, F.
 2912*
 JAEMES, D.
 3411*
 JAENISCH, R.
 718, 3060
 JAENISCH, W.
 6064*
 JAERVINEN, M.
 2926

JAFFE, N.
 4060*
 JAGARLAMOODY, S.M.
 460, 5049*
 JAGELMAN, D.G.
 5636*
 JAGODZINSKI, Z.
 3599*
 JAHNES, W.G.
 3178
 JAHNS, M.F.
 5609*
 JAIN, D.
 350
 JAIN, D.K.
 1931
 JAIN, K.K.
 4960*
 JAIN, P.K.
 616*
 JAKAC, D.
 331*
 JAKIMOV, M.
 5499*, 5500*
 JAKOUBKOVA, J.
 3905
 JAKUBOWICZ, K.
 2029*, 3793
 JALOWAYSKI, I.
 5561*
 JAMES, A.C.
 5198
 JAMES, A.E.
 4933*
 JAMES, F.
 1183*
 JAMES, V.H.T.
 1183*
 JANCINA, J.
 796*
 JANCZEWSKI, G.
 3575*
 JANDOVA, A.
 864*, 2827, 5679*
 JANICKI, K.
 1099, 1914, 3977*, 5411
 JANIK, P.
 3303, 3887
 JANISCH, W.
 5178, 5830*
 JANKU, O.
 3215
 JANOFF, A.
 3433*
 JANOWER, M.L.
 1474*
 JANOWITZ, H.D.
 2511
 JANS, P.
 2850
 JANS, D.
 1564

JANTSCH, B.
5073
JANUS, T.
2794*
JAO, J.
3334*
JAQUET, H.
1866*
JARD, S.
5441
JARRETT, J.E.
1224*
JARRETT, O.
1035*, 3805
JARRETT, W.F.H.
1035*, 3805, 4788
JASMIN, G.
3019*
JASTY, V.
1314, 3130, 4506
JASZCZ, W.
4578*
JAUMANN, R.
6098*
JAWORSKA, H.
4639
JAYANT, K.
3290*, 4297*
JAYET, A.
1482*
JAYLE, M.-F.
2956
JAYLE, M.F.
5769
JEAN, G.
597*
JEAN, R.
5397*
JEANLOZ, R.W.
4764*
JEANNET, M.
1807, 2608, 3173
JEANTEUR, P.
5881
JEHN, U.
5882
JELACIC, O.
3283*
JELINKOVA, E.
3197
JEMEC, B.
2359
JENKINS, B.A.G.
4196*
JENKINS, D.E.
6314*
JENKINS, ..
2344
JENNINGS, A.
2872
JENNINGS, R.H.
4914*

JENNISON, R.F.
4622
JENSEN, E.M.
1011, 1767*
JENSEN, F.
2584*, 3138, 5308
JENSEN, K.B.
2678*
JENSEN, M.K.
2809
JENSEN, P.B.
817*
JENSEN, R.D.
812, 5453, 5687*
JENSSON, O.
6117
JENTOF, V.L.
4804*
JEPPESSEN, TH.
5268
JEREMY, D.
2642
JERKOF SKY, M.A.
471
JETER, W.S.
1393
JEWELL, W.R.
2708*
JHINGRAN, S.G.
5609*
JIM, R.
4768*
JIRTLE, R.
2003
JITUIKI, D.
1373
JOFRE, J.A.
6194*
JOHANNESEN, T.A.
6157*
JOHANSEN, I.
2453
JOHANSSON, B.
464, 2516, 3296
JOHNSEN, D.O.
1613*
JOHNSON, D.E.
2372*, 2954, 2955
JOHNSON, D.S.
3410*
JOHNSON, E.A.
4451*
JOHNSON, E.Y.
695, 1002
JOHNSON, F.B.
4525
JOHNSON, F.L.
902, 5843*
JOHNSON, G.S.
1737, 3308, 3314, 4222*,
4508
JOHNSON, K.H.

5404
JOHNSON, L.A.
1723
JOHNSON, L.D.
462
JOHNSON, L.I.
5958
JOHNSON, M.S.
819*
JOHNSON, P.A.
4694
JOHNSON, R.E.
3763
JOHNSON, R.G.
1985
JOHNSON, R.J.
2185*
JOHNSON, R.T.
4517
JOHNSON, W.
5666*
JOHNSSON, S.
2101*
JOHNSTON, H.M.
1456*
JOHNSTON, W.W.
1182*
JOKLIK, W.K.
4583*
JOLLES, P.
6287*
JONES, C.T.A.
2472*
JONES, D.B.
3071
JONES, D.C.
4491
JONES, D.L.
938
JONES, E.W.
675*
JONES, H.W., JR.
3940
JONES, K.W.
3108, 4593*
JONES, L.H.
1795
JONES, M.E.
2892*
JONES, O.W.
4867
JONES, P.A.
2953
JONES, R.
1273
JONES, R.D.
4673
JONES, R.S.
938
JONES, S.E.
2880
JONES, V.E.

1406*
 ONSSON, A.
 1636*
 ONSSON, N.
 474, 1286*, 2625, 5324
 OOS, P.
 853
 ORDAN, E.
 3594*
 ORDAN, P.H., JR.
 2024*
 ORDAN, S.W.
 1657, 2455, 2765, 5872*
 ORDANOGLU, J.
 2143*
 JOSEFSON, H.
 1928
 JOSEPH, J.M.
 4659
 JOSEPH, L.B.M.
 736*
 JOshi, S.
 4366
 JODKIEWICZ, L.
 3587*
 JOLIAN, B.
 3106
 JOLIAN, J.A.
 1242
 JOLIANO, R.
 6344*
 JOLLIEN, P.
 4503
 JLOW, J.
 6255*
 JNG, A.
 6349*
 JNG, G.
 4156*
 JNG, H.D.
 985*, 6100*
 JNG, O.S.
 2881
 JNG, P.F.
 1927
 JNGE, U.
 6279*
 JNGMANN, R.A.
 4375
 JRALE, C.
 1766*
 JRG, L.
 6226*
 JRIN, M.
 3492*, 4686
 JRUKOVSki, J.
 2802*
 JSSAWALLA, D.J.
 534*, 4833*, 6082
 JADEN, O.
 5940*
 JBAKCI, T.

3456*
 KABAT, D.
 4994*
 KABIGTING, A.
 2495
 KABUTA, H.
 2564*
 KACHERGENE, N.B.
 6183*
 KACIAN, D.L.
 1352*, 3769, 5229
 KACZMARSKI, M.
 5427*
 KADAR, T.
 6091*
 KADAS, I.
 4805*
 KADER, M.M.A.
 1640*
 KADO, C.I.
 4421
 KAESS, H.
 5452
 KAFUKO, G.
 2628
 KAFUKO, G.W.
 3744
 KAGA, A.R.
 5570*
 KAGAN, A.
 3263
 KAGAN, A.R.
 3328*
 KAGAN, G.YA.
 3538*, 6070*
 KAHAN, B.
 449
 KAHN, L.B.
 3523*, 5577*, 5740*, 6198*
 KAHN, S.B.
 6338*
 KAICK, G.
 6048*
 KAISER, P.
 2741*, 6252*
 KAKEFUDA, T.
 2505
 KAKIZAWA, H.
 1434, 2190*
 KAKO, K.
 4740*
 KAKU, R.
 5539*, 6126
 KALASHINIKOVA, G.V.
 3590*
 KALE, V.V.
 4909*
 KALEDIN, V.I.
 5082
 KALETA, E.F.
 3148*
 KALF, G.F.

4022
 KALIFAT, R.
 4295*
 KALINER, M.A.
 2697*
 KALININA, L.I.
 4792
 KALISS, N.
 3182
 KALITEYEVSKY, P.F.
 5870*
 KALKOFF, P.
 6383*
 KALLMAN, R.F.
 3464*, 4964*
 KALLNER, H.
 3258
 KALTENBACH, F.J.
 4287*
 KALTER, S.S.
 1212*, 3825*
 KALUS, M.
 5470*
 KAMALPURIA, S.K.
 616*
 KAMAMOTO, Y.
 1554, 2402*, 4372, 4385,
 5183
 KAMBARA, T.
 4432
 KAMEN, B.
 4969*
 KAMESWARI, V.R.
 820*, 2381*, 5193*
 KAMINSKA, A.
 2462*
 KAMINSKA, L.P.
 5348
 KAMINSKAS, E.
 4992*
 KAMIYA, S.
 1278*
 KAMIYA, T.
 1551
 KAMIYAMA, R.
 2887*
 KAMO, I.
 4747*
 KAMPOURAKIS, N.
 6221*
 KAMPSCHMIDT, R.F.
 3192, 3374*
 KAMRA, O.P.
 1642*
 KANAGHINIS, H.T.
 2143*
 KANAZAWA, Y.
 868*
 KANBOUR, A.
 2110*
 KANDUTSCH, A.A.
 1483*

KANE, P.A.
825*
KANEKO, A.
2299, 2300, 3714
KANEKO, I.
4968*
KANEKO, M.
1549
KANG, K.-Y.
2884*, 4010, 4922*
KANHOIWA, S.
1690*
KANIGOWSKI, K.
6213*
KANISAWA, M.
4369
KANNAN, Y.
2949
KANNERSTEIN, M.
5782
KANO-TANAKA, K.
5204, 5904
KANTROWITZ, P.A.
5370*
KANZAKI, Y.
1426*
KAO, F.T.
630
KAO, M.-S.
4702
KAO, Y.S.
2024*
KAPITUL'IKIY, B.B.
3720*
KAPLAN, A.L.
4340*
KAPLAN, A.S.
1717
KAPLAN, E.L.
3966
KAPLAN, H.
504*
KAPLAN, H.S.
2880, 3608
KAPLAN, J.C.
2513, 3063, 3088
KAPLAN, J.H.
4187*
KAPLAN, M.B.
5247
KAPLAN, N.O.
4913*
KAPP, L.N.
5697*, 5698*
KAPSENBERG, J.G.
2257*
KAPULER, A.M.
2994
KAPULLER, L.L.
4256*, 6150*
KAPUR, B.M.L.
4955*

KARA, J.
1792, 3810
KARACA, M.
3456*
KARAM, J.D.
2871
KARAMOUCHEVA, L.
5499*
KARASAKI, S.
4784
KARCH, S.B.
2287*
KARDASZEWICZ, S.
6225*
KARDON, P.
1896, 3681
KAREWICZ, Z.
1098
KARIM, M.
1979
KARJALAINEN, O.
2818
KARK, A.E.
3189
KARMYSHEVA, V.YA.
5939*
KARNICKA-MLODKOWSKA, H.
3594*
KARON, H.
4126*, 4128*
KARP, V.P.
2842
KARPAS, A.
3079, 3785
KARRER, K.
5428*
KARSTEN, U.
980*
KARTASHEVA, L.A.
6152*
KARTENBECK, J.
5512*, 6179*
KASAEJAN, S.S.
4078*
KASABYAN, S.S.
6237*
KASAC, M.
586*
KASAMATSU, M.
2186*
KASCHULA, R.O.C.
6198*
KASHIWADE, H.
2104*, 2669*
KASHIWAGI, K.
3491*
KASHTANOV, N.F.
3976*
KASHULINA, A.P.
5090
KASLOW, R.A.
2129*

KASNIC, G.
2023*
KASNIC, G., JR.
2483, 2493
KASPRZAK, K.S.
594*, 4348*
KASSULKE, J.T.
477
KASTENBAUM, M.A.
4019
KASTNER, H.
6258*
KASYANENKO, I.V.
3574*
KATAOKA, N.
4579*
KATAOKA, Y.
4721*, 5489*
KATAUMI, S.
6227*
KATAYAMA, I.
2091*, 4950*, 6332*
KATAYAMA, K.P.
3940
KATES, J.
1766*
KATO, D.
4280*
KATO, H.
1662, 4816
KATO, K.
360, 4566
KATO, N.
1388, 4661
KATO, S.
1020, 1022, 1059
KATOH, T.
6222*
KATONA, F.
3443*
KATSIOULES, C.
352
KATSUMI, T.
6231*
KATSUTA, H.
360, 4211*, 5796
KATZ, C.
1541, 2981, 3002, 3647,
5072
KATZ, D.H.
2620, 3164
KATZ, E.
1707, 2522
KATZ, R.
3842
KATZ, R.U.
3017*
KAUFFMAN, S.L.
1092*
KAUFFMANN-MACKH, G.
6269*
KAUFMAN, D.G.

2312, 3685, 4394, 4437,
 5176
 AUFMAN, R.H.
 4340*
 AUNITZ, H.
 4965*
 AUR, J.
 6117
 AVAKLIEVA-DIMITROVA, YA.
 6037*
 AWACHI, T.
 1293*
 AWAHARA, I.
 1433
 AWAI, H.
 1432
 AWAI, S.
 1749
 AWAJI, K.
 5119, 5781, 5783
 AWAKAMI, T.
 1320
 AWAKAMI, T.G.
 3036, 5264
 AWAKATSU, K.
 2443*
 AWAMOTO, Y.
 4975*
 AWAMURA, A.
 2256*, 2540
 AWAMURA, A., JR.
 1021, 1049, 1052, 1382,
 1383
 AWAMURA, Y.
 3440*
 AWANAMI, J.
 5994*
 AWASAKI, H.
 1071*, 2711*
 AWASHIMA, K.
 1434
 AWASHIMA, T.
 3412*
 AWAZOE, Y.
 1593, 2334, 2983
 AY, E.R.M.
 3353*
 AY, H.E.M.
 1795
 AY, J.E.
 6294*
 AY, S.
 579*, 894*, 2106*, 5475*
 AYE, G.I.
 1461*, 3958*
 AYIBANDA, B.
 1991
 AYUMOVA, M.G.
 2045*
 AZ'MIN, S.D.
 2435*, 2743*, 3312
 AZANCIGIL, A.

1463*
 KAZANTSEVA, I.A.
 4108*
 KAZANTZIS, G.
 5009
 KAZARYAN, K.A.
 5968
 KEARNEY, W.H.
 3966
 KEAST, D.
 1368*
 KEDAR, E.
 2712*, 4620
 KEEFER, L.
 946, 3708, 5156
 KEHOE, J.M.
 4754*
 KEIR, H.M.
 5541*
 KEISER, H.R.
 2836, 4882*
 KEISSLING, R.
 3897
 KELLEN, J.A.
 1258, 1645*, 2395*
 KELLER, A.R.
 3383*
 KELLER, R.
 1406*
 KELLER, S.
 1567
 KELLER, S.J.
 5608*
 KELLER, W.
 5892
 KELLERER, A.M.
 3029
 KELLEY, D.E.
 1118
 KELLEY, R.O.
 673, 5240
 KELLICUTT, L.M.
 4481*
 KELLIE, A.E.
 2948
 KELLOFF, G.
 4565
 KELLOFF, G.J.
 308, 1313, 1581, 2550, 2551
 KELLY, G.
 3906
 KELLY, J.
 4981*
 KELLY, R.E.
 982*
 KELLY, R.M.
 2747
 KELLY, W.A.
 5196*
 KEMBLE, J.V.H.
 4350*
 KEMMER, C.

5884
 KEMPERMAN, J.H.
 1171*
 KEMPSON, R.L.
 3355*, 4053*
 KENDREY, G.
 1125
 KENNEDY, B.J.
 4937*, 5473*
 KENNEDY, J.S.
 1673*
 KENNEL, S.J.
 5308
 KENNEY, F.T.
 2510, 3295, 4585*
 KENZY, S.G.
 786, 3761
 KERAENEN, A.J.A.
 3501*
 KERN, G.
 5065*
 KERN, M.
 2048*
 KERNION, J.B. DE
 2358
 KERNOHAN, I.R.
 4414
 KERR, C.S.
 2318, 2925
 KERR, H.A.
 4976*
 KERR, I.B.
 2132*
 KERR, J.F.R.
 5020
 KERR, S.E.
 2137*
 KERRIGAN, G.
 6337*
 KERSTING, G.
 4908*
 KERTES, I.
 2074*
 KERTIKOWA, S.
 547
 KESCHMARAS, N.
 1276*
 KESSEL, D.
 4040
 KESSOUS, A.
 6144*
 KETCHAM, A.S.
 608, 757, 787, 854, 1443,
 2076*, 4703
 KETCHEL, M.M.
 2643
 KETT, K.
 4805*
 KETTERER, B.
 972*, 1611*
 KETTERER, H.
 2149*

KETTNER, M.
3444*
KEY, C.R.
2145*, 2286*, 2765
KEYSERLINGK, D.G.
6139*
KHACHATRYAN, E.A.
5768
KHADZHIEV, SP.
6037*
KHAFAGY, M.M.
4057*
KHAKIMOV, KH.A.
6073
KHANDEKAR, J.D.
3379*
KHARCHENKO, M.F.
561*
KHARLAMPOVICH, S.I.
4293*
KHAZOVA, L.A.
6257*
KHEIFETS, R.A.
5870*
KHEIR, S.
4171*
KHESIN, YA.YE.
5997*
KHESINA, A.Y.
368*, 2450*
KHOKHLOVA, M.P.
5746*
KHOLMUKHAMEDOVA, N.M.
5874*
KHUDOLEI, V.V.
2324
KHUONG-HUU, Q.
2957
KHUZHAMBERDIYEV, M.
5700*
KHVATOVA, N.V.
4181*
KHYMENKO, O.I.
5210
KIDD, R.L.
3370*
KIDESS, E.
4156*
KIDWELL, W.R.
4596*
KIEFF, E.
4548
KIELER, J.
1430, 4629
KIESSLING, A.A.
5901
KIJIMOTO, S.
437, 4773*
KIKAWA, S.
1426*
KIKUCHI, A.
6209*

KIKUCHI, H.
544, 1452*, 4012
KIKUCHI, K.
1452*, 3868
KIKUCHI, Y.
3868, 4095*
KILBY, D.
532*
KILHAM, S.S.
1361*
KILLEN, E.
6339*
KILLMANN, S.-A.
3448*
KIM, I.S.
6102*
KIM, K.H.
2778*
KIM, Y.M.
5616*
KIMBALL, R.F.
3657
KIMELDORF, D.J.
4491
KIMMEL, C.B.
4247*
KIMOTO, E.
1071*, 2711*
KIMOTO, T.
3094, 3133
KIMURA, I.
1362*, 1438, 4453*, 4609*,
5249
KIMURA, S.
1336, 1387
KINDERMAN, B.
4815
KINDERMANN, G.
6067*, 6377*
KING, C.
1295*
KING, J.M.
4584*
KING, N.W.
3781, 3822*, 3832*, 5925
KING, R.J.B.
1263
KINGSLEY, S.
1047, 3923*
KINKADE, J.M., JR.
1113
KINLEN, L.J.
766
KINOSHITA, N.
2928, 3678
KINOSHITA, Y.
1387
KINZEL, V.
5857*
KIPERVASSER, E.M.
6070*
KIPLING, M.D.

645*
KIRCHNER, C.
6047*
KIRCHNER, H.
3917*, 4757*
KIREEVA, I.S.
3021*
KIRICUTA, I.
4110*
KIRIYAMA, T.
1426*
KIRKLAND, J.A.
790*
KIRKMAN, H.
6364*
KIRSCH, N.
2386*
KIRSCH, W.M.
6329*
KIRSCHSTEIN, R.L.
2811, 3669, 3872
KIRSNER, J.B.
1141*
KIRSTEN, W.H.
4580*
KIRYA, B.G.
3744
KIRYABWIRE, J.W.M.
4657
KISCH, A.L.
5240
KISELEV, F.L.
461, 3090
KISELEV, P.N.
5981*, 5982*
KISELEVA, N.S.
2192*, 2193*, 3722*, 5502*
KISH, V.M.
5102
KISHORE, N.
1190*
KISIC, A.
4778*
KISIELOW, P.
3193
KISIELSKI, W.E.
5115, 5127
KISSELJOV, F.L.
5887
KISSLING, R.E.
4647
KISSMEYER-NIELSEN, F.
2676*, 2678*
KISUULE, A.
1094
KIT, S.
1729, 3060, 5894
KITAGAWA, M.
3863, 5312
KITAGAWA, M.
5368*
KITAGAWA, T.

945, 953, 4452*, 5098
KITAJIMA, T.
4376
KITAMURA, T.
3037
KITANO, M.
2671*, 4718*
KITSCHKE, H.
6045*
KITSCHKE, H.J.
6046*
KITTLICK, P.-D.
5151
KIZER, D.E.
2990, 3710
KJERBYE, K.E.
2678*
KLASSEN, A.
5844*
KLAUBER, M.R.
1097, 3974
KLAVINS, J.V.
3207, 4435
KLEHR, H.U.
3579*
KLEIN, E.
464, 1380, 1386, 1510, 1784,
1821, 2206, 2569*, 3869,
3897, 4690, 5888
KLEIN, G.
448, 466, 482, 1013, 1045,
1046, 1058, 1386, 1784,
2516, 2612, 2852, 3858,
3876, 3888, 3942, 4027,
4575, 4660, 4685, 5695*,
5882, 5913
KLEIN, H.J.
2019
KLEIN, H.Z.
4898*
KLEIN, K.M.
4402
KLEIN, M.
3900
KLEIN, W.J., JR.
2646, 4752*
KLEINMAN, M.S.
5320, 5371*
KLEINMANS, V.
6046*
KLEINSASSER, O.
2019
KLEINSCHMIDT, H.Y.
679*
KLEIST, S. VON
1827
KLEMENT, V.
442*, 1731
KLEMENT'YEVA, L.S.
4265*
KLEMM, G.
2383*

KLEMM, W.
5151
KLEMOLA, E.
456
KLETT, H.
1318
KLETZIEN, R.
4557
KLEVEN, S.H.
451
KLIER, E.
6253*
KLIETMANN, W.
4566
KLIMA, J.
6035*
KLIMANOVA, Z.F.
6244*
KLIMENKO, I.A.
6152*
KLIMOVA, N.F.
562*
KLINE, I.K.
3388*
KLINGER, I.
429
KLINGER, M.E.
3333*
KLINGMUELLER, G.
1157*, 3579*
KLISAK, I.
5861
KLONOWSKI, S.
2742*
KLCPPER, U.
4634, 4717*
KLOSTERHALFEN, H.
6394*
KLOUDA, P.T.
1061, 1825
KLUG, H.
6051
KLUSKENS, L.
3929*
KLVANA, M.
6226*
KLYACHKO, E.V.
1494*, 5440
KMET, J.
1935*
KNAPP, R.C.
3963*
KNAPPER, W.H.
4236*
KNAPSTEIN, P.
6169*
KNEALE, G.W.
2471*
KNIGHT, E., JR.
844
KNIGHT, R.A.
6365*

KNOPP, J.A.
2249*
KNORRE, D.
952, 5132
KNOX, W.E.
4004, 4314, 4791, 5641*
KNUDSON, A.G., JR.
528*, 3238
KNUTSON, C.O.
2242*
KOBAYASHI, A.
4330*
KOBAYASHI, H.
2570*, 4505, 5136, 6004*,
6322*
KOBAYASHI, M.
1434
KOBAYASHI, S.
1355*, 1485*, 5287*, 5954*
KOBAYASHI, Y.
544
KOCABAS, A.
3456*
KOCH, G.
2490
KOCH, H.
5875*
KOCH, M.A.
4549
KOCHEN, W.
979*, 6168*
KOCHETKOV, M.K.
6053
KOCHHAR, T.S.
383*
KODA, T.
4713*
KODAMA, M.
1577, 5141
KODAMA, T.
2570*, 4505
KOENIG, E.
6005*
KOEPE, H.
4639
KOESTNER, A.
1589, 5363, 5789
KOFMAN-ALFARO, S.
1301, 2461*
KOGA, C.
1593, 2983
KOGA, M.
3789
KOGAN, F.M.
6099*
KOGAN, I.YA.
5928*, 5996*
KOGANEMARU, T.
1426*
KOGURE, K.
1293*
KOH, C.-K.

2565*	KONDO, S.	KORFEL, Z.
KOH, Y.-C.	1436, 3666, 5836*	6213*
3446*	KONDO, T.	KORINEK, J.K.
KOHAN, S.S.	4975*	4598*
2415*	KONICKOVA, Z.	KORMAN, D.B.
KOHCHI, S.	3215	6189*
5180	KONIGSBERG, W.H.	KORN, C.S.
KOHLER, P.O.	2664*	5696*
6309*	KONIKOVA, E.	KORNACKA, L.
KOHN, H.	3855	2011
1304	KONIKOWSKI, T.	KORNEEVA, L.A.
KOHN, H.I.	5609*	5425
756	KONINGS, R.N.H.	KOROBKO, YU.A.
KOHOUT, E.	3068	5199
1449*	KONISHI, Y.	KOROLJ, T.M.
KOHOUT, J.	1554	2658*
1861*	KONO, T.	KOROSTELEVA, T.A.
KOIDE, T.	582*	3463*, 5291
5526*	KONOBÉ, T.	KORTWRIGHT, K.
KOJIMA, A.	1022	4965*
2700*	KONOVALOVA, N.P.	KOSAKI, G.
KOJIMA, K.	3147*	4987*
3404*, 3455*, 5904	KONRAD, P.	KOSHEL, I.V.
KOJIMA, T.	1843*	4183*, 6183*
1489*	KONSTANTINOVA, B.	KOSHIBA, K.
KOJIRO, M.	1192*	1249
3337*	KONSTANTINOVA, I.V.	KOSOW, D.P.
KOKA, M.	2663*	5547*
2821	KONWINSKI, N.	KOSS, L.G.
KOKOLIS, N.	4865	5521*
3991	KONYAR, E.	KOSSEY, P.
KOLARZ, G.	4946*	796*
1158*	KOOPS, D.H.	KOSTAKI, N.
KOLB, H.	5008	530*
5449	KOOPS, H.S.	KOSTER, L.
KOLESNICHENKO, T.S.	6038*	1240*
367*, 1603*, 2417*, 2995,	KOOS, W.	KOSTINA, L.I.
4438, 5766	4113*	6055*
KOLLER, L.D.	KOPAC, M.J.	KOSTRABA, N.C.
1312, 3749	4073*, 4133*	4090*, 4841
KOLLER, P.C.	KOPACZYNSKA, K.	KOSYAKOV, P.N.
3643*	2657*	3194
KOLLMORGEN, G.M.	KOPITO, L.	KOTANI, M.
4736*	2421*	1432
KOLODZIEJSKA, H.	KOPPER, L.	KOTLAREK-HAUS, S.
6358*	670*	3550*
KOLDS, T.D.	KOPROWSKI, H.	KOTLARSKI, I.
1258	1753, 4566, 6013*	1081*
KOLYADICH, M.N.	KOPSU-HAVU, V.K.	KOTLER, M.
368*	2926	681, 1744, 5262
KOMITOWSKI, D.	KOPTELOVA, YE.I.	KOTNER, L.M.
3576*	3538*	4094*
KOMMINENI, V.	KORABELNIKOVA, N.I.	KOTSCHY, M.
2978	3753	3438*, 3439*
KOMMINENI, V.R.C.	KORB, J.	KOUBA, K.
2966	855, 4588*	3042
KOMP, D.M.	KORDAC, V.	KOUBEK, K.
4947*	4042	492*
KONAGA, E.	KOREN, Z.	KOUNO, K.
4779*	1759	2413*
KONDO, K.	KORENEVSKAYA, M.I.	KOUNTZ, S.L.
452, 2105*	562*	4276*

OURI, R.E.	1933*, 2785*, 3984*, 4829*,	KREIS, W.
5081	6080	2371*
OURIAS, B.G.	KRAISELBUND, E.	KREMPASKY, V.
800*	5924	2422*, 6019*, 6371*
OURILSKY, F.M.	KRAJ, M.	KREMZNER, L.T.
1403*	5290, 5326	1451*
OVAC, W.	KRAJCI, M.	KRESS, S.C.
5428*	6311*	1185*
OVACEVIC, Z.	KRAJINA, Z.	KRIEG, K.
2176*, 4844	4904*	1956
OVACS, B.	KRAJINOVIC, S.	KRIEK, E.
2074*	1926	388*, 5804
OVACS, K.	KRAKORA, P.	KRINITZ, K.
976*, 1566, 1571, 1655*,	3905	4283*
2034*, 3379*, 4931*	KRAMARSKY, B.	KRIPALANI, I.
OVACS, L.	1501, 3049, 3116	4236*
2474*	KRAMER, F.R.	KRISHNA, G.
OVACS, Z.	5229	2369*
5355	KRAMER, I.R.H.	KRISTEVA, M.
OVALENKO, L.A.	2734*	2718
3539*	KRAMER, M.J.	KRISTOFOVA, H.
OVALENKO, S.P.	1732	492*, 3894
1653*	KRASIK, YA.D.	KRIVANEK, J.
OVALEV, I.YE.	5675*	6101*
487*	KRASKOVSKIY, G.V.	KRIVINKA, R.
OVALEVA, L.G.	5377*	6101*
562*, 4260*, 6062*	KRASNICKA, Z.	KRIVIT, W.
OVALEVA, T.P.	4055*	3210
3826*	KRASNIYANSKAYA, P.N.	KRIZAN, Z.
OVARIK, V.	5159	857*
4252*	KRASOWSKA, I.	KROES, R.
OVI, J.	5427*	3670, 4626
3276	KRAUS, A.S.	KROES, R.M.
OVNER, F.YA.	514	5335
3998	KRAUS, H.	KROH, H.
OVRIZHKINA, T.A.	4113*	4055*
6149*	KRAUS, R.	KROL, YA.M.
OYAMA, H.	6399*	6353*
4579*, 4987*	KRAUSE, H.P.	KROLLS, S.O.
OYAMA, K.	3428*	4096*, 5438
1022, 3840	KRAUSE, P.H.	KRONENBERG, H.
OZA, I.	6043*	4325*
6019*	KRAUSE, S.	KRONENBERG, K.
OZAKIEWICZ, J.	3445*	666*
4278*	KRAUSE, W.	KRONMAN, B.S.
OZENITZKY, I.	2184*	3933*
4982*	KRAUZE-JAWORSKA, H.	KRUEGER, F.W.
OZHEVNIKOVA, E.P.	3587*, 4843	1615*, 5160
5809	KRAVCHENKO, L.P.	KRUEGER, G.R.
OZHEVNIKOVA, I.N.	6238*	4007
4121*	KRAVCHENKO, L.V.	KRUEGER, G.R.
OZINETS, G.I.	1621*, 5075	4636
2224*	KRAWCZYNSKI, K.	KRUEGER, W.
OZLOV, YU.P.	3193	3509*
3721*	KREBS, D.	KRUESMANN, G.
OZLOWSKI, H.	5860*, 6045*, 6046*	6072*
4278*	KRECHETOVA, G.D.	KRUGER, F.W.
OZLOWSKI, J.W.	4845	5007
3587*	KREIBICH, G.	KRUGER, G.F.
RAEMER, P.M.	2927	5341
1440	KREIDER, J.W.	KRUGER, G.R.F.
RAIN, L.S.	4750*, 5259, 5350	2376*

KRUGLOVA, I.S.	KUMAGAMI, H.	KURMASHOV, V.I.
3989	3542*	4183*
KRUPEY, J.	KUMANISHI, T.	KURNICK, J.E.
470	1439	1106
KRUSANOVA, N.I.	KUMAR, A.	KUROCKIN, I.U.F.
2118*	2893*	5501*
KRUSH, A.J.	KUMAR, K.M.	KURODA, K.
557*, 622*, 4902*	3398*	2946, 4369
KRYKOWSKI, E.	KUMAR, S.	KURODA, Y.
3587*, 4639, 4843	4731*	1675*, 6323*
KRYUKOVA, I.N.	KUMKUMADJAN, V.A.	KUROKAWA, T.
1057, 1840	3831*	2583*, 6006*
KSHIRSAGAR, V.H.	KUMSARS, K.K.	KUROKI, T.
827*	3723*	2304, 3672, 3709, 4445,
KUAKUVI, N.	KUNCHORN, P.D.	5774
825*	5886	KUROZUMI, S.
KUBBA, K.	KUNICKI, A.	3373*
525*	4810	KURPIOS, J.
KUBICEK, M.T.	KUNIN, P.E.	5427*
3134	2842	KURSCHNER, E.
KUBIK, A.	KUNISHI, M.	5619*
6101*	1355*	KURTH, R.
KUBINSKI, H.	KUNTZ, R.E.	5035*
4481*	3944	KURYLEV, V.N.
KUBO, T.	KUNTZMAN, R.	2944
879*, 2778*	306, 1566	KUSAMA, S.
KUBOTA, Y.	KUNZ, W.	4822
3512*	371*	KUSCH, F.
KUCHENBUCH, H.S.	KUNZE, E.	4266*
6100*	6072*	KUSCHNER, M.
KUCHINO, Y.	KUPCHIK, H.	310*
4248*	1869*	KUSHIBE, M.
KUDO, T.	KUPFER, G.	4099*
6356*	978*, 1592	KUTCHMESHI, J.
KUDRYAVTSEVA, G.T.	KUPFER, M.	1445
4293*	978*, 1592	KUTINOVA, L.
KUEGELGEN, B.	KUPPER, L.L.	3101
563*	2772*	KUTSY, A.S.
KUEHL, J.F.W.	KUPRINA, N.I.	6238*
4863	2532	KUWAHARA, A.
KUEHN, P.G.	KURATA, K.	3701
4979*	3036	KUWAHARA, H.
KUEHNER, A.	KURATA, N.	6368*
1136*	5510*	KUWANO, A.
KUERSCHNER, E.	KURATA, T.	3430*
4082*	1432, 1433	KUWATA, T.
KUFE, D.	KURATSUKA, H.	1597, 1736, 5086, 5948*
3131	4892*	KUWERT, E.
KUFF, E.L.	KURATSUNE, M.	3222*, 5760*, 6040*
2492, 3103, 6288*	5180	KUZ'MINA, S.V.
KUHN, C.	KURBAN, A.K.	1976, 4792
5468*	2775*	KUZ'MINYKH, A.I.
KUHN, D.T.	KURENNAYA, S.S.	3720*
1909*	1162*	KUZE, M.
KULESZA, E.	KURIHARA, M.	5674*
4639	984*, 5416, 6082	KUZELA, S.
KULIN, H.E.	KURISUMOOTIL, C.	2422*, 6019*, 6371*
2148*	2126*	KUZMA, I.
KULKA, R.G.	KURLAND, L.T.	796*
5688*	4820	KUZMIN, V.I.
KULPA, J.	KURMAN, R.J.	3236
3217*	4226*	KUZMINA, S.N.

5700*
 KUZMINSKA, A.
 5590*
 KUZNETSOV, O.K.
 1748, 2576*, 3044, 4528,
 5930*
 KUZNETSOVA, I.P.
 2842
 KUZNIK, B.I.
 5675*
 KUZUMAKI, N.
 2570*
 KVEDAR, J.P.
 735*
 KWAK, H.M.
 6102*
 KYALWAZI, S.K.
 891*, 2906, 6279*
 KYREAGES, C.G.
 584*
 KYRIAKOS, M.
 3355*, 4053*
 KYRIAZIS, A.P.
 3211
 KYRLE, P.
 4150*
 LA FIANDRA, A.
 3105
 LA PLACA, M.
 1344
 LACASSAGNE, A.
 338, 2919*, 2956, 2957,
 5769
 LACKOVIC, V.
 1765*
 LACOMBA, T.
 942
 LACOUR, F.
 2606, 3081, 3100, 3214,
 3777
 LACOUR, J.
 565*, 2840, 3214, 4208*,
 6228*
 LADMAN, A.J.
 663*
 LAERUM, O.D.
 1133, 4391
 LAFFARGUE, F.
 4077*
 LAFFARGUE, P.
 4077*
 LAFONTAINE, N.
 6003*
 LAFUMA, J.
 3028, 5197
 LAGACHE, G.
 3514*
 LAGARDE, C.
 1216*
 LAGEMAN, A.
 5118, 6064*
 LAGEMANN, A.

6133*
 LAGERBORG, V.A.
 538
 LAGERLOEF, B.
 4783
 LAGERLOF, B.
 5478*
 LAGERMAN, A.
 5767
 LAHIRI, T.K.
 1147*
 LAI, M.M.C.
 1740
 LAIHO, K.U.
 2064*
 LAINE, R.
 4778*
 LAING, A.H.
 1478*
 LAIRD, H.M.
 1035*, 3805
 LAISSUE, J.
 1471*
 LAJOS, J.
 2255*
 LAKSHMI, M.S.
 2894*
 LALA, P.K.
 2877, 5446
 LAM, K.M.
 1722
 LAMBERT, A.E.
 868*
 LAMBERT, L.H., JR.
 1799, 3839, 4984*
 LAMBERTENGHI-DELILIER, G.
 597*
 LAMBERTENGHI, G.
 1047, 3142
 LAMBERTS, H.B.
 6038*
 LAMBOLEY, C.
 2053*
 LAMBRE, C.
 1728
 LAMERTON, L.F.
 1503
 LAMKIN, A.F.
 4028
 LAMON, E.W.
 3869, 5888
 LAMPE, J.
 661*
 LAMPPIN, D.W.
 4064*
 LANARI, A.
 6360*
 LANCET, M.
 1967
 LANCINI, G.
 3790
 LAND, C.E.

1662
 LANDGRAF-LEURS, M.
 702
 LANDI, E.
 5626*
 LANDON, J.
 2811, 5334, 6365*
 LANDON, J.C.
 3134, 5877
 LANDRY, M.
 4215*
 LANDSBERGER, F.R.
 5933*
 LANDSCHUETZ, CH.
 345
 LANE, I.
 4794
 LANE, N.
 504*
 LANE, W.T.
 1581, 3902
 LANG, C.M.
 5259
 LANG, W.
 5955*
 LANGBEIN, W.
 5777
 LANGE, A.
 5103
 LANGE, J.
 2487, 4521
 LANGER, W.
 4282*
 LANGLANDS, A.O.
 2834
 LANGLANDS, J.H.M.
 1102
 LANGLEY, G.R.
 4796*
 LANGLEY, R.A.
 4421
 LANGLINAI, P.C.
 2139*
 LANGLOIS, A.J.
 742*, 3075
 LANGNER, A.
 765, 772*
 LANGOWSKI, U.
 6384*
 LANGSTON, H.T.
 2264*
 LANKIN, V.Z.
 2088*
 LANTOS, P.L.
 1638*
 LANZEROTTI, R.H.
 5158, 6290*
 LAPEN, R.F.
 786
 LAPIS, K.
 506*, 569*, 670*, 1155*,
 1499*

LAPOTNIKOV, V.A.
4101*

LAPP, R.
1482*

LAPPE, M.A.
459, 5711

LARAIA, P.J.
2697*

LARBI, O.
2801*

LARDIS, M.P.
1786, 5323

LARSEN, C.J.
2201, 5281*

LARSEN, S.
405

LARSEN, V.
384*, 1290*, 2385*

LARSON, C.L.
3161, 3817

LARSON, D.L.
1683*

LARSON, J.E.
3073

LARSON, K.A.
6307*

LARSON, V.M.
415

LARSSON, S.
813

LASFARGUES, E.Y.
1501, 3049, 4769*

LASFARGUES, J.C.
3049

LASKIN, S.
310*

LASKINA, A.V.
3310

LASKOV, R.
4705*

LASKOWNICKA, Z.
1076*

LASNE, C.
1570

LASQUELLEC, B.F.
3065

LASTER, W.R., JR.
3660

LASZLO, J.
2161*

LATAL, D.
6172*

LATARJET, R.
2905

LATNER, A.L.
1537, 2348

LATTA, J.
3500*

LATTES, R.
785, 1461*, 3524*, 3958*,
6155*

LATTIMER, J.K.
2134*

LAU, M.
5120, 5763

LAU, T.J.
4377

LAUCLAN, S.C.
2185*

LAUDADIO, P.
6212*

LAUDER, I.
6233*

LAUGHLIN, J.
3441*

LAUGHTER, A.H.
2024*

LAUGIER, A.J.
5574*

LAUROVA, L.
864*, 5679*

LAUSCH, R.N.
471

LAUTENSCHLEGER, J.T.
4648, 4689

LAUZON, S.DE
2956

LAVER, W.G.
1353*

LAVI, S.
3816

LAVIALLE, CH.
5205

LAVIGNE, C.A.
2786*

LAVIN, P.
2181*

LAVRIN, D.H.
3835, 3871

LAVY, M.-E.
1948

LAW, L.W.
458, 469, 3909, 4676

LAWINSKI, M.
3438*, 3439*, 6027*

LAWKOWICZ, W.
5290

LAWLER, S.D.
1061, 1228*, 1825, 4980*

LAWLEY, P.D.
2971, 3674, 4480*, 5122

LAWRENCE, J.
4236*

LAWRENCE, W., JR.
1972

LAWS, E.R.
648*

LAWSON, A.L.
2815

LAWSON, T.A.
2329, 2436*, 2933

LAWTHER, P.J.
916*

LAZAR, C.
5594*

LAZAR, PH.
2432*

LAZAREV, I.M.
4124*

LAZO, A.
3551*

LAZOVSKA, J.
3042

LE CANNELIER, R.
1421*

LE GAL, Y.
576*, 1108*, 4116*

LE GOFF, L.
6242*

LE, M.
5732*

LE MEVEL, B.
3201

LE TREUT, A.
1216*

LEA, M.A.
3996

LEACH, H.
938

LEARY, P.
3995

LEATHEN, J.H.
5847*

LEAVENS, M.E.
5609*

LEB, D.E.
1404*

LEBEDEV, V.I.
6239*

LEBEDEV, V.N.
5425

LEBEDEVA, N.P.
4101*

LEBEDEVA, S.B.
2127*

LEBEDEVA, YU.L.
5425

LEBEL, J.S.
5384*

LEBLANC, L.
3993

LEBRAS, M.
3255, 4018

LEBREUIL, G.
605

LECATSAS, G.
5910

LECHOWSKI, S.
4810

LECK, I.
6083

LECLERC, J.-C.
3196

LECLERC, J.C.
5920

LECURE, J.

518*
 EDER, P.
 3845, 5950*
 EDERER, B.
 2018
 EDERER, E.
 2330
 EDINKO, N.
 2525
 EE, B.M.
 773*
 EE, D.
 2778*
 EE, D.J.
 376*
 EE, H.W.
 3988
 EE, J.A.H.
 1310*, 2266*, 3252, 4333*
 EE, J.C.K.
 1472*
 EE, K.-L.
 3295
 EE, K.M.
 3758
 EE, K.P.
 5237
 EE, L.F.
 4586*
 EE, O.B.
 2644
 EE, O.B.
 5372*
 EE, P.N.
 2935, 3698
 EE, R.C.K.
 5416
 EE, R.E.
 935
 EE, S.K.
 2778*
 EE, S.Y.
 1974
 EE, T.-C.
 2972
 EE, Y.B.
 2026*
 EE, Y.K.
 5919
 EE, Y.-T.N.
 3980*
 EES, R.E.M.
 514
 EEUWEN, A. VAN
 1789
 EFEBVRE, M.N.
 5301
 EFEBVRE, N.
 2526
 EFFALL, L.D., JR.
 4742*, 4827*
 EFFERT, H.

1791
 LEFKOWITZ, S.S.
 2587*
 LEGATOR, M.S.
 636, 1531, 4381
 LEGER, L.
 4162*
 LEGG, M.A.
 6306*
 LEGRAND, E.
 994, 5276, 6123
 LEGROS, N.
 637, 1563, 1990, 2993
 LEHMAN, J.M.
 1751
 LEHMAN, R.H.
 1224*
 LEHMANN, A.R.
 4035
 LEHMANN, D.
 1079*
 LEHMANN, F.G.
 1079*, 2102*
 LEIBERMAN, W.W.
 935
 LEIBOVITZ, A.
 2580*
 LEIBOWITZ, U.
 3260
 LEIDERMAN, E.
 403
 LEIFER, C.
 4100*
 LEINIKKI, P.
 3171
 LEIS, J.P.
 3047, 4551, 5876
 LEIVA, S.
 2969
 LEJEUNE, J.
 565*
 LEJTENYI, M.C.
 483*
 LEKLEM, J.E.
 5124
 LELIKOVA, G.P.
 3310
 LEMAIGRE, G.
 4162*
 LEMOINE, J.M.
 5816*
 LEMONDE, P.
 1824
 LEMTIS, H.
 6382*
 LENARD, J.
 5933*
 LENART, G.
 6135*
 LENCZYK, M.
 6277*
 LENGEL, C.R.

2508
 LENGES, J.
 5754*
 LENNARTZ, K.J.
 3459*
 LENNERT, K.
 6234*
 LENNETTE, E.H.
 696, 1771*, 3823*, 4513,
 4608*
 LENNOX, E.S.
 4915*
 LENTFER, D.
 6120
 LEON, J.
 5624*
 LEONARD, A.
 1674*
 LEONARD, E.J.
 1074*, 4619
 LEONARD, J.W., JR.
 3311
 LEONE, F.
 5660*
 LEONE, G.
 625*
 LEONG, J.A.
 1746
 LEONG, J.-A.
 3115
 LEPAGE, G.A.
 5603*
 LEPAGE, R.
 3022*, 4210*
 LEPOINT, A.
 3536*
 LECOIRE, J.
 1200*
 LEPPLA, S.H.
 5217
 LERNER, K.G.
 5843*
 LERNER, R.A.
 1832, 5308
 LEROUX-ROBERT, J.
 1908*
 LESCH, R.
 4285*, 5512*
 LESKO, S.A.
 5845*
 LESKO, S.A., JR.
 1572, 5845*
 LESNICK, G.J.
 604
 LESPINATS, G.
 3893
 LESSO, J.
 1779*
 LETHCO, E.J.
 4379
 LETNANSKY, K.
 6284*

LETSKIY, V.B.
 561*
 LETTRE, R.
 2169*
 LEUCHARS, E.
 4666
 LEUCHTENBERGER, C.
 5154
 LEUCHTENBERGER, R.
 5154
 LEUDERS, K.K.
 6288*
 LEVAN, A.
 2558, 2852, 3309, 4191*,
 5695*, 6110
 LEVAN, G.
 424, 4191*, 4601*
 LEVAN, N.E.
 5696*
 LEVANTHAL, B.G.
 4643
 LEVENBOOK, I.S.
 2591*
 LEVENBUK, I.S.
 5945*
 LEVENTHAL, B.
 3908
 LEVENTHAL, B.G.
 1083*, 6008*
 LEVER, C.S.
 4019
 LEVER, W.F.
 3461*, 5655*
 LEVERINGHAUS, M.
 1030
 LEVEY, R.H.
 4616
 LEVICK, L.J.
 986*
 LEVICK, S.N.
 986*
 LEVIJ, I.S.
 2330, 5786, 5805, 5828*
 LEVIN, A.S.
 2695*
 LEVIN, D.H.
 1318
 LEVIN, D.L.
 4301
 LEVIN, F.B.
 4147*
 LEVIN, M.J.
 707
 LEVIN, M.L.
 3968
 LEVIN, Y.M.
 494*
 LEVIN, A.
 718
 LEVINE, A.J.
 427, 433, 3060
 LEVINE, A.S.
 707, 2812
 LEVINE, B.
 983*
 LEVINE, E.M.
 4066*
 LEVINE, G.D.
 3959*, 4216*
 LEVINE, L.
 449, 3351*
 LEVINE, P.H.
 764, 4630, 4674, 5325, 5402,
 5969
 LEVINE, P.L.
 1374
 LEVINE, W.G.
 656*
 LEVINSON, C.
 3447*, 4484*, 6300*
 LEVINSON, S.S.
 4378
 LEVINSON, W.
 425, 1746, 3115, 3778
 LEVINSON, W.E.
 686, 2553, 3086, 3110
 LEVSHIN, V.F.
 5022
 LEVY, H.
 1718
 LEVY, J.A.
 1329, 2628
 LEVY, J.P.
 1403*
 LEVY, J.-P.
 3196
 LEVY, J.P.
 5920
 LEVY, N.L.
 3841, 5330
 LEVY, S.B.
 2628
 LEWAN, L.
 3390*
 LEWANDOWSKI, L.J.
 5213, 5217
 LEWIS, A.J.
 1793
 LEWIS, A.M., JR.
 707
 LEWIS, B.C.
 2813
 LEWIS, D.A.
 5615*
 LEWIS, D.J.
 1284*
 LEWIS, G.K.
 4668
 LEWIS, J.L., JR.
 3892
 LEWIS, J.S.
 5642*
 LEWIS, M.
 3750
 LEWIS, M.G.
 931*, 4728*, 5328
 LEWIS, P.
 3291
 LEWIS, S.M.
 1454*, 5486*, 5652*
 LEWIS, S.R.
 1683*
 LEWISON, E.F.
 1922
 LEWMAN, L.V.
 4075*
 LEYTON, C.
 2066*
 LEZIUS, A.G.
 6120
 LHOTKA, J.
 623*
 LHOTKA, L.
 803*
 LI, C.P.
 5932*
 LI, C.Y.
 2091*, 6332*
 LI, F.P.
 3251
 LI, H.C.
 5610*
 LI, Y.-T.
 4778*
 LIAO, K.T.
 4235*, 4990*
 LIAU, M.C.
 4005
 LIBANSKY, J.
 733*
 LIBCKE, J.H.
 6204*
 LICHTIGER, B.
 3360*
 LICKFELD, K.G.
 2405*
 LIDSKY, M.D.
 2024*
 LIE, S.O.
 484*, 1844*
 LIEBELT, A.G.
 889*, 1456*, 6331*
 LIEBELT, R.A.
 889*, 1456*
 LIEBERMAN, M.W.
 1117, 1297*, 4410
 LIEBERMAN, P.H.
 4006, 5646*
 LIEBERMAN, R.
 1813, 3184
 LIEBESKIND, D.S.P.
 2819
 LIECHTY, R.D.
 5461*
 LIEN, W.M.
 5554*

IFSHITS, V.M.	LINDENMANN, R.	5270
5439, 5873*	549	LITTLEFIELD, J.W.
IJINSKY, W.	LINDER, F.	2448*
946, 2951, 2978, 3653, 3704,	3282*	LITTLEFIELD, L.G.
3708, 4381, 4405, 5080,	LINDFORS, O.	2847
5113, 5142, 5156	2854	LITTLEJOHN, K.
IKHACHEV, A.YA.	LINDNER, E.A.	2709*, 3906
357	1887	LITTMAN, B.H.
IKHITE, V.	LINDSAY, V.J.	4619
2638	6294*	LITTON, L.E.
ILIENFELD, A.	LINDSTROM, D.M.	6362*
3968	4541	LITVINOV, N.N.
ILIENFELD, A.M.	LINDTNER, J.	2944
3973	808	LITVINOVA, S.N.
ILLEHEI, R.C.	LINE, D.H.	3719*
677*	2902	LITWACK, G.
ILLY, F.	LING, N.R.	1264
408, 1316, 1319, 3121	1835	LITWIN, S.
IM, R.	LINGEMAN, C.H.	5353
3929*	324*, 1992	LIU, C.H.
IMAS, C.	LINHARD, J.	1049
6068*	520*, 3157	LIU, C.-H.
IN, C.D.	LINIECKI, J.	1382
1993, 4463*	999*	LIU, C.H.
IN, J.-K.	LINNIK, A.B.	2540
5195*	3000, 5106, 5821*	LIU, M.
IN, J.T.	LINSMAIER-BEDNAR, E.M.	1540
3301	1612*	LIUZZO, B.
IN, P.	LICZNER, A.L.	1391
1008	5208, 5270	LIVESAY, V.T.
IN, T.M.	LIPKIN, G.	1781
1049, 1927, 2540	592*	LIVINGSTON, D.M.
IN, T.-Y.	LIPKIN, M.	2498, 5358
3926*	499*, 3239	LJUNGDAHL, I.
IN, Y.-C.	LIPMAN, M.	6113
1383	3118	LLEDO, S.M.
INCH, A.L.	LIPOVA, V.A.	3596*
1543	6192*	LLOYD, B.J., JR.
INCOLN, D.W.	LIPPI, U.	3099
5196*	473	LLOYD, F.A.
INDAHL, P.	LIPSETT, M.B.	505*
3995	4277*	LO, A.C.-H.
INDAHL, T.	LIPTON, A.	1258
5882	429	LO BUE, J.
INDAHL, U.	LIRA-PUERTO, V.	3070
2163*	6273*	LO CURTO, M.
INDBERG, K.	LISCHKA, G.	1391
2291*	6247*	LO GERFO, F.
INDBERG, L.G.	LISCO, H.	3910*
6081	756, 3118	LO GERFO, P.
INDBERG, R.	LISIEWICZ, J.	3181, 3910*, 4625
4029	1517, 2240*, 2849, 3018*,	LO, K.-J.
INDBERG, U.	3518*, 3519*, 6304*	1797
6333*	LISKER, R.	LOBB, D.S.
INDELL, A.	4243*	4980*
5638*	LISS, A.YU.	LOBDELL, G.
INDEMANN, M.	5377*	1100
6043*	LISS, E.	LOBUE, J.
INDEN, G.	570*, 6240*	5958
3693, 6082	LISZKOWA, A.	LOBUGLIO, A.F.
INDENBERG, K.	4602*	5507*
5676*	LITOVCHENKO, T.A.	LOCALIO, S.A.

3933*	3708	2734*
LOCHMAN, D.J.	LOOMIS, R.C.	LUCAS, S.
4887*	4338*	5387*
LOCKHART-MEMMERY, H.E.	LOPES CARDOZO, E.	LUCIS, O.J.
4355*	3216*	4423
LOCKNER, D.	LOPEZ BLANCO, O.	LUCIS, R.
5437	6360*	4423
LODDO, S.	LOPEZ-CORELLA, E.	LUDBROOK, J.
3285*	1652*	5386*
LODE, H.	LOPEZ, J.R.	LUDLUM, D.B.
2399*	2258*	4460*, 5138
LOEB, L.A.	LOPEZ-RIOS, F.	LUDOVICI, P.P.
1980	6249*	2545, 4504
LOEB, W.F.	LOPRIENO, N.	LUDWIG, E.H.
1337	1634*	2571*, 2572*
LOEBEL, F.	LOPS, M.	LUDWIG, H.
4207*	4184*	1721, 2542
LOEFROTH, G.	LORENC, R.	LUEDERS, G.
4428	4874*	1912*, 3560*
LOEWENSTEIN, D.	LORENTZEN, R.	LUEDERS, K.K.
2643	5845*	2492
LOFGREN, S.	LORIE, YU.I.	LUFTIG, R.B.
1848*	4130*, 4181*	1361*
LOFFIELD, R.B.	LOSKANT, G.	LUGANOVA, I.S.
673	5295	561*
LOG, T.	LOSNCZY, I.	LUGER, A.
1014	5157	1307, 3026, 5019
LOGAN, J.W.	LOTLIKAR, P.D.	LUGOVOD, V.I.
5411	372*, 936, 944	6238*
LOGAN, N.E.	LOUIS, C.J.	LUGWIG, H.
5411	5100	1716
LOHOELTER, H.	LOURIA, D.B.	LUHA, L.
6048*	4086*	372*, 944
LOHS, K.	LOUIT, J.	LUK'YANETS, V.V.
991*	1167*	560*
LOJDA, L.	LOVE, R.	LUKACS, L.
3937	555	4805*
LOLOVA, I.	LOWE, C.R.	LUKEMAN, J.M.
1154*, 3548*	2783*	1692, 6203*
LOMBARD, L.S.	LOWE, R.F.	LUKENS, J.N.
2328, 4492, 5152	1936*	1910*, 2137*
LOMBARDI, L.	LOWRY, S.P.	LUKES, R.J.
2327	2534, 2535	4801*, 6392*
LOMBARDI, R.	LOWRY, W.B.	LUM, D.
5661*	5466*	1304
LONDON, W.T.	LOWY, D.R.	LUNDBECK, H.
1834	1018	1848*
LONG, C.	LCZANOV, YEM.	LUNDE, M.N.
2550, 4565, 5919	6095*	698
LONG, K.R.	LU WANG, C.-Z.	LUNDEEN, P.B.
647*	4247*	1280*
LONG, L.A.	LUBET, R.A.	LUNDGREN, E.
919*	5081	567*
LONG, R.T.L.	LUBIN, M.	LUNDGREN, G.
1954	2896*	2968
LONGHINI, I.	LUBORSKY, S.W.	LUNDHOLM, K.
2661*	1354*	4930*
LONGHINO, C.	LUCAS, J.	LUNDHOLM, U.
4159*	5169	4529
LONGSTAFF, E.	LUCAS, J.J.	LUNDIN, P.M.
1537, 2348	683	3300
LOO, J.	LUCAS, R.B.	LUNDMARK, C.

4929*
 LUNDQUIST, G.
 2199*
 LUNGU, M.
 1027, 3833*
 LUNN, J.M.
 2348
 LUNTS, A.M.
 6122
 LUPULESCU, A.
 4218*
 LUPULESCU, A.P.
 2200*, 4910*
 LURIE, A.
 4050*
 LUSSIER, G.
 1824
 LUST, G.
 1720
 LUSTIG, E.S.
 2415*
 LUSTIG, M.
 1147*
 LUTCHER, C.L.
 3928*
 LUTESCU, I.
 2780*
 LUTHRA, U.K.
 672*, 4828*
 LUTTON, J.D.
 4073*, 4133*
 LUUKKAINEN, T.
 2818
 LUYENDIJK, W.
 3436*
 LUZI, P.
 5460*
 LUZZI, M.
 3218*
 LVOVSKIY, E.A.
 5981*, 5982*
 LYBERATOS, K.
 2143*
 LYNCH, H.T.
 557*, 622*, 4902*
 LYNCH, J.
 4902*
 LYNCH, J.B.
 1683*
 LYNCH, J.J.
 983*
 LYNCH, R.G.
 4677
 LYND, F.T.
 1253, 1622*
 LYND, J.Q.
 1253, 1622*
 LYNN, T.C.
 1049
 LYON, G.M., JR.
 1146*
 LYONS, G.

4192*
 LYSOV, V.V.
 2577*, 3826*
 LYSYUK, L.P.
 5785
 LYWOOD, J.G.
 5750*
 MA, R.M.
 1511
 MAASS, H.
 2793*, 5038*
 MAATZ, R.
 6271*
 MABRY, E.W.
 2357
 MABUCHI, K.
 512
 MAC DONALD, E.J.
 819*, 2799*
 MAC DONALD, J.S.
 3490*
 MAC DONALD, W.C.
 3380*
 MAC DONELL, J.D.
 3205
 MAC DOUGALL, M.
 3322*
 MAC GREGOR, A.B.
 1211*
 MAC INTYRE, E.H.
 1904*
 MAC KAY, B.
 4171*
 MAC KENZIE, F.A.F.
 977*
 MAC LAURIN, B.P.
 1835
 MAC LEOD, D.A.D.
 1211*
 MAC MAHON, B.
 808, 2783*, 3639*, 3971
 MAC MANUS, J.P.
 2001
 MAC MILLAN, E.
 1506
 MAC PHERSON, B.R.
 3898, 4774*
 MAC PHERSON, I.
 1738
 MAC PHERSON, I.A.
 4562
 MAC SWEEN, J.M.
 4796*, 5978
 MACA, R.D.
 1374
 MACAFEE, C.A.J.
 2727*
 MACASAET, F.
 5227
 MACBETH, R.A.L.
 1626*
 MACBETH, R.G.

1270
 MACCHIA, V.
 6282*
 MACEK, M.
 1973, 5934*, 5951*
 MACGREGOR, A.J.
 5615*
 MACH, B.
 860*
 MACH, O.
 733*, 1792, 5916
 MACHACEK, J.
 3288*
 MACHALA, O.
 3093
 MACHAVARIANI, M.G.
 692
 MACHESKO, M.R.
 5871*
 MACIEIRA-COELHO, A.
 4895*
 MACINOT, C.
 5408*
 MACINTYRE, E.H.
 5447, 5898
 MACK, T.
 5493*
 MACKAY, I.R.
 4781, 5978
 MACKAY, W.D.
 2636
 MACKENZIE, D.H.
 3399*, 3422*
 MACKEY, L.J.
 3805, 4788
 MACKIEWICZ, J.
 3599*
 MACKLES, A.M.
 5482*
 MACLEAN, N.
 2834
 MACNAB, J.C.M.
 4607*
 MADAR, E.
 1848*
 MADDEN, J.W.
 4479*
 MADDOX, I.S.
 4024
 MADDOX, W.A.
 794*
 MADEN, B.E.H.
 4015
 MADHAVAN, K.
 6118
 MADISON, R.M.
 3001, 5254
 MADROSZKIEWICZ, E.
 4810
 MADSEN, N.P.
 1559
 MAEDA, J.

2443*	MAHONEY, E.M.	MALAVEILLE, C.
MAEDA, M.	1414	962
2509	MAHRAN, M.	MALCOLM, D.
MAEDER, C.	4879*	5014
2107*	MAICANESCO-GEORGESCU, M.	MALDONADO, R.L.
MAEKAWA, A.	3365*	3127
3404*	MAIN, G.	MALEC, J.
MAEKAWA, K.	2114*	2011
4099*	MAIN, J.H.P.	MALEJKA-GIGANTI, D.
MAENTYJAERVI, R.A.	1034	4430
5937*	MAINWARING-BURTON, R.	MALEK, R.S.
MAENZA, R.M.	938	4014, 5579*
5801	MAINZER, K.	MALENKOV, A.G.
MAESHIRO, M.	5799	2058*, 4866
1929	MAIR, A.	MALERE, B.D.
MAESTRI, N.	3270	5671*
4487*, 5846*	MAIR, I.W.S.	MALFER, P.
MAESTRI, N.E.	6157*	2961
3119	MAIRANOVSKAYA, E.B.	MALHOTRA, S.L.
MAEZAWA, S.	6053	2218
6361*	MAIROSE, U.B.	MALI, S.
MAGAMADOV, YU.CH.	519*, 6092*	4828*
5502*	MAISEL, J.C.	MALICK, L.E.
MAGAZANNIK, R.L.	1127	6088*
4256*	MAISIN, J.R.	MALIK, M.A.R.
MAGDON, E.	1674*	2279*
2228*	MAIZEL, J.V., JR.	MALKIEL, S.
MAGDON, M.	4543	3866
2794*	MAJ, S.	MALKIEWICZ, B.
MAGE, M.	765	2240*, 3018*, 3518*, 3519*,
1810	MAJERUS, P.W.	6304*
MAGEE, P.N.	5843*	MALLAFRE, M.S.
303, 342, 1587, 2320, 4417,	MAJLE, T.	3368*
4460*, 5138	1019	MALLET, L.
MAGNIN, C.	MAJNO, G.	988*
1807, 2608	1461*, 3958*	MALLING, H.V.
MAGNUS, K.	MAJOR, I.R.	1584, 4483*
1923	2375*	MALLION, R.B.
MAGNUSSON, G.	MAKAROV, M.R.	632
726, 6113	4265*	MALLUCCI, L.
MAGOS, C.	MAKEEVA, O.O.	1830, 5910
2378*	5096	MALMGREN, R.A.
MAGOVERN, G.J.	MAKINO, S.	3797
3445*	1410	MAMARIL, F.P.
MAGRASSI, F.	MAKINODAN, T.	2816
2239*, 4339*	5338	MANAKER, R.A.
MAHAFFEE, D.	MAKITA, A.	443*
4853	1044	MANAPA, G.
MAHALEY, M.S., JR.	MAKIUCHI, M.	329*
3841, 5330	510	MANCINI, L.O.
MAHBOUBI, E.	MAKIURA, S.	1314, 3130
1935*	2402*, 4372, 4385, 5183	MANCONI, P.E.
MAHER, V.M.	MAKMAN, M.H.	4712*, 6031*, 6033*
1572	2103*, 2173*	MANDACHE, F.
MAHER, V.M., SR.	MALAISE, E.P.	2780*
5845*	493, 3725	MANDEL, P.
MAHGOUB, E.S.	MALAMUD, N.	2171*
655*	4200*	MANGALIK, A.
MAHLBERG, U.	MALASKOVA, V.	5373*
3955*	3905	MANGANE, M.
MAHNOVSKI, V.	MALATHI, V.G.	338
3283*	447*	MANHEIMER, L.

4835*
 MANIGAULT, M.P.
 6242*
 MANIGAULT, P.
 1882, 2895*
 MANKODI, R.C.
 5497*
 MANLY, K.F.
 1012
 MANN, D.L.
 1819, 3908, 6008*
 MANN, J.R.
 3493*
 MANN, M.
 3693
 MANN, P.G.
 663*
 MANNICK, J.A.
 2637
 MANNING, J.S.
 3137, 3770
 MANNINI-PALENZO, A.
 2539
 MANOCCHIO, G.
 2313
 MANOLOV, G.
 2852, 3795
 MANOLOVA, Y.
 2852, 3795
 MANOYLOV, JU.S.
 6188*
 MANOYLOV, S.YE.
 6188*
 MANSANI, F.E.
 6171*
 MANSOUR, E.G.
 3648
 MANSOUR, M.A.
 4057*
 MANTEL, N.
 811, 2217
 MANTOVANI, G.
 6032*, 6033*
 MANTOYAAI, G.
 6030*
 MANTYJARVI, R.A.
 5251
 MANUKYAN, L.A.
 5693*
 MANYKO, V.M.
 2459*
 MANZ, H.J.
 3332*
 MARAFANTE, E.
 990*
 MARAMOROSCH, K.
 1369*, 1759
 MARANTZ, C.
 4239*
 MARCHAC, D.
 2738*
 MARCHALONIS, J.J.

5314
 MARCHESI, V.T.
 4743*
 MARCHOW, L.
 594*, 4348*
 MARCO, A.T. DI
 2308
 MARCONI, P.
 5984*
 MARCOTTE, J.
 1538
 MARCOVE, R.C.
 1303, 3385*
 MARCULLO GASPAR, E.
 3635*
 MARCZYNSKA, B.
 4572
 MARDINEY, M.R., JR.
 2654*, 5306
 MAREE, D.
 1216*
 MARETSIS, M.
 3600*
 MARGALITH, E.
 5333
 MARGALITH, M.
 5333
 MARGGRAF, W.D.
 4549
 MARGOLIS, L.B.
 2825
 MARHOLEV, L.
 2666*
 MARIANI, T.
 769, 3120, 4512, 5340
 MARIC, M.
 6230*
 MARIN, G.
 725
 MARJANOVIC, A.
 3289*
 MARK, J.
 554, 4191*, 4214*, 4601*
 MARK, L.P.
 5313
 MARKARYAN, D.S.
 5899
 MARKELOV, B.A.
 2663*
 MARKHAM, P.D.
 5929*
 MARKOV, D.V.
 987*
 MARKOVIC, B.
 2777*
 MARKOVIC, V.
 1198*
 MARKOWA, J.
 4602*
 MARKS, P.A.
 4025
 MARLOW, P.B.

2781*
 MARMORSHEIN, S.YA.
 2842
 MARQUARDT, H.
 2304, 2316, 3709, 4400,
 4445, 5173, 5774
 MARQUES, D.
 6341*
 MARQUET, E.
 2010, 4240*
 MARQUEZ, L.
 2804*
 MARRIOTT, G.
 4622
 MARROCU, F.
 4203*
 MARSA, G.W.
 3763
 MARSH, B.R.
 4928*
 MARSH, J.B.
 1251
 MARSHALL, I.D.
 1425*
 MARSHALL, N.
 3730, 4188*
 MARSHALL, S.
 1519*, 3802
 MARSHALL, V.M.
 5541*
 MARSHALL, V.R.
 5386*
 MARSILI-FELICIANGELI, F.
 2227*
 MARTEAU, M.
 1818
 MARTIN, A.
 6146*
 MARTIN-BERTHELO, M.C.
 689
 MARTIN, D.H.
 4404
 MARTIN, D.P.
 3872
 MARTIN, D.W., JR.
 4993*
 MARTIN, E.
 4624
 MARTIN, F.
 2805*, 4664
 MARTIN, G.M.
 3942
 MARTIN, G.S.
 3128, 5914
 MARTIN, I.
 4202*
 MARTIN, J.E.
 4307
 MARTIN, J.M.
 587*, 2063*
 MARTIN-LALANDE, J.
 3363*

MARTIN, M.A.
413, 5915
MARTIN, M.L.
1359*, 3747, 4647, 5973
MARTIN, M.-R.
1836
MARTIN, M.S.
4664
MARTIN, N.
2614
MARTIN, R.G.
4171*, 4542, 4596*
MARTIN-RUEDA, R.
488*
MARTIN, T.E.
4991*
MARTIN, T.J.
2839
MARTIN, W.J.
2629
MARTINEZ, I.
6082
MARTINEZ-PALOMO, A.
2585*, 4310
MARTINEZ TELLO, F.J.
6160*
MARTINO, E.C.
4724*, 5932*
MARTINO, P.
5424
MARTIROSYAN, D.M.
444*, 5899
MARTOS, L.M.
693, 2517
MARTYNENKO, A.G.
6152*
MARTYNOVA, R.P.
2838
MARTYNOVA, V.A.
3538*, 4180*, 6070*
MARUCCI, A.A.
5357
MARUCHI, N.
510
MARUGAMI, M.
4385, 5183
MARUGAMI, N.
4462*
MARUNA, R.
778*
MARUSYK, R.G.
739*, 1070*
MARUYAMA, Y.
769, 4512, 5340
MARX, W.
1471*, 2085*, 4860
MARZA, V.
5588*
MAS MARTINEZ, C.
4978*
MASAKI, H.
5368*

MASALA, B.
2390*
MASALAWALA, K.S.
4300*
MASARACCHIA, S.
2726*
MASEK, K.
3424*
MASHELKAR, B.N.
3474*
MASI, M.
2714*, 2715*
MASON, A.M.S.
6366*
MASON, A.S.
6366*
MASON, C.H.
4827*
MASON, M.M.
1271, 4522
MASON, T.J.
5412
MASS, N.
1967
MASSARG, E.J.
5456
MASSE, R.
5197
MASSEYEFF, R.
3993
MASSICOT, J.G.
2549
MASSIMO, L.
4357*
MASTERSON, J.G.
712
MASUBUCHI, K.
6085
MASUDA, Y.
1964
MASUJI, H.
4595*
MASUNAGA, J.
6176*
MATALON, M.
3972
MATARAZZO, R.
6278*
MATEJA, F.
6020*
MATES, J.
3215
MATHAN, M.
736*
MATHE, G.
601
MATHEW, K.T.
6200*
MATHEWS, M.B.
3495*, 4189*, 5651*
MATHIESON, B.J.
1062

MATHISEN, O.
5823*
MATIENKO, N.A.
2838
MATILLA, A.
6146*
MATIS, J.
1779*
MATOLO, N.M.
3974
MATRICARDI, V.R.
6330*
MATSUDA, M.
5403
MATSUDAIRA, H.
5863
MATSUI, I.
2008
MATSUI, S.
541
MATSUKI, K.
2853
MATSUMOTO, H.
4416, 5776
MATSUMOTO, T.
4745*
MATSUMOTO, Y.
4892*
MATSUNAGA, H.
3451*, 4047
MATSUO, E.
6024*
MATSUO, N.
4881*, 6166*
MATSUO, Y.
3233
MATSUOKA, K.
838
MATSUOKA, Y.
5312, 5524*
MATSUSHIMA, T.
5510*, 5525*
MATSUURA, H.
6177*
MATSUYAMA, M.
1649*, 2965, 3442*, 5837*
MATSUYAMA, T.
722
MATSUZAKI, M.
1151*
MATTELIN, G.
1674*
MATTER, B.E.
2445*
MATTERN, C.F.
5683*
MATTHAES, P.
6269*
MATTHEWS, N.
1135*
MATTHEWS, R.H.
4897*

MATTINGLY, R.F.
 3307
 MATUO, Y.
 2949
 MATYUSHINA, YE.D.
 3954*
 MATZENAUER, H.
 778*
 MAUCHAUFFE, M.
 5281*
 MAUEL, J.
 432
 MAUGEL, T.K.
 2841, 3449*
 MAUGH, T.H.
 5721*
 MAUNG, L.
 2750
 MAUNDURY, R.
 4151*, 4640, 5962, 6216*
 MAURER, H.S.
 6128
 MAURI, C.
 834, 843
 MAURO, J.
 6074
 MAUVAIS-JARVIS, P.
 5034*
 MAVLIGIT, G.
 4749*, 5568*, 5966
 MAVLIGIT, G.M.
 596*
 MAWAS, C.
 551
 MAWDESLEY-THOMAS, L.E.
 2331
 MAY, E.
 434
 MAY, G.
 3444*
 MAY-LEVIN, F.
 835, 6195*
 MAY, P.
 434
 MAYER, A.
 718
 MAYER, D.
 6349*
 MAYER, J.
 5590*
 MAYER, V.W.
 2325
 MAYHEW, E.
 5584*, 5588*, 6344*
 MAYLATH-PALAGYI, J.
 1499*
 MAYS, C.W.
 1104
 MAYSKIY, I.N.
 1876*
 MAZA, L.M.
 1524*

MAZEL, P.
 1627*
 MAZIARZ, Z.
 394*
 MAZIERES, B.
 2233*
 MAZURENKO, N.P.
 2578*, 4631, 5927*
 MAZZARELLA, L.
 892*
 MAZZARELLA, P.
 3543*
 MC ADAMS, A.J.
 6313*
 MC ALACK, R.F.
 1785
 MC ALEER, W.J.
 415
 MC ALLISTER, R.M.
 442*, 1002, 2495, 3076,
 3602
 MC ALLISTER, W.
 4352*
 MC ANINCH, J.
 2046*
 MC ARTHUR, J.R.
 6299*
 MC BEATH, S.
 2831
 MC BRIDE, C.M.
 2641, 3878, 4749*
 MC BRIDE, J.A.
 4213*
 MC CAIN, B.
 1015
 MC CALL, M.G.
 3274
 MC CAMMON, J.R.
 705, 708, 4710*
 MC CARTHY, B.J.
 4991*
 MC CLAIN, K.
 4580*
 MC CLURE, P.D.
 875*
 MC COMBS, R.M.
 1360*, 2542
 MC CONKEY, E.H.
 1127
 MC CORMACK, L.J.
 4165*
 MC CORMICK, G.M., II
 3655
 MC CORMICK, K.J.
 414, 467, 476, 703
 MC COY, E.G.
 1497*
 MC COY, J.L.
 1783, 4674, 4676, 4687
 MC COY, M.M. II
 3533*
 MC COY, N.T.

1783
 MC CREDIE, K.B.
 1395, 5966
 MC CRUMB, F.R., JR.
 3034
 MC CULLOCH, E.A.
 1448*, 4726*
 MC CULLOUGH, B.
 3066
 MC CULLY, D.J.
 730*
 MC CURDY, J.D.
 1180*
 MC DEVITT, H.O.
 2686*, 4670
 MC DIVITT, R.M.
 2920*
 MC DONALD, R.
 4532, 4572
 MC DONNELL, J.P.
 3110
 MC DONOUGH, S.K.
 405
 MC DOUGALL, I.R.
 1673*
 MC DOUGALL, J.K.
 446*, 4593*
 MC DOUGHALL, J.K.
 3108
 MC DOWELL, M.J.
 4583*
 MC EWAN, A.
 2367*
 MC EWEN, J.
 3270
 MC FALL, R.
 2991
 MC FEELY, A.E.
 2841, 3449*
 MC GILL, M.
 2878
 MC GIVEN, A.R.
 1868*
 MC GOWAN, L.
 392*, 2158*
 MC GRATH, C.M.
 714, 3067
 MC GUIRE, P.M.
 2586*
 MC GUIRE, W.L.
 1242, 2872
 MC INTIRE, K.R.
 4644
 MC INTYRE, D.
 393*
 MC INTYRE, O.R.
 516, 748
 MC KHANN, C.F.
 460
 MC KIBBIN, J.B.
 4011
 MC KINNELL, R.G.

3061
 MC LAUGHLIN, C.L.
 890*
 MC LEAN, A.E.M.
 965
 MC LEOD, D.L.
 4533
 MC MULLAN, G.
 3384*
 MC NUTT, N.S.
 721
 MC PHEDRAN, P.
 6090*
 MC TAGGART, H.S.
 1478*
 MC WRIGHT, C.G.
 4697
 MCARTHUR, W.P.
 5239
 MCCLURE, P.D.
 5325
 MCCORMICK, W.F.
 5694*
 MCCREDIE, K.B.
 5360
 MCFARLANE, E.S.
 5288*
 MCGINNIS, J.P.
 5634*
 MCGOWAN, J.
 5128
 MCKAY, F.W., JR.
 5412
 MCKEE, E.E.
 5466*
 MCKELWAY, W.
 5372*
 MCKHANN, C.F.
 5049*
 MCKINNELL, R.G.
 5238
 MCLANE, M.F.
 5321
 MCLEOD, G.M.
 5386*
 MCMAHON, N.J.
 5663*
 MCNAMEE, R.
 5298
 MEAD, J.A.R.
 1457*
 MEADOWS, P.S.
 2837
 MEARES, E.M., JR.
 4085*
 MECHLER, B.
 860*
 MEDGYESI, G.
 332*, 334*
 MEDGYESI, G.A.
 1838, 2668*
 MEDINA, D.
 3003, 3004, 3230
 MEDNYK, M.R.
 5274
 MEDRAS, K.
 5085
 MEDZIHRADESKY, J.
 1790, 3855
 MEEKER, W.R., JR.
 761
 MEGA, T.
 4462*
 MEHLMAN, D.J.
 2635
 MEHROTRA, T.N.
 1181*
 MEHTA, F.S.
 4407, 4834*
 MEIER, D.A.
 1688*, 1689*
 MEIER, E.CH.
 5354
 MEIER, H.
 308, 1207, 2647, 4034,
 4067*, 5316
 MEINKE, W.
 1763
 MEIREN, D.V.
 2052*, 4439
 MEISS, H.K.
 2705*
 MEISTER, H.
 4344*, 6133*
 MEITES, J.
 830, 1951, 2344, 4965*
 MEJIA-LAGUNA, J.E.
 2378*
 MEKLER, L.B.
 5398
 MEL'NIKOVA, N.N.
 3312
 MELAMED, M.R.
 5454
 MELCHERS, F.
 4707*
 MELDOLES, M.F.
 6282*
 MELE, G.
 1941*
 MELENDEZ, L.V.
 491*, 1723, 3757, 3781,
 3822*, 3824*, 3832*, 4312,
 5925
 MELERA, P.W.
 2342
 MELICK, W.F.
 982*
 MELLIN, H.
 4659
 MELLORS, R.C.
 906
 MELNICK, J.L.
 431, 1718, 2535, 2694*,
 3755, 4691, 5372*
 MELNIKOV, D.N.
 6137*
 MELNYKOVYCH, G.
 1112
 MELTZER, M.S.
 1074*, 4619, 4761*
 MELVIN, K.E.W.
 2836*, 4847
 MENAKANIT, W.
 1931
 MENARD, S.
 2326
 MENDECKI, J.
 1974
 MENDELSON, D.
 1963
 MENDELSON, I.S.
 5829*
 MENESES HOYOS, J.
 925*
 MENEZES, J.
 5242
 MENEZO, J.L.
 3371*
 MENNEL, H.D.
 1156*, 1594, 5107, 5108,
 5110, 5162, 5719*
 MENNINGER, F.F., JR.
 3156
 MENON, I.A.
 2055*, 6345*
 MENSAR, A.
 821*
 MENYE, P.-A.
 2796*, 3280*
 MENZIES, D.N.
 5621*
 MED, T.
 1879*
 MERANZE, D.R.
 377*
 MERCHAN CIFUENTES, J.
 4284*
 MERETEY, K.
 3212
 MERIGAN, T.C.
 417, 1700, 3208
 MERKOV, A.M.
 3279*
 MERKOW, L.
 709
 MERKOW, L.P.
 584*, 1134*, 3717*, 5772
 MERLIN, E.
 3081
 MEROLD, V.A.
 5149
 MEROLLA, R.
 2849
 MERRETT, T.G.
 5334

MERRILL, D.A.
 764
 MERRILL, J.M.
 1310*
 MERSHEIMER, W.L.
 1498*
 MERTEN, D.
 6383*
 MESA-TEJADA, R.
 3207
 MESROBEANU, L.
 1548
 MEISSER, R.
 3334*
 MEISSMER, B.
 6206*
 MEISSMORE, H.
 6029*
 METAFORA, S.
 4025
 METCALF, D.
 627*, 910, 2077*, 2097*,
 5667*
 METCALF, T.G.
 3150*
 METTERS, J.S.
 6298*
 METTLER, L.
 2107*
 METZGAR, R.S.
 5381*
 METZGER, H.
 1870*, 3582*
 METZLER, M.
 335
 MEUNIER, J.
 3174, 3914*
 MEUNIER, M.
 2301
 MEUTH, N.L.
 1012, 5219
 MEYER, A.
 5817*
 MEYER, A.T.
 3948
 MEYER-BERTENRATH, J.G.
 2043*
 MEYER-BURG, J.
 2153*
 MEYER, G.
 1836, 1948, 4567, 5299,
 5433, 5911, 5964
 MEYER, H.W.
 4080*
 MEYER, R.R.
 5608*
 MEYER, W.
 535
 MEYERS, A.
 3610
 MEYERS, B.
 401

MEYERS, B.R.
 2198*
 MEYERS, P.
 455, 4531
 MICCO, P. DE
 1948
 MICHAELS, L.
 3082
 MICHALIKOVA, B.
 6311*
 MICHALUK, W.
 3265
 MICHEAU, C.
 3344*, 3421*, 4138*, 4208*,
 5598*, 6228*
 MICHEEL, B.
 5342, 5343, 5884, 5963
 MICHEL, I.
 833
 MICHELAZZI, L.
 2297*
 MICHELSON, A.M.
 354, 382*, 2994, 3659
 MICHLMAYR, G.
 2125*
 MICK, D.L.
 647*
 MICKELSEN, O.
 4330*
 MICKLEM, H.S.
 4501*
 MICU, D.
 5396*
 MIDDLETON, V.L.
 5395*
 MIDELL, A.I.
 4887*
 MIELNIK, J.
 5590*
 MIGLIAVACCA, F.
 3486*
 MIGNOT, J.
 2303, 3664
 MIGORODSKAYA, L.N.
 1465*
 MIGUEL VELASCO, J.
 6249*
 MIHAESCO, E.
 2674*
 MIHAILOVICH, N.
 2328, 4412, 4492, 5152
 MIHICH, E.
 2671*, 4718*
 MIKAYA, Z.A.
 1875*
 MIKE, V.
 3385*
 MIKHAILOV, I.G.
 6352*
 MIKITEN, T.M.
 4484*, 6300*
 MIKO, M.

4246*
 MIKOLASEK, J.
 6034*
 MIKOSHIBA, A.
 3336*
 MIKUTA, J.J.
 2820
 MIKUZ, G.
 2018
 MILAM, D.F.
 3203
 MILAS, L.
 2588*
 MILCU, ST.-M.
 3365*
 MILDNER, G.
 5419
 MILEA, N.
 5588*
 MILES, P.A.
 5569*
 MILHAM, S., JR.
 1932
 MILIEVSKAYA, I.L.
 3722*
 MILKU, SH.M.
 2698*
 MILLAR, G.N.
 975*
 MILLAR, R.C.
 4703
 MILLARD, M.
 3409*
 MILLER, A.
 1419, 1837
 MILLER, C.A.
 4066*
 MILLER, D.A.
 3473*, 5599*
 MILLER, D.S.
 5381*
 MILLER, E.
 4383, 5298
 MILLER, E.C.
 911, 2412*, 4386
 MILLER, E.S.
 537, 538, 816, 2883*
 MILLER, F.
 5224
 MILLER, G.
 756, 3118
 MILLER, H.H.
 1309*, 4847
 MILLER, H.I.
 395
 MILLER, J.
 2991
 MILLER, J.A.
 911, 2412*, 4386, 5107
 MILLER, J.F.A.P.
 1860*, 2629
 MILLER, J.M.

3113, 4763*, 5236
 MILLER, L.
 4425
 MILLER, L.D.
 3113, 5236
 MILLER, L.T.
 1314
 MILLER, O.J.
 3473*, 5599*
 MILLER, O.W.
 1110*
 MILLER, R.G.
 3176
 MILLER, R.K.
 932*
 MILLER, R.W.
 812, 1505, 2589*, 2998,
 3630*, 3740, 3975, 4329*,
 4486*
 MILLER, S.
 2662*
 MILLER, S.H.
 1903*, 3515*
 MILLER, T.
 1303
 MILLS, D.R.
 5229
 MILNE, R.J.
 5411
 MILO, G.E. JR.
 5267
 MILOSLAVSKII, I.M.
 3313
 MILSTEIN, C.
 4189*, 5550*, 6010*
 MILSTIEN, J.B.
 5900
 MILTON, P.J.D.
 6298*
 MINAYEVA, M.N.
 3343*
 MINCER, H.H.
 5634*
 MINCIONE, G.
 5189*
 MINEGISHI, K.
 4388, 5165
 MINEKAWA, Y.
 5894
 MINGAZZINI, P.C.
 2970
 MINNA, J.
 540, 552
 MINOWADA, J.
 399, 2645, 3746, 3812, 4306,
 4571, 4948*
 MINTY, C.C.J.
 1867*
 MINTZ, B.
 2874
 MIQUEL, J.
 4498*

MIRAND, E.A.
 406, 440*, 3077, 3122
 MIRON, M.
 5488*
 MIRSKY, H.S.
 5580*
 MIRSON, I.M.
 1289*
 MIRVISH, S.S.
 358, 1586, 2966, 3690
 MISDORP, W.
 4268*
 MISHENEVA, V.S.
 559*
 MISHIMA, Y.
 3528*, 5699*
 MISHKIN, M.
 975*
 MISHRA, L.C.
 1457*, 1769*
 MISTRY, P.
 2595*
 MISTRY, P.B.
 5276
 MITAL, H.S.
 566*
 MITAL, V.P.
 1423*
 MITCHELL, D.M.
 1072*
 MITCHELL, D.N.
 6028*
 MITCHELL, E.
 2483
 MITCHELL, G.F.
 4670
 MITCHELL, H.J.
 6105*
 MITCHELL, J.C.
 3726
 MITCHELL, M.S.
 3159, 3854
 MITCHELL, W.M.
 4598*
 MITCHEN, J.R.
 3746
 MITCHLEY, B.C.V.
 958, 3680
 MITELAMAN, F.
 4191*
 MITELMAN, F.
 424, 2554, 4601*, 5221,
 5462*, 6081
 MITROPOLSKY, A.N.
 4107*
 MITTAL, P.K.
 763
 MITTELMAN, L.A.
 5834*
 MITZNEGG, P.
 1639*
 MIURA, M.

1434
 MIURA, Y.
 2884*
 MIWA, T.
 3429*, 3707
 MIYAHARA, M.
 5539*, 6126
 MIYAJI, T.
 957, 1274*
 MIYAKAWA, M.
 5674*
 MIYAKE, S.
 3840
 MIYAKE, T.
 2147*
 MIYAKE, Y.
 1618*
 MIYAKI, K.
 2946, 4369
 MIYAKI, M.
 4043
 MIYAMOTO, H.
 4722*
 MIYAMOTO, K.
 2544
 MIYATA, S.
 4003
 MIYAZAKI, K.
 4714*
 MIYOSHI, I.
 4595*, 4974*
 MIZEJEWSKI, G.J.
 2732*
 MIZELL, M.
 3035
 MIZELL, S.
 2781*
 MIZRAHI, A.
 3746
 MIZUNO, D.
 1388, 4661
 MIZUNO, D.I.
 5518*
 MIZUNO, F.
 1322
 MIZUNOE, F.
 3840
 MIZUTANI, S.
 1345
 MKHEIDZE, D.M.
 5270
 MOBERGER, G.
 3529*, 5581*
 MOCARELLI, P.
 1075*
 MOCHIZUKI, Y.
 1986, 3403*
 MODAN, B.
 1919, 3258, 3972
 MODAN, M.
 3972
 MODLINGER, R.S.

4893*
 OE, K.K.
 4584*
 OEHRING, T.
 548
 OELLER, T.
 6110
 OELLING, K.
 2518, 2519
 OEPERT, S.
 2036*, 2784*, 3286*, 6103*
 OETTOENEN, M.
 1915
 OFFATT, B.
 1975
 OFFITT, A.E., JR.
 4403
 OGABGAB, W.J.
 403
 OGENSEN, B.
 2676*, 3250, 5759*
 OGILEVSKAYA, I.A.
 3297
 OHACSY, J.
 4946*
 OHALLATEE, E.A.
 6318*
 OHANAKUMAR, T.
 5381*
 OHIT, B.
 3168
 OHR, J.
 5963
 OHR, M.
 3535*
 OHR, U.
 5155, 5858*
 OHR, W.
 777*, 2387*
 OISEENKO, M.I.
 5425
 OISIU, M.
 2142*
 OKEYEVA, R.A.
 562*
 OKYR, M.B.
 3854
 MOLINA, A.
 2390*
 MOLINS, M.
 6360*
 MOLL, J.
 2004
 MOLLING, K.
 5035*
 MOLNAR, Z.
 1534, 2989
 MOLONEY, J.P.
 5742*
 MOLONEY, W.C.
 3233
 MOLTENI, A.

3500*
 MOLZ, L.
 2741*
 MONBER, F.
 971*
 MOMMA, W.
 5875*
 MONACO, A.P.
 3686
 MONAKHOV, N.K.
 5670*
 MONASTYREVA, L.A.
 1219*
 MONASTYRSKAYA, B.D.
 6147*
 MONDAL, S.
 2316
 MONDOVI, B.
 2830, 5987*
 MONNIER, J.
 3561*, 6144*
 MONOV, N.
 5423
 MONROE, S.A.
 2041*
 MONTAGNANI, A.
 615*
 MONTAGNIER, L.
 2552
 MONTALDO, G.
 2252*, 5042*
 MONTAUT, J.
 1200*
 MONTEMURRO, D.G.
 4846
 MONTERO, V.F.
 6160*
 MONTES DE OCA, F.
 1709
 MONTES, L.F.
 6283*
 MONTESANO, R.
 2312
 MONTEVERDE, R.
 3315
 MONTEZANO, R.
 5176
 MONTGOMERY, J.R.
 2688*
 MONTGOMERY, P.C.
 2691*, 4753*
 MONTGOMERY, P.O@B.
 644
 MONTI-BRAGADIN, C.
 2548
 MOOLTEN, F.L.
 5990*
 MOON, R.C.
 1564, 3006
 MOORE, C.
 1272
 MOORE, C.O.

419
 MOORE, D.H.
 614, 1325, 1501, 1726, 3049,
 3116, 3804, 4769*, 5953*
 MOORE, G.E.
 2645, 3746, 4306, 4948*
 MOORE, J.
 1430, 4629
 MOORE, M.
 326*, 3071, 3896
 MOORE, S.H.
 1026
 MOORE, T.L.
 1869*, 5370*
 MOORE, V.
 523*, 6336*
 MOORE, W.G.
 2018
 MOORES, R.R.
 3928*
 MOPERT, S.
 5419
 MORA, P.T.
 1032, 1315, 1351
 MORAGAS, J.M.DE
 5392*
 MORAIS, R.
 5488*
 MORASCA, L.
 2361
 MORAWETZ, F.
 6385*
 MORAX, S.
 3174
 MOREE-TESTA, P.
 2432*
 MOREL, C.
 1991
 MORENTIN, J.M. DE
 1633*
 MORGAN, C.
 2544
 MORGAN, D.A.
 3330*
 MORGAN, J.F.
 2152*, 2992, 3885, 4727*,
 4972*
 MORGAN, J.M.
 2335
 MORI, H.
 3707
 MORI, L.H.
 3726
 MORI, P.G.
 4357*
 MORI, W.
 807, 5318
 MORI, Y.
 1020
 MORIMONT, M.
 4135*
 MORIN, O.

1818	3348*	1982, 4965*
MORISHIMA, T.	MOSCHINI, G.B.	MOYER, P.P.
5677*	2537	1767*
MORITA, A.	MOSER, H.	MOYNAHAN, E.J.
1434	1234*	5705
MORITA, T.	MOSES, H.L.	MOYNE, M.A.
1121	4598*	6372*
MORITSUGU, Y.	MOSHKOWITZ, B.	MOYSEYENKO, L.YE.
1335	878*	6340*
MORIWAKI, K.	MOSIYENKO, M.D.	MOYSIADI, S.A.
2015, 3133	5983*	5997*
MORLAND, J.	MOSKALIK, I.G.	MOZAFARI, M.
5125	4101*	3408*
MORLEY, G.W.	MOSKOVKINA, O.YA.	MOZZI, R.
1413	445*	5444, 5669*
MOROHASHI, M.	MOSS, D.J.	MRACEK, J.
6154*	4635	6020*
MORONI, C.	MOSS, E.	MUCHOLDA, F.
1710	2754	623*, 803*
MOROSQVA, V.T.	MOSS, W.T.	MUCKLE, D.S.
3418*	2061*	5722*
MORRIS, B.	MOSSALLAM, I.	MUEHLBOCK, O.
1874*	1311*	905, 1727
MORRIS, H.P.	MOSZEW, J.	MUELLER, D.
364, 536, 578*, 1484*, 1968,	2400*	885*, 1654*, 2123*, 4282*,
1986, 3321*, 3403*, 3423*,	MOTOI, M.	6108
3504*, 3988, 3996, 4001,	3078, 3811, 5286*	MUELLER, K.
4072*, 4087*, 4092*, 4178*,	MOTOIU-RAILEANU, I.	661*
4210*, 4271*, 4838*, 4844,	3627*, 5867*	MUELLER, M.
4857, 4989*, 5339, 5451,	MOTOMIYA, Y.	1043, 5884, 6179*
5538*, 6114	947	MUELLER, W.E.G.
MORRIS, J.E.	MOTT, D.M.	411
634	5807	MUENTZING, J.
MORRIS, P.J.	MOTT, M.G.	3476*
1060, 1229*, 3890, 3891	4063*	MUGGED, M.
MORRISON, A.S.	MOTTA, G.	4921*
2783*	6211*	MUGGIA, F.M.
MORRISON, S.D.	MOTTERAM, R.	4888*
2733*	4166*	MUIR, C.S.
MORROW, C.P.	MOTTET, N.K.	809, 1931, 2748, 3619,
5483*	2973	4832*, 6082
MORROW, J.F.	MOTYCKA, K.	MUKAI, N.
5278*	2827	5287*
MORROW, R.	MOULIN, M.C.	MUKERJEE, D.
1094	669*	4514
MORROW, R.H.	MOULTON, J.E.	MUKHERJEE, A.B.
3744	799*, 4469*	4996*
MORROW, R.H., JR.	MOUNIER-KUHN, P.	MUKHERJEE, T.
4789	2739*	5386*
MORTARA, G.	MOURIQUAND, C.	MULDER, C.
5583*	2595*, 5672*	5279*
MORTAZAVI, S.H.	MOURIQUAND, J.	MULLER, E.
3408*	2595*	5116, 5657*
MORTON, D.A.	MOUTON, D.	MULLER, H.K.
307	1573	1867*
MORTON, D.L.	MOUTON, Y.	MULLER, M.
3797, 4676	3241*, 6285*	1166*, 5211, 5305, 5562*
MORTON, J.I.	MOVILEANU, D.	MULLER, R.
4559	1548	5220, 6286*
MOSBECH, J.	MOVSESYAN, K.S.	MULLER, S.A.
581*	5693*	3786
MOSCHETTO, Y.	MOY, P.	MULLINS, G.M.

5304
 MUMFORD, D.M.
 467, 5432
 MUNAKATA, N.
 5605*
 MUNK, K.
 3149*
 MUNKLEY, R.M.
 3493*
 MUNN, A.
 4304
 MUNOZ, M.C.
 3371*
 MUNOZ, N.
 805, 806, 3248
 MUNRO-FAURE, A.D.
 306
 MUNRO, T.R.
 4741*
 MUNUBE, G.M.R.
 3744
 MUNYON, W.
 5924
 MUPAS, R.S.
 1445
 MURAD, T.M.
 1145*, 5083
 MURAKAMI, E.
 2105*
 MURAKAMI, K.
 5495*
 MURAMATSU, M.
 2322, 4925*
 MURANAKA, M.
 582*
 MURAO, T.
 3807, 5252
 MURATA, M.
 1049
 MURAVIOVA, N.I.
 5501*
 MURETTO, P.
 774*
 MUROTA, S.I.
 1144*
 MURPHY, A.
 819*
 MURPHY, E.D.
 3943
 MURPHY, G.P.
 1039*, 3054, 4737*
 MURPHY, M.J.
 1874*
 MURPHY, M.L.
 1317
 MURPHY, P.
 3996
 MURPHY, R.L.
 983*
 MURR, L.
 777*, 2387*
 MURRAY, D.E.

2136*
 MURRAY-LYON, I.M.
 4906*
 MURRAY, R.F.
 396
 MURRAY, R.K.
 4587*
 MURTHY, A.S.K.
 2421*
 MURTY, C.N.
 2864
 MUSHINSKI, E.B.
 3190
 MUSSHOF, K.
 6383*
 MUSSON, R.A.
 2664*
 MUSUMECI, R.
 6145*
 MUTO, M.
 1121
 MWESIGA, E.
 2027*
 MYASNIKOV, A.I.
 5095
 MYERS, B.
 3784
 MYERS, B.J.
 3944
 MYERS, D.D.
 308, 2647
 MYERS, D.K.
 1670*
 MYERS, G.H., JR.
 3838
 MYERS, M.H.
 6355*
 MYERS, M.W.
 5947*
 MYERS, S.L.
 2882
 MYKING, A.O.
 322*
 MYLES, A.
 2972
 MYLONAS, N.
 3991
 MYNORS, J.M.
 6079
 MYSIK, M.
 2794*
 MYSZEWSKI, M.E.
 3791
 N'DIAYE, P.
 825*
 NABHOLZ, M.
 2865
 NACHMAN, R.L.
 3394*
 NACHTIGAL, M.
 431, 1029, 3830*
 NADAREYSHVILI, A.YE.

1875*
 NADHORNA, N.Y.
 5274
 NADJAR-FOSSE, G.
 5817*
 NADKARNI, J.J.
 1058, 4690
 NADKARNI, J.S.
 1058
 NADLER, J.V.
 3324*
 NADZHARYAN, N.U.
 444*
 NAEGELE, R.F.
 3759
 NAEIM, F.
 1524*
 NAGAI, A.
 2884*
 NAGAKI, D.
 438
 NAGAMATSU, A.
 3701
 NAGANUMA, M.
 2008
 NAGAO, M.
 5143
 NAGASAKI, H.
 4462*
 NAGASAWA, H.
 2305, 2975
 NAGASE, H.
 4274*
 NAGATA, C.
 1549, 1577, 2434*, 5094,
 5141
 NAGATA, M.
 2069*
 NAGATA, T.
 1460*, 1582
 NAGATA, Y.
 4416
 NAGATOMO, T.
 2105*
 NAGAYAMA, T.
 6227*
 NAGAYO, T.
 5089
 NAGEL, G.A.
 2254*, 4725*, 5063*
 NAGOYA, T.
 2960, 2965, 3062
 NAGURA, H.
 4465*
 NAGY, A.
 3443*, 6091*
 NAGY, M.P.-C.
 2668*
 NAHMIAS, A.
 2580*
 NAHMIAS, A.J.
 1719, 4581*

NAHNSEN, L.
 5449
 NAHON-MERLIN, E.
 2606
 NAIDE, Y.
 3431*
 NAIPAUL, N.
 1804
 NAIR, C.N.
 844
 NAIRN, R.C.
 1846*, 1867*, 1868*, 2617,
 3924*
 NAITHANI, Y.P.
 1181*
 NAITO, M.
 1020, 1059
 NAJEAN, Y.
 678*
 NAJMAN, A.
 678*
 NAKADATE, M.
 1278*, 5094
 NAKAGAWA, S.
 2398*
 NAKAGAWA, Y.
 2564*, 5556*
 NAKAGOME, Y.
 2008
 NAKAHARA, W.
 4594*
 NAKAI, G.S.
 673
 NAKAI, Y.
 5603*
 NAKAJIMA, K.
 3522*, 4051*
 NAKAMOTO, T.
 2821
 NAKAMOTO, Y.
 6196*
 NAKAMURA, K.
 1597, 1736
 NAKAMURA, S.
 3913*
 NAKAMURA, T.
 4223*
 NAKAMURA, Y.
 3516*
 NAKANISHI, K.
 3440*
 NAKANO, H.
 949
 NAKASHIMA, S.
 2977
 NAKATA, T.
 4938*
 NAKATSUKA, M.
 2888*
 NAKAYAMA, S.
 1666, 1667
 NAKAYASU, M.

4871
 NAKAZATO, H.
 542
 NAKAZUMA, Y.
 5517*
 NALESKINA, L.A.
 546
 NALLY, F.F.
 797*
 NAM, J.M.
 752
 NAMBA, M.
 1269
 NAMBA, Y.
 5302
 NAMKUNG, M.J.
 950
 NANDI, S.
 416, 1340, 3067
 NANKIN, H.
 2814
 NANKIN, H.R.
 1453*
 NARANG, H.K.
 727*
 NARAYAN, K.A.
 792*
 NARAYAN, D.
 4517
 NARCISSE, G.
 2430*
 NARDO, G.L., DE
 3464*
 NARISAWA, T.
 949
 NARTSISSOV, R.P.
 6183*
 NARURKAR, L.M.
 341
 NARURKAR, M.V.
 341
 NARUSE, S.
 1306
 NARUTO, H.
 4740*
 NARYKA, J.J.
 982*
 NASELLO, M.A.
 2533
 NASH, A.D.
 1222*
 NASH, G.
 2139*
 NASH, R.E.
 2014, 4205*
 NASIELL, K.
 2720
 NASIELL, M.
 2720
 NASKALSKI, J.
 1517, 2240*, 3518*
 NASO, R.B.

3738
 NASONOV, A.P.
 6153*
 NASR, K.
 2761
 NASSAR, V.H.
 4945*
 NASTAC, E.
 1027, 1037*, 3829*
 NASTI, J.
 2239*
 NASYROV, R.L.
 3015*
 NATAF, B.M.
 4173*
 NATALE, N.
 1075*, 1817
 NATHANS, D.
 1752, 3741, 3776
 NATHANSON, N.
 1854*
 NATHENSON, S.G.
 1847*
 NAU, F.
 5637*
 NAU, R.C.
 896*
 NAVARRO, M.
 5397*
 NAVONE, R.
 3566*, 3571*
 NAYAK, D.P.
 1338, 5382*
 NAZAR, R.N.
 4944*
 NAZERIAN, K.
 5284*
 NEALE, S.
 2451*
 NEAUPOUR-SAUTES, C.
 1403*
 NEBERT, D.N.
 4409
 NEBERT, D.W.
 349, 1241, 1252, 4433
 NEBORAK, YU.T.
 3585*
 NECHAYEVA, T.I.
 3562*
 NEDBAL, P.
 3197
 NEELD, W.E., JR.
 1543
 NEEMEH, J.A.
 4242*
 NEETHLING, A.C.
 4457*
 NEGONESCU, I.
 3472*
 NEGORO, H.
 838
 NEGRONI, G.

2241*
 NEHRIY, H.Z.
 5210
 NEIMAN, I.N.
 2251*
 NEIMAN, P.E.
 500*, 5226, 5901
 NEIMAN, R.S.
 4801*, 5610*
 NEISH, W.J.P.
 659*
 NELSON, D.
 4487*
 NELSON, D.P.
 5846*
 NELSON, D.S.
 468, 3609
 NELSON, J.H.
 3705
 NELSON, K.
 2605
 NELSON, L.W.
 4193*
 NELSON, M.
 3609
 NELSON, N.
 3265
 NELSON, P.G.
 540, 552, 595*
 NELSON, R.L.
 640, 1535, 1591, 1661
 NELSON-REES, W.A.
 442*, 1002, 1755, 3076,
 4524
 NELSON, V.G.
 2040*
 NELSON, V.R.
 5480*
 NEMEC, J.
 676*
 NEMENOVA, N.M.
 6070*
 NEMIROVSKAYA, B.M.
 1172*
 NEMOTO, H.
 6085
 NEMOTO, N.
 1388, 2322
 NEMOTO, T.
 2133*, 4737*
 NERI, V.
 5614*
 NES, W.R.
 3301
 NESBIT, M.
 5473*
 NESBIT, M.E., JR.
 1939*, 3210
 NESHKOVICH, B.A.
 2280*
 NESNOW, S.
 4478*

NETH, R.
 3986
 NETSKY, M.G.
 1090*
 NETTER, A.
 6224*
 NETTESHEIM, P.
 1265, 3405*, 4404, 4413,
 5113
 NEUBAUER, D.W.
 2276*
 NEUMANN, G.
 1417, 6093*
 NEUMANN, H.
 3775, 4089*, 5272
 NEUMANN, H.G.
 335
 NEUMANN, H.-G.
 4427
 NEUMANN, H.G.
 5798
 NEUMANN, V.
 6101*
 NEVILLE, A.M.
 3400*
 NEVINS, M.P.
 1556
 NEVO, S.
 535
 NEWBERNE, P.M.
 1558, 3673, 5335
 NEWBURGH, R.W.
 5558*
 NEWELL, G.R.
 5969, 6089*
 NEWELL, R.F.
 4413
 NEWMAN, M.W.
 3397*
 NEWTON, W.A.
 688
 NEY, R.L.
 1486*, 4853
 NEYFAKH, S.A.
 5670*
 NEYMAN, I.N.
 5045*
 NEZELOF, C.
 2050*, 6232*
 NG, A.B.P.
 1887
 NG, T.
 1437
 NI, L.Y.
 1056, 2632
 NIANG, I.
 823*
 NICHOL, C.A.
 2392*
 NICHOLSON, H.O.
 6111
 NICHOLS, B.L.

3230
 NICHOLS, W.W.
 424
 NICIOKA, CH.K.
 3347*
 NICKERSON, P.A.
 3500*
 NICOLI, J.
 1836
 NICOLIN, A.
 4679
 NICOLIS, G.L.
 4893*
 NICOLSON, G.L.
 2009, 2651*, 4915*
 NICOLSON, M.
 2495
 NICOLSON, M.O.
 1731
 NIEBURGS, H.E.
 2723*
 NIEDERLE, B.
 676*
 NIEDERMAN, J.C.
 456
 NIELSEN, A.M.T.
 1176*
 NIELSEN, J.
 1290*, 2385*
 NIELSEN, O.E.
 973*
 NIELSEN, S.M.
 4059*
 NIELSON, D.
 6324*
 NIELSON, J.
 384*
 NIEMANN, T.
 6269*
 NIEMI, M.
 2845
 NIEPOLOMSKA, W.
 6275*
 NIEWEG, H.O.
 6038*
 NIGRO, N.
 5998*
 NIGRO, R.
 6191*
 NII, S.
 2579*, 4591*
 NIIMURA, K.
 3431*
 NIIMURA, M.
 6208*
 NIKAIDO, O.
 4494
 NIKONOVA, T.V.
 367*, 2995, 5766
 NILSONNE, U.
 482
 NILSSON, K.

1809, 2613, 5913
 NILSSON, S.
 2101*
 NILSSON, T.
 3476*
 NIND, A.P.P.
 1867*, 1868*
 NINICHENKO, A.N.
 5095
 NIRENBERG, M.
 540, 2866
 NISHIDA, S.
 1754, 2528
 NISHIHARA, H.
 4422, 5403
 NISHIHARA, T.
 2683*, 2684*
 NISHIKAWA, K.
 2949, 4223*
 NISHIMURA, E.T.
 4416, 4768*
 NISHIMURA, S.
 4248*
 NISHIO, O.
 4453*
 NISHIO, Y.
 1812, 2681*, 3278*
 NISHIOKA, K.
 1049, 1052, 2256*, 2478*,
 2610, 5297
 NISHIOKA, M.
 2627
 NISHIOKA, S.
 2256*
 NISHIURA, H.
 2416*
 NISHIWAKI, H.
 1434
 NISHIYAMA, H.
 5013
 NISHIYAMA, M.
 2256*
 NISHIYAMA, R.H.
 5567*
 NISHIZUKA, Y.
 2700*, 5168
 NISHIZUMI, M.
 5180
 NISONOFF, A.
 2611, 3175
 NISSELBAUM, J.S.
 4894*
 NIWAYAMA, G.
 2857, 4254*
 NIXON, G.W.
 4958*
 NIYOSHI, I.
 3773
 NIZZE, H.
 662*
 NKRUMAH, F.K.
 3257

NOALL, M.W.
 336
 NOBEL, T.A.
 4634
 NODA, S.
 4973*
 NODSKOV-PEDERSEN, S.
 2089*
 NOEBEL, B.
 6065*
 NOEDL, F.
 2226*
 NOERJASIN, B.
 1833
 NOGUCHI, A.
 5509*
 NOGUCHI, Y.
 2354
 NOHARA, M.
 4871
 NOHARA, Y.
 1929
 NOJIRI, H.
 1143*, 1173*
 NOMURA, S.
 1732, 1733, 3058, 3111,
 3758
 NOMURA, T.
 5286*
 NONDASUTA, A.
 2767, 2768
 NONOYAMA, M.
 1703, 3792, 4516
 NORDENSTAM, H.
 6113
 NORDGREN, L.
 1196*
 NORMAN, A.
 5861
 NORMAN, J.L.
 2122*
 NORFOTH, K.
 6395*
 NORRBY, E.
 739*, 1070*, 4563, 5986*
 NORRBY, K.
 3300
 NORRIS, F.H., JR.
 2568*
 NORRIS, H.J.
 2111*, 5453, 5569*, 5687*
 NORRIS, W.P.
 1000*
 NORTHINGTON, J.W.
 403
 NORTHROP, R.L.
 4572
 NORTHUP, J.D.
 4033
 NORTON, S.J.
 4939*
 NOSAL, G.

3366*
 NOSSAL, G.J.V.
 1829
 NOTAKE, Y.
 5645*
 NOTKINS, A.L.
 1810, 4581*, 6013*
 NOVAK, E.R.
 1445
 NOVIKOV, D.K.
 5995*
 NOVIKOVA, M.A.
 2194*
 NOVIKOVA, V.F.
 2191*
 NCVIKOVA, V.I.
 5995*
 NOVOTNA, L.
 1790, 3855
 NOWAK, K.
 6275*
 NOWAKOWSKI, E.
 3823*
 NOWELL, P.C.
 607
 NOWINSKI, R.C.
 1026, 1325, 1695, 1726,
 2561*, 2610, 3144, 5214,
 5234
 NOWOTNY, A.
 5303
 NUCIFORO, G.
 5682*, 5691*
 NUGENT, C.A.
 4292*
 NUGENT, F.W.
 6306*
 NUNNA, N.G.
 2140*
 NURYAGDYEV, S.K.
 4109*
 NUUTILA, M.
 1915
 NUZZO, G.
 6261*
 NYDEGGER, U.E.
 4069*
 NYUNOYA, K.
 6323*
 O'BRIEN, P.
 1420*
 O'BRIEN, P.H.
 2061*
 O'BRIEN, R.L.
 4426
 O'CONNOR, G.B.
 1543
 O'CONNOR, P.J.
 5122
 O'CONNOR, G.T.
 3865, 4630, 4723*
 O'CROININ, P.

2150*
 O'DONNELL, P.V.
 2871
 O'GARA, R.W.
 631
 O'HOPP, S.
 4590*
 O'NEILL, F.J.
 2543, 3033, 3053
 O'NEILL, J.A.
 2935
 O'NEILL, R.T.
 2144*, 2820
 O'RIDDAN, M.L.
 836
 O'RIDDAN, M.L.
 2831
 O'ROURKE, C.M.
 4005
 O'SHEA, J.D.
 1643*
 OAKS, D.D.
 5972
 OBARA, T.
 404
 OBARA, Y.
 1410
 OBERBARNSCHEIDT, J.
 5854*
 OBERMAN, H.A.
 4097*
 OBOSHI, S.
 4693, 5526*
 OBUKH, I.B.
 692, 1057, 1840
 OCKEY, C.H.
 3494*
 ODA, K.-I.
 3089
 ODA, T.
 2016, 2528, 3487*, 5243,
 5253, 5909
 ODILI, J.L.
 1794
 OEGREN, S.
 2163*
 OELERT, W.
 6383*, 6388*
 OESTBERG, G.
 2130*
 OETTGEN, H.F.
 5351
 OEFEN, C.D.
 2688*
 OEFERS, S.
 738*
 OEFICER, J.E.
 684
 OFORI-NKANSAH, N.
 2377*
 OGATA, M.
 1618*

OGATA, T.
 4432, 6223*
 OGAWA, I.
 5517*
 OGAWA, K.
 3811, 4519, 4859, 5286*,
 5474*
 OGAWA, M.
 516, 748
 OGDEN, D.A.
 4501*
 OGINO, T.
 3083
 OGSTON, C.M.
 3452*
 OGSTON, D.
 3452*
 OGURA, H.
 3487*
 OGURA, T.
 4384
 OH, J.O.
 2537
 OHARA, K.
 1427
 OHAYON, E.
 1405*, 1871*
 OHBU, D.
 3522*, 4051*
 OHE, K.
 1358*, 2531
 OHIRA, I.
 2310, 3013
 OHIRA, S.
 2884*
 OHMORI, M.
 5954*
 OHNO, R.
 1434
 OHNUMA, T.
 4091*, 4948*
 OHSUGI, M.
 1826
 OHTA, H.
 4274*
 OHTAKI, N.
 4714*
 OHTSUKI, H.
 4174*
 OHTSUKI, Y.
 5942*, 5954*
 OIKAWA, A.
 4871
 OKA, H.
 3375*
 OKA, S.
 5540*
 OKA, Y.
 874*
 OKABAYASHI, F.
 1119
 OKADA, K.

1123
 OKADA, M.
 4458*, 4470*
 OKADA, N.
 5104
 OKADA, S.
 1630*, 4070*, 4084*, 5697*,
 5698*
 OKADA, T.
 3223*, 4576
 OKADA, Y.
 1119
 OKAGAKI, T.
 785, 1462*, 3543*
 OKAJIMA, E.
 947, 5183
 OKAMOTO, T.
 3668
 OKAMURA, S.
 1372
 OKANO, H.
 3789
 OKANO, T.
 4471*, 5776
 OKAWA, Y.
 4745*
 OKAZAKI, H.
 4820
 OKBI EL
 2801*
 OKIGAKI, T.
 4886*
 OKITA, G.T.
 4573
 OKITA, K.
 2627
 OKSMAN-DOMEJEAN, F.
 1405*
 OKUBO, C.K.
 1363*
 OKUDA, H.
 3502*
 OKUDA, K.
 6166*
 OKULOV, V.B.
 5296
 OKULSKI, J.
 2167*, 2849, 6304*
 OKUMOTO, M.
 2537
 OKUNEWICK, J.P.
 5285*
 OKUYAMA, T.
 722
 OL'SHEVSKAYA, L.V.
 3950
 OLAH, Z.
 4134*
 OLD, L.J.
 1726, 1841, 5323, 5336
 OLDHOFF, J.
 6038*

OLDSTONE, M.B.A.
1832, 2013, 3852
OLINICI, C.D.
2065*, 4110*
OLISCHLAEGER, A.
3964*
OLIVARES, L.
2804*
OLIVARES, T.A.
5320
OLIVER, D.
5504*, 5506*
OLIVER, I.T.
1611*
OLIVER, J.
968, 2934
OLIVER, J.A.
503*
OLIVER, L.
573*
OLIVETTI, G.
6171*
OLIVIE, M.
2488, 3091
OLJSHANETSKAYA, A.D.
2194*
OLOFSSON, J.
5522*
OLSEN, C.
4763*
OLSEN, R.G.
705
OLSEN, S.
3250
OLSHEVSKAJA, L.V.
2825
OLSON, C.
1312, 2873, 3113, 5236,
5237
OLSON, R.L.
2060*
OLSZEWSKI, W.
2028*, 2157*, 2197*, 3497*,
5592*, 6207*
OLURIN, O.
3983*
OMAR, J.B.
566*
OME, K.B.DE
2932
OMINE, M.
4031
OMOKAWA, T.
6026*
OMURA, S.
2016
ONARIR, R.
1463*
ONG, T.
2401*
ONG, T.-M.
2445*, 4468*

ONISHI, T.
4925*
ONO, K.
1020, 1022, 1059
ONO, S.
2977
ONO, T.
3511*, 4043, 5607*
ONODA, T.
1020, 1022
ONODERA, Y.
3429*
ONOE, T.
2299, 2300, 3714
ONOZAKI, K.
6006*
ONUSHCHENKO, I.A.
4101*
OPFER, A.W.
3311
OPLER, L.A.
2173*
OPPENHEIM, A.
379*
OPPENHEIM, J.J.
4619, 4744*, 4756*, 4757*
OPPERMANN, A.
6305*
OPPOLZER, R.
1233*
ORANGE, R.P.
2697*
ORBAN, E.
3259
ORCI, L.
868*
ORD, M.G.
1129
ORDEANU, A.
5588*
ORDER, S.E.
749, 3237, 3963*
ORDUZ, M.G.B.
391*
OREFICE, S.
6145*
ORENSTEIN, J.M.
5810
OPENSTEIN, M.M.
3527*, 5578*
ORESTANO, F.
4155*, 6169*
ORIZAGA, M.
1641*
ORLANDG, R.A.
5513*
ORLOV, YU.A.
3416*
ORMEA, F.
1897*, 1898*
ORMEROD, M.G.
4035

OROSZLAN, S.
465, 1698, 2495, 2551,
2592*, 3875
ORR, D.J.
2971, 3674
ORR, T.
4614, 5345
ORR, W.MCN.
6315*
ORTEGA, R.
4961*
ORTH, D.N.
4598*
ORTH, G.
5881
ORTON, C.
6336*
ORYE, E.
6130
ORYWALL, D.
885*, 6108
OSA, L.L. DE LA
2806*, 2807*
OSATO, T.
1025, 1051, 1322
OSAWA, T.
2583*, 6006*
OSBORN, M.
3495*, 5651*
OSE, H.
2800*
OSECHINSKII, I.V.
5398
OSHIRO, L.S.
696, 4513, 4608*
OSHIRO, T.
1929
OSHIRO, Y.
2823
OSLER, A.G.
4363
OSNES, J.B.
5125
OSOBA, D.
1053
OSSERMAN, K.E.
3189
OSSKE, G.
1409, 4102*, 4302
OSSKI, G.
1888
OSSWALD, H.
2382*
OSTASHKOV, L.K.
2119*
OSTERGAARD, E.
4826*
OSTERTAG, H.
5266, 5956*
OSTROUMOVA, M.N.
6175*
OSTROVTSEV, L.D.

6053
 STRYANINA, A.
 5185*
 STRYANINA, A.D.
 5708
 SWALD, P.
 2399*
 SZACKI, J.
 6277*
 TANI, S.
 2274*, 2275*
 TANI, T.T.
 553, 4001
 TERO, G.O.
 3560*, 6194*
 TERUELO, J.H.
 5061*
 TH, D.
 5317
 TSUKA, H.
 3701, 3789
 TT, F.
 6094*
 TT, H.
 4632
 TTAVIANI, G.
 4806*
 TTEN, J.
 1737
 TTEN, J.A.
 4046
 TTO, R.
 6398*
 TTOMAN, R.E.
 5861
 UTZEN, H.C.
 5353
 UYAHIA ET LALIAM, A.
 1421*
 VCHINNIKOV, YU.A.
 4866
 VE, P.
 1484*, 5451
 WEN, C.A., JR.
 4242*
 WEN, N.T.
 4993*
 WENS, R.B.
 4597*
 WOR, R.
 5546*
 XMAN, M.N.
 707, 2812
 YASU, R.
 2113*, 4376
 ZAKI, T.
 1142*
 ZER, H.L.
 1039*, 2492, 3034, 3048,
 3768, 4525, 4596*
 ZZELLO, L.
 930*, 1411, 2099*

PACHALIYA, N.A.
 1875*
 PACHECO, H.
 962, 3658
 PACIFICO, E.
 593*, 1288*
 PADEH, B.
 3683
 PADILLA, F.
 2078*
 PADLAN, E.A.
 6021*
 PAEGLE, R.D.
 6347*
 PAGANO, J.S.
 1703, 3792, 3809, 4516
 PAGE, G.A. LE
 2397*, 2590*
 PAGEAUT, G.
 6305*
 PAGLIA, M.A.
 3323*
 PAGLIARDI, G.L.
 5048*
 PAI, M.K.
 1804
 PAI, S.R.
 871*, 872*
 PAIGE, W.S.
 3698
 PAIK, W.K.
 936, 3988
 PAJDAK, W.
 1517, 4158*, 6304*
 PAKH, M.
 1838
 PAL, S.G.
 5486*
 PALEKAR, L.
 3700
 PALESE, P.
 2490
 PALFRAMAN, J.F.
 1583
 PALMA, L.D.
 1039*, 3054
 PALMER, A.
 2811
 PALMER E.L.
 1359*
 PALMER, E.L.
 3747, 4647, 5973
 PALMER, M.S.
 5803
 PALOMBINI, L.
 4561
 PALOWSKY, G.
 6271*
 PAMUKCU, A.M.
 4387
 PAN, H.L.
 950

PAN, S.F.
 2815
 PANAZZOLO, A.
 2726*
 PANDOLFI, M.
 4983*
 PANEDA CUESTA, F.
 5659*
 PANERO, M.
 3267, 3978*
 PANI, P.K.
 1323
 PANICKER, K.N.S.
 4299*
 PANOPOULOUS, C.
 3939
 PANOV, M.A.
 5177
 PANSE, T.B.
 867*, 4298*
 PANTANGCO, E.E.
 2762
 PANTELEAKIS, P.N.
 415
 PAOLETTI, E.
 5924
 PAOLETTI, P.
 3014*
 PAOLILLI, P.
 4426
 PAPACHARALAMPOUS, N.
 800*
 PAPACHARALAMPOUS, N.X.
 1088
 PAPADOPULU, G.
 5079
 PAPAMICHAIL, M.
 1407*, 3568*, 3569*
 PAPANICOLAOU, N.
 6221*
 PAPATESTAS, A.E.
 3189
 PAPE, C.
 6262*
 PAPE, D.H.
 1477*
 PAPENBURG, J.
 5855*
 PAPIERZ, W.
 3599*, 4112*
 PAPOLCZY, A.
 6091*
 PAPOUSEK, F.
 2850
 PAPP, J.P.
 1149*
 PAPWORTH, D.S.
 4501*
 PARANJPE, M.S.
 3882
 PARASKEVAS, F.
 3185

PARDO, F.R.
 391*
 PARDO, M.
 584*, 1134*, 3717*, 5772
 PARDO, V.
 3409*
 PARIS, J.
 628*
 PARK, C.H.
 1448*
 PARK, J.K.
 3231
 PARKER, J.C.
 5283*
 PARKER, J.C., JR.
 4056*
 PARKHOMENKO, I.I.
 1210, 1762, 3147*, 5175,
 5819*
 PARKHOUSE, B.
 4915*
 PARKHOUSE, R.M.E.
 176*, 783*
 PARKS, W.P.
 450, 699, 2498, 3867, 5257,
 5358, 5970
 PARMENTIER, R.
 4160*
 PARM, L.
 660*
 PARMIANI, G.
 40, 755, 1610*, 2622
 PARODI, S.
 3662
 PARONETTO, F.
 2087*
 PARR, I.
 4633
 PARRILLA, P.P.
 3596*
 PARRINGTON, J.M.
 1031
 PARROW, A.
 2199*
 PARRY, E.W.
 5635*
 PARSHAD, R.
 2724*, 4977*, 5430
 PARSHIN, A.N.
 2127*, 3292
 PARSONS, D.F.
 6330*
 PARSONS, J.T.
 706
 PARTEVYAN, A.G.
 3482*
 PASCAL, R.R.
 197*, 504*
 PASCAL, Y.
 354
 PASCUAL, E.
 6146*

PASHINTSEVA, L.P.
 2118*
 PASKIN, D.L.
 5548*
 PASQUALINI, C.D.
 1803, 3299, 3733*
 PASSEY, R.D.
 1273, 3645
 PASTAN, I.
 1737, 3314, 4222*, 4508
 PASTERNAK, G.
 2624, 5342, 5343, 5356,
 5963
 PASTERNAK, L.
 2624
 PASZTOR, E.
 6255*
 PASZTOR, L.M.
 4088*
 PATAKFALVI, A.
 1857*, 5355
 PATAKI, J.
 961
 PATEL, D.
 5621*
 PATEL, D.R.
 5836*
 PATEL, I.R.
 4644
 PATEL, R.
 5337
 PATERNI, L.
 5733*
 PATKOWSKI, J.
 2615
 PATOCKA, F.
 4588*
 PATRICK, A.L.
 3253
 PATRUCCO, A.
 4363
 PATTEN, S.F.
 2566*
 PATTERSON, L.T.
 1394
 PATTERSON, R.
 2046*
 PATTERSON, W.B.
 1302
 PATTI, J.
 1077*
 PATTILLO, R.A.
 3307
 PATWARDHAN, J.R.
 827*
 PAUL, B.
 4409
 PAUL, D.
 429, 1791
 PAUL, J.S.
 644
 PAUL, S.M.

3035
 PAUL, W.E.
 2620, 3164
 PAULI, R.M.
 5605*
 PAULUZZI, S.
 1712, 1764*
 PAULY, J.E.
 4863
 PAUTSCH, F.
 2889*
 PAVAN, R.
 473
 PAVELETZ, N.
 1165*
 PAVIA, R.A.
 6014*
 PAVIA, U.
 5460*
 PAVIE, J.
 3196
 PAVILANIS, V.
 3886
 PAVLOSKI, S.
 4049*
 PAVLOV, D.
 2083*
 PAVLOVA, M.V.
 5822*
 PAVLOVSKY, A.
 1116, 1800
 PAVLYUCHENKOVA, R.P.
 3194
 PAVLYUSHCHIK, A.V.
 3369*
 PAWELETZ, N.
 2169*
 PAWINSKA-PRONIEWSKA, M.
 765, 772*
 PAWLICKI, M.
 6276*
 PAXTON, J.
 5933*
 PAYAN, H.
 605
 PAYET, M.
 6
 PAYMASTER, J.C.
 526*, 1226*, 1930, 3264,
 6086
 PAYNE, B.
 396
 PAYNE, J.E.
 2084*
 PAYNE, L.N.
 1323
 PAYNE, P.M.
 6082
 PAYNTER, O.E.
 33
 PAZ, B.
 3972

EACOCK, E.E., JR.
 4479*
 EACOCK, J.H.
 540, 552, 595*
 EAKMAN, D.C.
 3232
 EARSE, A.G.E.
 3396*, 5618*
 EARSON, D.
 4731*
 EARSON, G.
 3800, 4614
 EARSON, G.
 5345
 EARSON, G.R.
 110
 EARSON, J.G.
 248
 EARSON, J.W.
 3102
 CK, A.W.
 306
 CK, E.B.
 3981*
 CK, R.M.
 3981*
 CKHAM, M.J.
 4234*
 DERSEN, B.
 1213*, 1495*, 3448*, 4842
 DERSEN, B.N.
 5664*
 DERSEN, E.
 809, 6082
 DERSEN, P.L.
 280*
 DERSEN, S.N.
 3864
 DERSON, T.
 2893*, 6124
 IO, G.
 3780, 5902
 ORAZZI, J.J.
 3470*
 OROSO, A.F.
 1557
 BLES, P.T.
 1732, 1733, 1734, 3058,
 3132
 LER, T.C.
 1283*
 RS, F.G.
 72
 SKER, S.J.
 2992
 TERS, T.
 2220*
 G, A.E.
 342, 4002, 5093, 5123
 RUM, G.D.
 5957
 LLON, F.

573*
 PEKER, J.
 4179*
 PELCZARSKA, A.
 2615
 PELED, A.
 751, 768
 PELLEGRINO, C.
 5682*
 PELLER, P.
 141*
 PELLERIN, D.
 2050*
 PELTOKALLIO, P.
 4627
 PELYUKHOVA, R.N.
 1161*
 PEMBERTON, A.H.
 4050*
 PENA, A.S.
 6337*
 PENA, N.C. DE LA
 2415*
 PENALVER, J.A.
 4545
 PENCEA, V.
 5594*
 PENDOLA, R.
 4506
 PENHOET, E.E.
 2832
 PENMAN, S.
 2524
 PENN, I.
 5728*
 PENNELLI, N.
 112, 3572*
 PENNINGTON, S.N.
 364
 PENSABENE, J.W.
 2321
 PEPE, FR.
 3470*
 PERA, C.
 3361*, 5624*
 PERAINO, C.
 934, 1244, 5084, 5127
 PERBELLINI, A.
 6229*
 PERCHE, J.-C.
 2438*
 PERCY, A.K.
 4820
 PERDUE, J.F.
 4557
 PEREBATOVA, M.A.
 531*
 PERENCEVICH, E.N.
 274*
 PEREZ, C.
 4352*
 PEREZ, F.J.H.

391*
 PEREZ-PASTEN, E.
 2378*
 PEREZ-SANDOVAL, D.
 1191*
 PERGUM, G.D.
 5395*
 PERIES, J.
 2488, 3091
 PERIMAN, P.
 3844, 4538
 PERIN, F.
 39
 PERIN, J.P.
 6287*
 PERIN-ROUSSEL, D.
 2433*
 PERK, K.
 183, 4634
 PERKINS, F.H.
 5338
 PERKINS, I.V.
 3257
 PERKINS, J.P.
 1904*
 PERLMUTTER, A.
 5464*
 PERLMUTTER, R.A.
 1770*
 PERNOT, M.
 5408*
 PERRAUD, R.
 3028, 5197
 PERRICELLI, A.
 2640
 PERRY, R.P.
 851, 1118
 PERRY, S.
 227, 4031
 PERRYMAN, L.E.
 5292
 PERSHIN, G.N.
 5096
 PERSKY, L.
 2899*
 PERSSON, B.H.
 5638*
 PERSSON, T.
 6333*
 PERTAYA, A.V.
 3200
 PERTIZ, E.
 3969
 PERTSEMLIDIS, D.
 4893*
 PERZADAEV, R.O.
 3488*
 PERZADAYEV, R.O.
 6132*
 PERZIK, S.L.
 5570*
 PERZIN, K.H.

3381*, 3524*, 5508*

PESCATORE, S.

3345*

PESTERNIKOV, V.M.

5865

PESTOVSKAYA, G.N.

6148*, 6150*

PETERING, H.G.

91*

PETERS, L.J.

929*

PETERS, N.

3362*

PETERS, R.L.

308, 1797, 4665, 5254, 5331

PETERSEN, D.F.

1440

PETERSEN, G.R.

4333*

PETERSEN, K.

371*

PETERSEN, K.W.

1531

PETERSON, B.YE.

2267*

PETERSON, J.A.

4259*

PETERSON, M.R.

3166

PETERSON, N.P.

3549*

PETERSON, P.A.

2178*

PETERSON, R.D.A.

4672

PETERSSON, B.

2199*

PETITO, C.K.

3392*

PETKOV, G.

6338*

PETKOVIC, S.

1198*

PETO, R.

38, 958, 1924, 3680, 3698

PETRAKIS, N.K.

508

PETRAKIS, N.L.

3273

PETRIC, M.

5903, 5949*

PETRICCIANI, J.C.

3872

PETRINI, M.T.

6032*

PETRONIC, V.

1198*

PETROV, V.G.

6350*

PETROV, V.I.

6350*

PETRUNYAKA, V.V.

3950

PETTAVEL, J.

1166*

PETTENGILL, O.S.

3498*, 4951*

PETTERSSON, A.

5437

PETTERSSON, U.

704, 3057, 3095

PETTY, L.G.

2367*

PETUKHOV, V.I.

6257*

PETYAYEV, M.M.

4474*

PEVNITSKII, L.A.

5968

PEZLAROVA, A.

2827

PFEFFERMAN, R.

5805

PFEIFFER, S.E.

5167, 5363

PFITZER, P.

1477*

PFLEIDERER, A., JR.

1153*

PFRETZSCHNER, C.

6254*

PHILIPS, F.S.

1532, 4400

PHILIPSON, L.

704, 1713, 3057

PHILLIP, M.J.

1793

PHILLIPS, A.D.

5838*

PHILLIPS, E.L.

5285*

PHILLIPS, J.

4622

PHILLIPS, J.M.

3679

PHILLIPS, L.A.

1732, 1733, 1734

PHILLIPS, M.E.

3868

PHILLIPS, P.A.

1368*, 5273

PHILLIPS, R.A.

3176

PHILLIPS, S.M.

2515

PHILLIPS, T.F.

3469*

PHILLIPS, T.M.

179*, 4728*, 5328

PHILLIPS, V.

2744*

PHILPOTT, R.M.

4906*

PHIPPS, F.C.

4403

PIACENTINI, G.

2295*

PIANTADOSI, C.

2379*

PIATKOWSKI, Z.

2187*

PICARD, L.

1200*

PICKERING, A.F.

1441

PICKERING, K.

4695

PICKREN, J.W.

3477*

PIEKARSKI, N.

6007*

PIENKOS, E.J.

6235*

PIENTA, R.J.

5325, 5877

PIEPER, M.

4045

PIER, A.C.

3649

PIERCE, G.E.

744

PIERONI, G.

2596*

PIERSCINSKA, E.

5551*

PIESSENS, W.F.

637, 1990

PIETROIUSTI, M.

3267

PIETSCHMANN, H.

1158*

PIETTE, M.

6143*

PIKE, B.L.

1106

PIKE, M.C.

766, 1094, 3744

PILCH, B.Z.

3907

PILCH, Y.H.

745, 1389, 3160, 3898,

4774*

PILERI, A.

5048*

PILGRIM, H.I.

1981, 2012, 5017

PILLINGER, D.J.

1646*, 3009

PILOTTI, S.

1227*

PIMSTONE, B.L.

4912*

PINCUS, T.

407, 408, 1711

PINDBORG, J.J.

200, 4834*

INKARD, K.J.
4166*

INKERTON, H.
58, 1805, 4560

INN, V.W.
1842*

INNOW, W.
6103*

IOVANETTI, E.
4200*

IPER, R.C.
786

PKIN, J.
2580*

ROFSKY, B.
1376

RONT, A.
6217*

ROSKY, R.R.
2415*

RRO, G.
1957

SANO, J.C.
5298

STER, L.
2487

TARO, R.
2031*

TCHUMONI, C.S.
4451*

TELKA, D.R.
120

TENKO, N.N.
4122*

TOT, H.C.
4851, 5000*, 5514*

TOUT, M.J.
43, 1254, 1255

TT, P.
1616*

TT, T.H.
3272

TTMAN, G.
5557*

TZURRA, M.
2296*, 5984*

ZER, L.I.
3316

ZON, P.
3249

ZZI, T.
4207*

ACA, M. LA
2235*, 2236*, 2539

AGEMANN, P.G.
550

AGEMANN, P.G.W.
1357*, 3510*, 4869, 4900*

ANINSEK, J.A.
753

APP, F.V.
1287*, 1652*

PLASSMANN, H.W.
2519

PLATA, E.J.
5683*

PLATONOVA, G.N.
1629*, 3597*, 6272*

PLATT, D.S.
3327*

PLAVEC, V.
6230*

PLAYFAIR, J.H.L.
750

PLEASANTS, J.R.
2689*

PLENERT, W.
2682*, 3847

PLENGVANIT, U.
4257*

PLETNEV, S.D.
6053

PLEWIG, G.
1880

PLOCINIK, B.A.
3183

PLQEG, E.V.D.
6038*

PLOWRIGHT, W.
72

PLUMMER, G.
712

PLUOT, M.
5101, 6071*

PLUZANSKA, A.
3925*, 4639, 4843

POCHON, F.
354, 382*, 2994, 3659

PODWORSKI, H.
4127*

PODZEY, L.K.
1604*

POGO, A.O.
6109

POGOSIANZ, H.E.
4317

POGOSYANTS, E.E.
3310, 5938*, 6219*

POGOSYANTS, YE.YE.
1913*

POINTNER, H.
1552

POINTON, R.C.S.
393*

POIRIER, L.A.
3022*, 4210*

POIRIER, M.C.
3022*, 4210*

POKROVSKIY, A.A.
5075

POKROVSKY, A.A.
1621*

POLAC, N.
5391*

POLAK, J.M.
3396*, 5618*

POLAN, A.K.
6074

POLAND, A.
306

POLIAKOVA, P.
857*

POLISHCHUK, R.F.
3721*

POLIVODA, B.I.
6153*

POLIVODA, O.M.
6153*

POLJAK, R.J.
2656*

POLKOWSKA-KULESZA, E.
4843

POLKOWSKA-KULESZA, E.
3487*

POLL-GOUATER, A.
3157

POLLACK, S.
2605

POLLACK, S.V.
2769

POLLARD, C.E.
344

POLLARD, H.M.
1149*

POLLARD, M.
99, 5778

POLLI, E.
597*, 1479*

POLLIACK, A.
1774*, 3112, 4098*, 5786,
5805, 5828*

POLLICE, L.
1523*

POLLINI, G.
4473*

POLUKHINA, M.A.
5897

POLYZONIS, M.
1553

POMERANZ, J.R.
2937

POND, H.S.
1039*

PONG, R.S.
954, 5174

PONSAN, X.
3626*

PONTEN, J.
3, 1442, 1952, 5447

PONZ DE POSADAS, G.
4206*

PONZONE, A.
5477*

POOLEY, A.S.
1263

POOLEY, F.D.

385*
POPANDOPULO, S.I.
6353*
POPE, J.H.
694, 4635
POPESCU, A.
1548
POPESCU, H.I.
389
POPESCU, I.G.
1862*
POPESCU, M.
5359
POPESCU, N.C.
5770
POPHAM, R.R.
5553*
POPISIL, M.
1879*
POPKOVA, G.A.
6373*
POPOVA, YU.N.
3483*
POPOVIC, D.
6230*
POPOVIC, K.
6230*
POPOVIC, M.
737*
POPP, F.A.
5099, 5140
POPPER, P.J.
306
POPPI, M.
4953*
POREBSKA, A.
1076*
POREP, A.
979*
PORIES, W.
3306
PORIES, W.J.
3648
POROSHIN, K.K.
6138*
PORRO, R.S.
3392*, 4006
PORTA, G.D.
2326, 4675
PORTEOUS, D.D.
4741*
PORTER, D.
4715*
PORTER, K.
1193*
PORTER, M.
749
PORTER, N.H.
4906*
PORTOLANI, M.
2236*
PORWIT-BOBR, Z.

5255
PORZSOLT, F.
6047*
POSENER, L.N.
2758
POSER, H.
254
POSKANZER, D.C.
2345
POSTIGLIONE, G.
4159*
POSWILLO, D.E.
1259
POTAPENKOVA, L.S.
1893, 3463*
POTDAR, G.G.
4299*
POTH, J.L.
1664
POTICHA, S.M.
2113*
POTOP, I.
2698*
POTREPKA, R.F.
1279*
POTT, E.
5135
POTT, F.
3617
POTTER, B.
666*
POTTER, C.G.
1296*
POTTER, C.W.
3904
POTTER, M.
1806, 3190, 3946, 6021*
POTTER, V.R.
2979, 3504*, 4072*, 4161*,
4178*, 4271*
POUGET, J.
6224*
POULIGUEN, Y.
204
POUND, A.W.
2329, 2436*, 2933, 4399
POUPON, M.-F.
3893
POURNY, C.
2270*
POVLSEN, C.O.
5617*
POWARS, D.R.
4228*
POWELL, A.S.
1225*
POWELL, D.E.B.
826*
POWELL, G.M.
1291*
POWELL, H.
86*, 1506

POYNTER, R.W.
4411, 5128
PRADHAN, A.M.
5801
PRAGE, L.
3095
PRAGER, M.D.
1816
PRAGNELL, I.B.
5651*
PRASAD, J.N.
4957*
PRASAD, K.N.
538, 1246, 1631*, 2362,
2924, 3465*, 4916*, 4998*
PRASAD, N.
4582*
PRASAD, R.
4582*
PRAT, G.A.
3017*
PRATT, R.C.
3697
PRATT, R.D.
933, 4237*
PREAUX, J.
2475*, 3953*
PREDA, F.
6145*
PREHN, R.T.
25*, 4401, 5293, 5353, 5711
PREISLER, H.D.
1298*, 4086*
PREISS, J.
861*
PREISSLER, P.
1615*
PREJEAN, J.D.
2704*
PREMKUMAR, E.
2988
PREMONT, J.
5441
PRESCOTT, B.
5932*
PRESENTY, B.
183
PRESSMAN, D.
2671*, 4704
PRESTAYKO, A.W.
2813
PRESTON, E.
3940
PRETLOW, T.G.
4758*
PRETLOW, T.G., II
6343*
PRETTY, H.M.
919*
PREUD'HOMME, J.L.
3900, 4716*, 5311
PREUSSMANN, R.

2915*, 5108, 5162
 RICE, C.H.G.
 3071
 RICE, E.
 177*
 RICE, F.M.
 553, 4976*
 RICE, F.W.
 3077
 RICE, H.M.
 5467*
 RICE, J.M.
 634, 4387
 RICE, M.R.
 3170
 RICE, P.J.
 59, 3080, 3713
 RICE, R.
 2524
 RICHARD, J.
 4868
 RIDAN, H.
 3973
 RIESTER, W.A.
 2217
 RIESTLEY, J.
 2134*
 RIGGINA, E.L.
 4317
 RINCE, A.
 2628
 RINCE, J.E.
 3726
 RINCLER, G.L.
 4644
 RINDULL, G.
 873*
 RINEAS, J.W.
 4592*
 RIORE, R.L.
 440*, 4837*
 RIORI, E.
 2179*
 RIORI, E.S.
 158, 401, 688, 1697, 1802
 RIS, J.
 3561*, 6144*
 RISTASOVA, S.
 2502
 RITCHARD, D.J.
 2484, 4515
 ROBERT, M.
 3107
 ROBST, G.S.
 5608*
 ROBST, H.
 3428*
 RODESCU, V.
 2780*
 RUDI, G.
 321*, 1261, 2308, 3921*
 RUFFITT, M.R.

1379, 4046, 4530
 PROKOF'YEVA, O.G.
 52
 PROKOP, O.
 1863*
 PROLLA, J.C.
 1141*
 PROPP, R.M.
 6140*
 PROPPING, P.
 2410*
 PROSE, P.H.
 1038*
 PROST-DVOJAKOVIC, R.J.
 6164*
 PROUT, G.R., JR.
 4323*
 PRUSOVA, F.
 209*
 PRUTKIN, L.
 869*
 PRUYN, F.H.A.M.
 3024*
 PRUZANSKI, W.
 4767*, 4905*
 PRY, T.W.
 4654
 PRYDZ, H.
 3296
 PUCHKOV, JU.G.
 6190*
 PUCK, T.T.
 630
 PUCKETT, C.L.
 2833
 PUDOV, V.I.
 1164*, 3342*
 PUGH, R.C.B.
 1450*
 PUGLIELLI, M.
 6178*
 PUKHALSKAYA, E.CH.
 1629*
 PULLIAM, L.A.
 3192
 PUMPHREY, J.G.
 3946
 PUNDBORG, J.J.
 4407
 PURCHASE, H.G.
 5714
 PURCHASE, I.F.H.
 1255
 PURO, D.
 296*
 PURO, H.E.
 2333
 PURTILO, D.T.
 1435
 PURVES, E.C.
 750
 PURVES, L.R.

5788
 PUTNAM, C.W.
 5728*
 PUTONG, P.
 2061*
 PUTZKE, H.-P.
 2383*
 PUVION, F.
 775*
 PYLEV, L.N.
 3015*, 5117
 QASBA, P.K.
 1761
 QUADRI, S.K.
 1951
 QUAGLINO, D.
 843
 QUATRALE, A.C.
 2098*
 QUATTRO, V.DE
 3372*
 QUEENER, S.F.
 578*, 4989*
 QUEISSER, U.
 3964*
 QUEISSER, W.
 3964*
 QUENTIN, E.
 5765
 QUENUM, C.
 203
 QUERINJEAN, P.
 6010*
 QUIE, P.G.
 3837
 QUIGLEY, J.P.
 1342, 5917
 QUINTON, A.
 3287*
 QUINTRELL, N.
 425
 QUIROGA MICHEO, E.
 4819, 4821
 RABASA, S.L.
 1803, 3299
 RABBISOI, G.
 1902*
 RABELLINO, E.
 1376
 RABES, H.
 347
 RABES, H.M.
 1560, 5073
 RABIDEAU, P.W.
 961
 RABIER, M.
 824*
 RABIN, H.
 1028, 1320, 4524, 5345
 RABINOWITZ, M.
 4720*
 RABINOWITZ, Z.

2002, 2337, 3045, 3683,
 5222, 5808
 RABSON, A.S.
 1725, 3669, 4538, 5891
 RABSTEIN, L.
 3703
 RABSTEIN, L.S.
 123, 2500, 4665, 5149, 5254, 5331
 RACADOT, J.
 573*
 RACE, R.E.
 5612*
 RACEVSKIS, J.
 4943*
 RACHMELER, M.
 6303*
 RACHMILEWITZ, B.
 878*
 RACHMILEWITZ, E.A.
 4098*
 RACHMILEWITZ, M.
 878*
 RACKER, E.
 4316
 RACOVEANU, C.
 1862*
 RADEMACHER, R.
 3937
 RADIZOWSKI, C.
 1430
 RADLOFF, R.
 1444
 RADNOT, M.
 506*, 569*
 RADOCHAY, L.
 5869*
 RADOM, S.
 4251*, 5591*
 RADOMSKI, J.L.
 1247, 1248
 RADOUCO-THOMAS, C.
 3366*
 RADUJKOV, Z.
 6230*
 RADZIKOWSKI, C.
 3193, 4629
 RAFALOVICH, M.B.
 3578*
 RAFFI, A.
 3408*
 RAGAB, A.H.
 4352*
 RAGLAND, W.L.
 45
 RAHI, A.H.S.
 3889
 RAHIMI, A.
 5520*
 RAI, K.R.
 2860, 4013
 RAI, S.
 763
 RAICHEV, R.
 3735*, 5170
 RAICK, A.N.
 4367
 RAIKHLIN, N.Y.
 3950, 4123*, 6236*
 RAILEANU-MOTOIU, I.
 1862*
 RAIMONDI, L.
 1822
 RAISYS, N.
 6007*
 RAITCHEVA, E.
 3644
 RAJCANI, J.
 2547
 RAJEWSKY, M.F.
 5172, 5756*, 6389*
 RAJKA, G.
 5585*
 RAJU, M.V.S.
 820*, 5191*, 5193*
 RAKOV, A.I.
 1161*
 RAKUSANOVA, T.
 1717
 RALPH, P.
 4615
 RAMACHANDRAN, G.
 6200*
 RAMACHANDRAN, P.
 728*, 3398*, 6200*
 RAMADAN, M.A.-E.
 1588
 RAMON, A.M.
 840
 RAMOS, C.V.
 3331*
 RAMOT, B.
 3231, 3271
 RAMSEY, R.L.
 6016*
 RAMULU, C.
 2381*, 5191*
 RAN, M.
 3862
 RANA, M.W.
 3357*
 RANADIVE, K.J.
 793*, 871*, 3474*
 RANCHOD, M.
 5472*
 RANDALL, C.C.
 3087
 RANDALL, Z.C.
 4920*
 RANERATH, E.
 264*
 RANERATH, K.
 264*, 1705
 RANDT, A.
 5963
 RANG, E.
 2751
 RANGAN, S.R.S.
 1767*, 2117*
 RANJINI, R.
 2730*
 RANKIN, A.
 1730
 RANKIN, B.J.
 4534
 RANKOW, R.M.
 1091*
 RANSBERGER, K.
 3588*
 RANZI, T.
 597*
 RAO, C.
 514
 RAO, K.V.N.
 2328, 4412, 4492, 5152
 RAO, L.G.S.
 2870
 RAO, P.R.
 5663*, 6018*
 RAPOPORT, G.L.
 2224*
 RAPOPORT, S.
 4289*
 RAPOPORT, S.I.
 3954*
 RAPP, F.
 710, 1205, 2543, 3033, 3043,
 3083, 3141, 4083*, 4520,
 4536, 5052*, 5890, 5918
 RAPP, H.J.
 1074*, 3877, 4619
 RAPP, W.
 5068*, 6048*
 RAPPAPORT, H.
 3231, 3356*, 4052*, 5498*,
 6205*
 RAPPORT, M.M.
 4778*
 RASCHKE, E.
 3583*, 4152*
 RASHEED, S.
 124, 2495
 RASKA, K., JR.
 3798
 RASKAS, H.J.
 1333, 1363*, 3748, 4311,
 4547
 RASKOVA, T.M.
 3538*
 RASMUSSEN, R.E.
 4362, 5835*
 RATCLIFFE, H.
 2600*
 RATCLIFFE, J.G.
 6365*, 6366*
 RATCLIFFE, N.A.

240
 RATH, F.W.
 319*, 4103*
 RATHKAMP, G.
 4478*
 RATHNAM, P.
 1486*
 RATLIFF, C.R.
 2891*
 RATNAM, S.S.
 1987
 RAUHS, R.
 5428*
 RAUSCHER, H.
 1085
 RAUSIS, C.
 2744*
 RAUTH, A.M.
 1685*
 RAUTU, I.
 2253*, 5391*
 RAVENTOS, A.
 2071*
 RAVICOVITCH, R.E.
 5281*
 RAVITZ, G.
 3203
 RAVNIHAR, B.
 808
 RAWLS, W.E.
 1718, 2534, 2535, 2604,
 4691, 5372*
 RAY, P.K.
 2968
 RAY, R.
 3782
 RAYBAUD, CL.
 1221*
 REAGAN, J.W.
 1887
 REARDON, M.A.
 4917*
 REBINOWITZ, Z.
 4038
 RECTOR, W.D.
 959
 REDDY, C.R.R.M.
 820*, 2381*, 5191*, 5193*
 REDDY, J.
 5543*
 REDDY, J.K.
 2351, 2352
 REDDY, M.M.
 5527*
 REDDY, P.G.
 2381*, 5191*
 REDDY, P.S.
 3445*
 REDDY, R.
 2875
 REDDY, S.S.
 5193*

REDDY, T.V.
 1277*
 REDMON, L.
 4614
 REED, C.D.
 5250
 REED, D.J.
 664*
 REEDMAN, B.M.
 4635
 REEM, G.H.
 4907*
 REEN, D.J.
 3205
 REES, J.A.
 457, 3213
 REES, K.R.
 2183*
 REES, R.C.
 3904
 REES, R.J.W.
 6028*
 REESE, W.H., JR.
 33
 REEVES, A.L.
 2333
 REEVES, B.R.
 4980*
 REGAN, J.D.
 3316, 4496*, 4963*
 REGE, V.
 5337
 REGNARD, J.
 2261*
 REGNERY, D.C.
 1356*, 1425*
 REHBEIN, F.
 5449
 REHDE, H.
 6103*
 REHFELD, C.E.
 1104
 REHN, M.
 1691*, 1928
 REICH, E.
 139*, 1342
 REICH, T.
 6098*
 REICHARD, P.
 726
 REICHARDT, W.
 6383*
 REICHEL, W.
 6103*
 REID, T.W.
 1984
 REID, W.D.
 2369*
 REIOBORD, H.E.
 192*
 REIDER, C.
 2707*

REIFENBERG, U.
 1863*
 REIJNIERSE, K.
 3024*
 REILLY, C.A., JR.
 2484, 4515
 REILLY, C.J.
 2246*
 REINA, A.
 3567*
 REINER, E.
 5537*
 REINER, J.
 1817
 REINGOLD, I.M.
 4231*
 REINHARD, M.
 1912*, 3580*
 REINHOLD, A.W.
 4827*
 REIS, H.E.
 1, 3222*, 5761*, 6040*
 REISS, J.
 373*
 REISS, W.
 2406*
 REITER, E.O.
 2148*
 REITSEMA, J.
 388*
 REITZ, M.
 5921
 REITZ, M.S.
 3790, 5906
 REIZENSTEIN, P.
 4783
 REJMANOWSKI, T.
 5625*
 REJTHAR, A.
 5967, 6107*
 REMINGTON, J.S.
 1799, 3839, 4984*
 REMMELE, W.
 6136*
 RENGIER, H.C.
 3055
 RENKAWEK, K.
 4055*
 RENNER, E.D.
 4900*
 RENNKE, H.
 3017*
 RENDIRTE, A.M.
 202
 RENZI, G.
 1907*
 RETTIG, P.G.
 6007*
 REUBER, M.D.
 48, 64, 939, 1949, 2717,
 2967
 REUSS, A.

1160*
 REVA, C.
 6164*
 REVANKAR, S.N.
 3474*
 REVILLARD, J.-P.
 2660*
 REY, J.M.
 5397*
 REYMOND, R.D.
 5542*
 REYNES, M.
 2303, 3664
 REYNOLDS, R.D.
 4072*
 REYNOLDS, R.K.
 4535, 5935*
 REYNOLDS, S.A.
 4966*
 REYNOSO, G.
 3846, 4737*, 5992*
 REZNIKOFF, C.
 5879
 RHEINS, M.S.
 6308*
 RHIM, J.S.
 2315, 2508, 3703, 3756,
 3902, 4537
 RHOADES, J.W.
 2372*, 2954, 2955
 RHOADS, A.R.
 6114
 RIBACCHI, R.
 1712, 2238*, 4371, 5389*
 RIBI, E.E.
 3877
 RICCARDO, D.
 1011
 RICCI, M.
 2290*
 RICE, B.F.
 1140*, 1177*
 RICE, F.A.H.
 1180*
 RICE, J.M.
 3001, 4444
 RICH, M.A.
 1331, 4645
 RICHARD, J.L.
 3649
 RICHARD, M.H.
 2562*, 5241
 RICHARDS, F.F.
 2664*, 3532*
 RICHARDS, J.F.
 1437
 RICHARDS, S.H.
 532*
 RICHARDSON, H.L.
 4379
 RICHARDSON, L.S.
 3755

RICHARDSON, M.E.
 4379
 RICHARDSON, S.G.
 6339*
 RICHART, R.M.
 785, 1462*, 3413*, 3543*,
 3962*, 4233*
 RICHERT, N.J.
 422, 3771
 RICHES, A.C.
 463, 4772*
 RICHETTA, E.
 2121*
 RICHMAN, A.V.
 3178, 4724*
 RICHMOND, C.R.
 997*
 RICHTER, C.B.
 3947, 5113, 5245
 RICHTER, G.W.
 2446*
 RICHTER, R.
 1796, 2619
 RICK, K.
 2036*
 RICKARD, K.A.
 4325*
 RIDDLE, P.
 5964
 RIDLEY, A.
 2623
 RIECHE, K.
 375*
 RIECHERS, L.
 3102
 RIEGER, F.
 6181*
 RIEPER, J.P.
 3347*
 RIESCO, A.
 2066*
 RIEU, D.
 5397*
 RIFKIN, D.B.
 139*, 1342, 1747, 5917
 RIGBY, P.G.
 1126, 3836
 RIGGS, J.L.
 696, 4608*
 RIGGS, O.E.
 2766
 RILEY, W.D.
 1904*
 RILL, A.
 5380*
 RIMAI, L.
 3154*
 RIMINGTON, J.
 381*
 RINDLER, R.
 5190*
 RINGELMANN, W.

347, 1560
 RINGERTZ, N.
 6082
 RINGERTZ, N.R.
 1808
 RIOPELLE, J.L.
 3019*
 RIOS, A.
 2968, 3199, 4682, 5993*
 RIOU, G.
 3117
 RIOULT, J.
 3414*
 RIPPAULT, J.
 900*
 RIPPS, C.S.
 1850*
 RISCIBIETH, R.H.
 4777*
 RISSMAN, E.
 4958*
 RITCHIE, A.C.
 53
 RITTER, R.I.
 416
 RITZ, R.G.
 5712
 RITZMANN, S.E.
 1683*
 RIVADENEYRA, J.
 6273*
 RIVASI, F.
 6266*
 RIVASI, P.
 6266*
 RIVERA, E.M.
 2306
 RIVERA, G.
 2049*
 RIVIERE, D.
 1199*
 RIVOSECCHI, P.
 2699*
 RO-CHOI, T.S.
 2875
 ROBB, J.A.
 4526, 4542
 ROBBERTSON, D.
 1124
 ROBBINS, G.F.
 4236*
 ROBBINS, P.W.
 3796
 ROBERT, J.-M.
 2072*
 ROBERT, J.M.
 6142*
 ROBERT, M.
 5921
 ROBERT-VAGUE, D.
 1512
 ROBERTS, E.

5455	4964*	ROLLAND, J.M.
ROBERTS, I.M.	RODE, H.N.	1867*, 1868*
937	2170*	ROLOFF, J.N.
ROBERTS, J.D.	RODE, I.	1910*
6089*	522*	ROLOVIC, Z.
ROBERTS, J.D.B.	RODERMUND, O.E.	2044*
5097	232	ROMANENKO, A.M.
ROBERTS, J.J.	RODEY, G.E.	1465*, 6245*
2353, 4397	3837	ROMEN, W.
ROBERTS, M.	RODKINA, R.A.	4472*, 5856*
2046*	6219*	ROMIEU, C.
ROBERTS, P.F.	RODO, J.E.	5961
6316*	6360*	RONA, E.
ROBERTSON, M.A.	RODRIGUEZ, A.R.	3443*
2755, 2756, 2759	2808*	RONDIER, J.
ROBERTSON, M.G.	RODRIGUEZ LOECHEZ FERNANDEZ,	4136*
858*	J.4142*	RONGEY, R.W.
ROBERTSON, M.R.	RODRIGUEZ-TRUJILLO, F.	684, 695, 1002, 2495
2642	6297*	RONICHEVSKAYA, G.M.
ROBIN, J.	RODRIGUEZ, V.	2838
5281*	3384*, 5360	RONQUIST, G.
ROBIN, M.S.	ROE, F.J.C.	1442
3745	38, 958, 3680, 5021, 5773	ROOD, J.J. VAN
ROBINETTE, J.	ROEHER, H.D.	1789
538	4045	ROOME, A.P.
ROBINS, A.B.	ROEHL, L.	4063*
4168*	979*, 6168*	ROOS, B.
ROBINSON, A.	ROELCKE, D.	285*
3232	174*	ROOT, R.K.
ROBINSON, H.L.	ROEPCKE, G.	6321*
1326	2950	ROSAI, J.
ROBINSON, J.A.	ROESSMANN, U.	3521*, 3525*, 4743*, 4932*,
836	5560*	4990*, 5575*, 5576*
ROBINSON, J.C.	ROGACHEVA, V.S.	ROSAS-URIBE, A.
6309*	1609*	3356*, 4052*
ROBINSON, M.J.	ROENTINE, G.N.	ROSATO, F.E.
4835*	3908	2898*
ROBINSON, W.A.	ROENTINE, G.N., JR.	ROSBASH, M.
1106, 5373*, 5493*	3183, 3861	4967*
ROBINSON, W.S.	ROGERS, A.E.	ROSE, D.P.
1326	1558	4920*
ROBL, M.G.	ROGERS, J.	ROSE, I.A.
5237	5663*	5547*
ROBLIN, R.	ROGERS, N.G.	ROSE, N.R.
1033	731*	1815
ROCA, M.	ROGERS, Q.R.	ROSEN, O.M.
6337*	3046	1459*
ROCCHI, P.	ROGG, H.	ROSEN, P.
1261	5146	302
ROCHE, J.	ROHATGI, V.K.	ROSEN, V.J.
1199*	566*	4491
ROCHEMAURE, J.	ROHDE, L.	ROSENAU, W.
5817*	2383*	6127
ROCHON, M.	ROHRBACH, R.	ROSENBERG, E.B.
919*	5120, 5763	4643, 4674, 5325
ROCKERT, H.	ROIZMAN, B.	ROSENBERG, G.L.
6174*	1206, 1365*, 3050, 3821,	4581*
ROCKEY, J.H.	4548	ROSENBERG, R.N.
4753*	ROKICKI, W.	5558*
ROCKEY, J.M.	333*	ROSENBERG, S.A.
178*	ROLAND, A.	2162*, 2880, 3183
ROCKWELL, S.C.	5325, 5402	ROSENBERGOVA, M.

2502	6348*	ROZANOVA, L.M.
ROSENBLATT, L.S.	ROTA, A.N.	561*
1686*	2473*	ROZE, C.
ROSENBLUM, W.I.	ROTH, D.	1275*
4911*	379*	ROZENSTRAUCH, L.S.
ROSENCRANTZ, M.	ROTH, D.G.	4256*
285*	4239*	ROZGA, B.
ROSENFELD, C.	ROTH, F.K.	2462*
3537*, 4041	175*, 455	RUBENSTEIN, A.B.
ROSENGREN, A.M.	ROTH, J.	505*
1196*	4080*, 4272*	RUBERTI, R.F.
ROSENGREN, B.	ROTH, J.A.	4953*
285*	3994	RUBETSKOI, L.S.
ROSENGREN, E.	ROTH, K.	3000, 3554*
1196*	5866	RUBIES PRAT, J.
ROSENKRANZ, H.S.	ROTH, L.J.	4978*
590*	951	RUBIN, A.D.
ROSENQUIST, H.	ROTHENBERG, S.P.	1994, 5958
2291*	888*, 4969*	RUBIN, H.
ROSENSTEIN, R.W.	ROTHERHAM, J.	1412, 3128, 4558
2664*, 3532*	553	RUBIN, L.R.
ROSENSTOCK, J.G.	ROUESSE, J.	102
1100	3556*, 6195*	RUBIN, P.
ROSENTHAL, J.	ROUGET, P.	1680*, 4356*
1810	1772*	RUBINSTEIN, L.J.
ROSENTHAL, L.J.	ROUHANDEH, H.	3603, 4498*
1705	145*, 1347	RUBIO, C.
ROSENTHAL, P.N.	ROUJEAU, J.	2080*
1326	4295*	RUBNITZ, M.E.
ROSENTHAL, S.R.	ROUNDS, D.E.	6029*
2213, 6007*	5696*	RUBTSOVA, G.V.
ROSENTHAL, W.S.	ROUSE, B.T.	4840
4451*	4667	RUBTSOVA, YE.D.
ROSNER, F.	ROUSSEAU, G.G.	487*
5668*	6127	RUCKES, J.
ROSS, A.E.	ROVENSKY, Y.A.	2153*
946, 3708	2825	RUDALI, G.
ROSS, E.J.	ROVERA, G.	340, 4390
4319	1884, 5535*	RUDD, F.V.
ROSS, E.M.	ROW, F.J.C.	6321*
6338*	2797*	RUDDERS, R.A.
ROSS, J.	ROWBOTHAM, H.D.	4061*
3867, 5950*	292*	RUDDON, R.W.
ROSS, W.	ROWE, W.P.	1280*, 3999
5855*, 5856*	407, 408, 1018, 1329, 1711,	RUDIKOFF, S.
ROSS, W.B.	1735, 5258	6021*
644	ROWINSKI, J.	RUDMAN, D.
ROSS, W.C.J.	591*	646*, 5511*
958	ROWLAND, G.	RUDNEVA, I.A.
ROSSEN, E.	2629	3753
2421*	ROWLAND, G.F.	RUDNICKI, T.
ROSSI, G.B.	758, 760, 782*	1677*
2665*	ROWSON, K.E.K.	RUDOBIELSKA, M.
ROSSI, H.H.	3082	5427*
3029	ROY-BURMAN, P.	RUDOLPH, E.
ROSSI, R.	149*, 5247	4730*
5444, 5669*	ROY, R.	RUDOLPH, H.
ROSSMEISL, D.	233	4045
6399*	ROY, S.C.	RUDOLPH, R.H.
ROSSUM, G.D.V. VAN	4229*	776*, 3172
3423*	ROYSTER, H.P.	RUECKERT, R.R.
ROSZEL, J.F.	1507	5907

RUEGSEGGER, C.H.
1166*

RUEHL, H.
3917*

RUEMKE, P.
2710*

RUETTNER, J.R.
5902

RUFFOLO, E.H.
1093*

RUGSTAD, H.E.
3296, 6334*

RUHL, E.
2126*

RUIPEREZ POLO, S.
6249*

RUIZ, F.
2177*

RUMACK, B.
4659

RUMI, L.
1803, 3299

RUMMEL, H.H.
2740*

RUMMEL, W.
1160*

RUNDALL, T.
1024

RUNOVA, Y.N.
1289*

RUOSLAHTI, E.
4627, 4637

RUPP, W.D.
2453

RUPRECHT, R.
1343

RUSCIANI, L.
1897*

RUSH, E.A.
890*

RUSK, H.S.
1214*

RUSSELL, A.S.
3023*

RUSSELL, B.R.
90*, 5137

RUSSELL, E.
5952*

RUSSELL, I.S.
6342*

RUSSFIELD, A.B.
2925

RUSSO, G.
1350

RUSTEN, G.W.
3669

RUSTIA, M.
2999

RUTLEDGE, F.D.
2770

RUTLEDGE, F.N.
1401, 5483*

RUTMAN, J.Z.
1297*

RUTMAN, R.J.
2503

RUTTNER, J.R.
3780

RUVIDIC, R.
2044*

RYAN, J.P.
2158*

RYAN, W.L.
856

RYAZANOVA, L.G.
6239*

RYAZANTSEVA, I.N.
6351*

RYBA, M.
1775*

RYBAKOVA, L.I.
5090

RYBAKOVA, T.M.
3167

RYDELIUS, P.A.
567*

RYDELL, R.E.
4430

RYGAARD, J.
5617*

RYSER, H.J.P.
918*

RYTTER, M.
3559*

RYMLIN, A.M.
4961*

RZECZYCKI, W.
859*, 3471*

RZEHA, K.
5551*

SA, H.H.
6363*

SAAL, F.
3733*

SABBADINI, E.
3922*

SABBATH, M.
140*, 1567

SABEL, M.
1639*

SABHARWAL, P.S.
383*

SABINE, J.R.
2963, 4782

SABINE, M.C.
475, 4624

SACERDOTE, A.
5998*

SACHAR, D.
2511

SACHATELLO, C.
4230*

SACHATELLO, C.R.
791*

SACHNAZAROV, N.
3830*

SACHS, H.
788, 2793*, 5038*

SACHS, L.
2002, 2337, 2735*, 2844,
2879, 3045, 3683, 3938,
4038, 4613, 5222, 5627*,
5808

SACK, H.
6400*

SACKMANN MURIEL, F.
4545

SADIKALI, F.
3166, 4882*

SADOFF, L.
2907, 5736*

SADRI, S.
1449*

SAEGESSER, F.
1482*, 2744*, 3411*, 5563*

SAEKI, H.
4012

SAEZ, S.
1978, 4971*

SAFAIE-SHIRAZI, S.
5461*

SAFFER, E.A.
3859

SAFFIOTTI, U.
2312, 3685, 4394, 4437,
5176

SAFFORD, J.W.
2690*

SAFRANY, L.
1155*

SAHIAR, B.E.
4407

SAIM, A.
3365*

SAINEROVA, H.
5889

SAINI, N.
1690*

SAINT CYR, C. DE V.
740*

SAINT-RUF, G.
2438*

SAIRENJI, T.
1010, 2609

SAITO, H.
586*, 1321

SAITO, K.
3455*

SAITO, M.
2354, 5545*

SAITO, T.
2884*

SAKAI, H.
1683*

SAKAI, K.
2982

SAKAI, S.	SALVATI, A.	SANI, B.
2716	810	5102
SAKAI, T.	SALVATORES, D.	SANKALE, M.
4594*, 6215*	6156*	5, 6, 825*, 3157, 3993,
SAKAKI, T.	SALWA, J.	6000*
2443*	1796, 2619, 5378*, 5840*	SANOU, A.
SAKAKURA, T.	SALZBERG, S.	2796*, 3280*
2700*	3748, 4547	SANPE, T.
SAKAMOTO, A.	SALZER, G.	1049
3465*	1236*	SANT, M.V.
SAKASHITA, T.	SALZMAN, N.P.	898*
1398	5231	SANTAGATI, G.
SAKATOKU, J.	SAMAMA, M.	1902*
1426*	6164*	SANTAMARIA GARCIA, J.L.
SAKIYAMA, H.	SAMI, B.P.	6249*
2559, 3796	5807	SANTAMARIA, L.
SAKSELA, E.	SAMOILOVICH, L.N.	2314, 2390*
568*, 4627, 4797*	1602	SANTANDER, S.
SAKUMA, A.	SAMPLE, W.F.	5659*
949	454, 1041	SANTESSON, L.
SAKUMA, F.	SAMSO, A.	3876
4453*	3079	SANTIAGO, H.
SAKURADA, T.	SAN, R.H.C.	5628*, 6155*
3431*	1596	SANTOKI, O.
SAKURAI, Y.	SANCHEZ, C.	2897*
1628*, 2583*, 6006*	2804*	SANTOKI, Y.
SAKURANE, H.	SANCHEZ-CASIS, G.	2897*
5678*	880*	SANTORO, A.
SALA, J.M.	SANCHEZ GARRIDO, F.	5496*
1954	5596*	SANTORO, A.S.
SALA, L.	SANCHEZ, R.	2830
4288*	4145*	SANTOS, A.
SALAMAN, M.H.	SANCHEZ, S.R.	6146*
1801	2807*	SANTOS, G.W.
SALAN-MARTINEZ, M.	SANCHO, H.	5304
2005	3344*, 3421*	SANTOTO, A.S.
SALAZAR, H.	SANDAKATA, K.	5987*
2110*	2075*	SANTTI, R.S.S.
SALDITT, G.	SANDBERG, A.A.	2926
6218*	399, 541, 1475*	SANY, J.
SALERNO, R.A.	SANDER, J.	2053*
2500, 3848, 5149	517*, 1608*, 2426*, 5188*,	SANZ ESPONERA, J.
SALIH, H.	5852*	144*, 4284*
5129	SANDERS, B.G.	SANZHAROVSKAYA, N.K.
SALIM, M.	3941	4296*
4015	SANDERS, D.	SAPOROSCHETZ, I.B.
SALINAS, F.A.	3607	71, 352, 378*
5388*	SANDERS, F.K.	SAPOZHNIKOVA, M.A.
SALISACHS, L.	22*, 5256	2479*
5442	SANDIFER, S.H.	SAPP, J.P.
SALM, R.	1420*	5405*
4196*	SANDRITTER, W.	SAPRIN, A.N.
SALMASO, E.	5120	5874*
1943*	SANFORD, B.H.	SARAL, R.
SALMEEN, I.	746	4596*
3154*	SANFORD, K.K.	SARAN, H.S.
SALMON, H.	2724*, 4976*, 4977*, 5265,	870*
1871*	5430	SARFATY, G.
SALMON, S.E.	SANFORD, R.S.	1616*
516	3333*	SARGENT, F.T.
SALSBURY, A.J.	SANGHVI, L.D.	2899*
6028*	3290*	SARIN, P.S.

688
 SARINANA, C.
 2005
 SARKAR, N.H.
 1026, 1325, 1501, 1695,
 1726, 3049, 3116, 3144,
 4850
 SARKAR, S.
 4615
 SARMA, P.S.
 123, 308, 1014, 1328, 1734,
 2495, 3098, 4524, 4550,
 5886
 SARONWALA, K.C.
 763
 SARRAZIN, D.
 6195*
 SARTWELL, P.E.
 1922
 SASAKI, M.
 1410
 SASAKI, T.
 838
 SASSE, D.
 3580*
 SASSON, Z.B.
 3112
 SASTRY, G.A.
 5527*
 SATO, E.
 4292*
 SATO, G.
 1791
 SATO, G.H.
 4913*
 SATO, H.
 1168*, 2861, 4721*, 5336,
 5489*
 SATO, J.
 1269
 SATO, K.
 2448*, 5339, 5490*
 SATO, M.
 1983
 SATO, S.
 4095*, 4211*, 5545*, 5556*
 SATO, T.
 412, 949, 1366*, 2355, 3142,
 5944*
 SATOH, H.
 3320, 4923*, 4924*, 4968*
 SATOH, S.
 5366*, 5971
 SATOH, T.
 4395
 SAUER, G.
 428, 3038, 5269, 5753*,
 5757*
 SAUER, H.
 5428*
 SAUER, Z.
 6230*

SAUGER, F.
 290*
 SAUL, G.
 5764
 SAUNDERS, E.F.
 4026
 SAUNDERS, F.C.
 5150
 SAUNDERS, G.F.
 6375*
 SAURO, F.M.
 4379
 SAUTIERE, P.
 3348*
 SAUTTER, C.
 2774*
 SAVA, G.
 258*
 SAVAGE, E.W.
 4331*
 SAVEL, H.
 548
 SAVENKO, M.I.
 3554*
 SAVET, J.-F.
 2225*, 3558*
 SAVIC, B.
 3583*, 4152*
 SAVICH, K.V.
 3591*
 SAVITSKY, I.G.
 3574*
 SAVLOV, E.D.
 5513*
 SAVOST'YANOV, G.A.
 4528
 SAVULESCU, A.
 1548
 SAWADA, H.
 4194*, 4198*
 SAWICKI, W.
 165, 591*, 1753
 SAWITSKY, A.
 2860, 5668*
 SAXENA, B.B.
 1486*
 SAXENA, H.
 566*
 SAXINGER, W.C.
 5921
 SAY, B.
 1139*
 SCALA, R.A.
 2404*
 SCALES, R.W.
 4668
 SCAPOLI, G.L.
 4275*
 SCARAVILLI, F.
 6229*
 SCARPA, A.
 1487*

SCARPA, C.
 1906*
 SCELSI, R.
 2970
 SCERBOVA, E.N.
 1672*
 SCHABORT, J.C.
 43, 346, 1254
 SCHACHENMAYR, W.
 283*
 SCHACHTSCHABEL, D.
 5552*
 SCHACHTSCHABEL, D.O.
 4082*, 4901*, 5619*
 SCHADE, R.O.K.
 4269*
 SCHADE, G.
 4765*
 SCHAEFER, A.E.
 4186*
 SCHAEFER, W.
 2487, 4521
 SCHAEFFER, B.T.
 1797
 SCHAFFER, H.
 283*
 SCHAFFER, J.A.
 3432*
 SCHAFFER, W.
 5004
 SCHAFF, Z.
 6291*
 SCHAFF, ZS.
 1155*
 SCHAFFER, P.A.
 1360*
 SCHAISON, G.
 4176*, 5747*
 SCHAJOVICZ, F.
 - 5649*
 SCHAKI, R.
 3683
 SCHALLER, J.
 3066
 SCHALLER, J.P.
 5267
 SCHALTEGGER, H.
 4441
 SCHANDL, E.K.
 3406*
 SCHANTZ, A.
 4934*
 SCHAPIRA, F.
 1949, 5716
 SCHAPIRA, G.
 2175*
 SCHAPPERT-KIMMIJSER, J.
 2760
 SCHARFF, M.D.
 180*, 1806, 3844, 4705*
 SCHATZKI, P.F.
 894*, 2106*

SCHAUENSTEIN, E.
5190*

SCHAUER, A.
6072*

SCHECHTER, J.
5528*

SCHECHTER, P.J.
951

SCHEELE, C.M.
3743

SCHEER, D.I.
1726

SCH EINBERG, M.A.
5568*

SCH ELER, W.
661*

SCH EN, R.J.
4720*

SCH ENDEL, P.F.
3073

SCH ENKEN, J.R.
4059*

SCH ER, C.D.
720, 1755, 2867, 4526

SCH ER, W.
412

SCH ERER, E.
356, 3715*

SCH ERER, M.
6025*

SCH ERF, H.R.
5294

SCH ERER, K.
1991, 2189*, 2560

SCH ERSTEN, T.
2101*, 4930*

SCH EURL EN, H.
254

SCH EURL EN, P.G.
2204, 6050*

SCH EVING, L.E.
4863

SCH IDLOVSKY, G.
2546

SCH IFFER, D.
2121*, 3014*, 3376*, 4459*

SCH IFFER, L.M.
1105, 1397, 4013

SCH IFFER, M.A.
5482*

SCH IFFER, Z.
4446

SCH ILLER, A.L.
4061*

SCH IMMER, B.P.
2164*, 6119

SCH IMPFF, S.
4659

SCH INDEL, J.
3728

SCH INDLER, R.
1471*, 5190*

SCH ININA, E.
810

SCH INK, W.
3256

SCH IODT, T.
184

SCH LABACH, A.
680

SCH LEGEL, W.
6349*

SCH LIENGER, S.
5408*

SCH LITTER, H.E.
2231*

SCH LOM, J.
1696, 2489, 3774, 3804

SCH LOSS, G.T.
4504

SCH LOTE, W.
1912*

SCH MAEHL, D.
1615*, 2250*, 2272*, 3020*

SCH MAHL, D.
3281*

SCH MALZL, F.
255*, 574*, 912*, 3507*,
4153*

SCH MAUZ, R.
211*, 4818

SCH MELZ, U.O.
3969

SCH MID, F.A.
4008

SCH MIDT, C.G.
3222*, 6040*, 6044*, 6384*

SCH MIDT, C.O.
2082*

SCH MIDT, J.D.
3990

SCH MIDT, R.
2384*

SCH MIDT-RUPPIN, K.H.
5079

SCH MIDT, W.C.
283*

SCH MITT, W.
2151*

SCH MITZ, A.
2195*

SCH MITZ, H.
6025*

SCH MITZ-MOORMANN, P.
5401

SCH MITZ, R.
4129*

SCH MOECKEL, C.
1157*

SCH NEEWEISS, U.
2131*

SCH NEIDER, B.
4

SCH NEIDER, F.

3428*

SCH NEIDER, G.
1185*, 2039*

SCH NEIDER, J.
5111, 5118, 5830*

SCH NEIDER, J.A.
242

SCH NEIDER, M.
480

SCH NEIDER, R.
4827*, 5706

SCH NEIDERBAUR, A.
5070*

SCH NEIDERMAN, M.A.
4301

SCH NEIWEIS, K.E.
1719

SCH NEWEIS, K.E.
1223*, 5980*

SCH NIEDERS, B.
371*

SCH NYDER, U.W.
1136*

SCH OCHET, S.S.
6204*

SCH OCHET, S.S., JR.
5694*

SCH OECH, G.
3986

SCH OENAUER, M.
6191*

SCH OENBERG, B.S.
206

SCH OENENBERGER, H.
2431*

SCH OENHERR, W.
862*

SCH OENTAL, R.
1542

SCH OFIELD, G.B.
2466*

SCH OLES, V.E.
4939*

SCH OLLE, H.
3917*

SCH OLTZE, P.
5118, 5178

SCH OLZE, P.
5073

SCH OMERUS, P.
2082*

SCH ONBERG, M.
1318

SCH ORR, I.
239, 1486*, 4853

SCH ORR, W.F.
5665*

SCH OTT, G.
923*

SCH OTTENFELD, D.
5646*, 6355*

SCH OTZ, W.

5424
 SCHRAMM, T.
 991*, 5005, 5885, 5931*
 SCHRAMM-THIEL, N.
 3444*
 SCHRANTZ, J.L.
 2468*
 SCHREIBER, D.
 5111, 5118, 5178, 5765,
 5767, 5830*
 SCHREIBER, G.
 5512*, 6179*
 SCHREIBER, H.
 3405*, 4404, 5113
 SCHREIBER, M.
 6179*
 SCHREIBER, M.M.
 213*
 SCHREK, R.
 556*, 3339*
 SCHRENK, K.-H.
 4141*
 SCHRIER, S.L.
 1664
 SCHRIJVER, F. DE
 3517*
 SCHRODER, A.
 202
 SCHRODER, R.
 5452
 SCHROEDER, J.
 4869
 SCHROEDER, M.
 5072
 SCHROEDER, T.M.
 5023
 SCHROHENLOHER, R.E.
 5991*
 SCHUBERT, D.
 881*, 2725*
 SCHUBERT, G.
 4282*
 SCHUBERT, G.E.
 6234*
 SCHUBERT, I.
 5857*
 SCHUELLER, E.F.
 4837*
 SCHULER, D.
 2294*, 3417*
 SCHULLER, P.L.
 2230*
 SCHULTE-HOLTHAUSEN, H.
 5225, 5908
 SCHULTZ, E.F.
 3070
 SCHULZ, D.
 3583*, 4152*
 SCHULZ, J.
 1170*
 SCHULZ, M.D.
 4933*

SCHULZ, U.
 1084
 SCHUMACHER, H.R.
 2841, 3449*
 SCHUMAN, B.M.
 4891*
 SCHUMAN, L.
 3968
 SCHUR, P.H.
 759
 SCHWAAB, G.
 4138*
 SCHWARTZ, J.
 1004
 SCHWARTZ, R.S.
 2515, 4628, 5745*
 SCHWARZ, R.
 2010, 4240*
 SCHWEISGUTH, O.
 551, 5598*
 SCHWEIZER, K.
 2938, 3220*
 SCHWEIZER, R.T.
 4276*
 SCHWEPPE, J.S.
 4375
 SCHWERING, H.
 6384*
 SCHYRA, B.
 2736*
 SCIARRA, D.
 6178*
 SCOLNICK, E.M.
 450, 2498, 3096, 3867, 4523,
 5232, 5257, 5358, 5970
 SCOPPA, P.
 989*, 990*
 SCORNIC, J.C.
 4049*
 SCORNIK, J.C.
 1464*
 SCOTT, B.S.
 2547
 SCOTT, D.F.
 4072*, 4178*, 4271*
 SCOTT, J.F.
 3788
 SCOTT, M.T.
 6015*
 SCOTT, W.A.
 6186*
 SCOTTI, T.M.
 4544
 SCURO, S.
 2726*
 SEALY, R.
 3523*, 5577*
 SEAMAN, E.
 2136*
 SEARLE, C.E.
 2207
 SEBBA, F.

5734*
 SECK, I.
 3157, 6000*
 SEDAGHATIAN, M.R.
 3387*
 SEDGWICK, J.A.
 1245
 SEEBER, S.
 5529*, 6379*
 SEEGER, R.C.
 4744*
 SEGAL, A.
 1541, 5072
 SEGAL, D.M.
 6021*
 SEGALL, A.
 3214
 SEGI, M.
 5416
 SEHON, A.
 2638
 SEHON, A.H.
 3922*
 SEIBERT, F.B.
 5479*
 SEIBERT, R.A.
 1580
 SEIDEL, H.
 2036*
 SEIDEL, H.J.
 411
 SEIDEL, H.-J.
 3145*
 SEIDEL, H.J.
 5203
 SEIDL, F.
 778*
 SEIDLER, E.
 1590
 SEIDMAN, H.
 1942*, 3262
 SEIDMAN, I.
 3647
 SEIDO, T.
 4693, 5526*
 SEIFERT, G.
 539, 4129*
 SEIFERTOVA, M.
 4466*
 SEILER, P.
 436
 SEKI, S.
 2016
 SEKIGAWA, H.
 4281*
 SEKINE, T.
 1052
 SEKIYA, S.
 691, 1597, 1736, 5086,
 5948*
 SEKIYA, T.
 3089

SEKIZUKA, H.
2104*, 2669*
SEKKAT, A.
3174
SELEZNEV, YE.K.
1890
SELIGMAN, M.
171*
SELIGMANN, M.
1873*, 3900, 4176*, 4716*,
5311
SELIKOFF, I.J.
3601
SELIVANOV, A.A.
2577*, 3826*
SELJELID, R.
1419
SELKIRK, J.K.
2304, 3709, 4424, 4445,
5774
SELL, S.
935, 1117, 5561*
SELLAKUMAR, A.
2940
SELLAKUMAR, A.R.
2312, 5176
SELLERS, L.
2174*
SELTZER, M.H.
2898*
SELYE, H.
5194*
SELZER, G.
3523*, 5577*, 6198*
SEMAN, G.
1692, 1802
SEMENCHUK, D.D.
496*
SEMENKOV, V.F.
1080*
SEMEKOVA, L.A.
3090
SEMJOVA, L.A.
5887
SEMKOW, R.
1019
SEN, L.
2202
SENDO, F.
257Q*, 4505
SENDON, B.
2910
SENELAR, R.
5397*
SENGHOR, G.
823*
SENITZ, D.
6180*
SENO, S.
3094
SENOK, H.
5312

SEPPALA, M.
4627, 4637
SERCARZ, E.E.
1837
SERFATY, D.
6224*
SERGEL, O.S.
3221*
SERGEVIN, V.V.
5602*
SERKOVSKOYA, G.S.
2388*
SEROR, J.
258*
SERPICK, A.
4659
SERRE, A.
5397*
SERRE, H.
2053*
SERRES, F.J. DE
2401*, 2445*
SERROU, B.
5961
SETHI, S.
3586*
SETLOW, J.K.
1540, 3657
SETLOW, R.B.
4496*
SEWALL, W.
4934*
SEYAMA, Y.
1044
SEYTES, I.F.
561*
SEZZI, M.L.
172*
SFORZA, C.
3470*
SFORZA, M.
1943*
SGIBNEV, A.K.
5106
SGIBNEVA, O.V.
6237*
SGIBNEVA, O.W.
4078*
SHAAR, C.J.
2929, 4455*
SHABAD, L.M.
1576, 1603*, 2388*, 2441*,
2450*, 2995, 3000, 3011,
3015*, 3652, 3719*, 5766
SHADDUCK, J.A.
3066
SHADDUCK, R.K.
1453*, 2140*
SHAFER, R.B.
887*
SHAH, I.C.
1303, 3736*

SHAH, J.P.
5654*
SHAH, K.V.
1039*, 3034, 3054, 3612
SHAH, N.K.
4230*
SHAH, S.A.
2971, 3674, 4480*, 5122
SHAKULOV, R.C.
1494*
SHAKULOV, R.S.
5440
SHALL, S.
3434*
SHAMAYEVA, E.M.
6272*
SHAMAYEVA, YE.M.
3597*
SHAMBERGER, R.J.
638, 3245*, 4092*
SHAMMA, M.H.
2753
SHAMMUGARATNAM, T.
6082
SHANI, M.
1919, 5222
SHANK, R.C.
1276*, 1613*, 2767, 2768,
3008, 4418
SHANMUGAM, G.
5347
SHANMUGARATNAM, K.
809, 2748, 4683
SHANNON, W.M.
732*
SHAPIRA, Y.
4098*
SHAPIRO, A.M.
3916*
SHAPIRO, H.M.
3933*
SHAPIRO, S.
261*
SHAPIRO, S.I.
213*
SHAPOSHNIKOV, D.
2128*
SHAPOT, V.S.
1466*, 4845, 6182*
SHARGEL, L.
1627*
SHARMA, B.K.
2113*
SHARMA, J.M.
786, 3761, 5282*
SHARMA, R.K.
3531*, 4071*
SHARON, N.
99, 5778
SHAROUKHOVA, K.S.
5501*
SHAROVSKAYA, JU.JU.

5834*	2309, 2317	1335, 2529
SHARP, E.A.	SHEN, M.-F.	SHIMOSATO, Y.
208	3926*	1293*, 4811, 5526*
SHARP, P.A.	SHEPPARD, J.R.	SHIN, H.S.
4546	433, 439, 2843, 4916*	3182
SHARPINGTON, C.	SHERBET, G.V.	SHINGLETON, W.W.
523*, 4167*, 6336*	2894*	2833
SHATALOVA, G.G.	SHERIDAN, J.D.	SHINKAI, K.
5887	1985	4942*
SHATKIN, A.J.	SHERMAN, D.	SHINOZUKA, H.
3105	1454*	363
SHATTON, J.B.	SHERWOOD, L.M.	SHIOIRI-NAKANO, K.
5538*	596*	2684*
SHAW, C.R.	SHETH, N.A.	SHIOKAWA, Y.
5121	793*	3223*
SHAW, D.S.	SHETTY, T.K.	SHIOTSUKA, R.N.
937	341	4863
SHAW, J.D.	SHEVACH, E.	SHIPKEY, F.H.
532*	3179, 3184	3948
SHAYDROV, V.V.	SHEVACH, E.M.	SHIPLEY, W.U.
487*	2835	5864
SHAYN, A.A.	SHEVCHENKO, N.G.	SHIPMAN, C. JR.
1925, 2659*	3418*	2476*
SHBAKLU, Z.	SHEVELEV, A.S.	SHIPMAN, C., JR.
2775*	1080*	3754
SHCHERBAK, N.P.	SHEVELEV, B.I.	SHIRAKAWA, S.
2450*	445*	1999
SHCHERBAKOVA, M.G.	SHIBUYA, C.	SHIRAKI, S.
3243*, 6190*	3707	1390
SHCHERBAKOVA, D.YE.	SHIELDS, R.	SHIRATO, E.
1285*	6186*	4701
SHCHERBINSKAYA, A.M.	SHIER, W.T.	SHIRLEY, R.L.
4396	1798	1414
SHCHERBYNS'KA, A.M.	SHIFRINE, M.	SHIRODKER, S.R.
5274	101	6043*
SHEAHAN, D.G.	SHIGEMATSU, H.	SHIROZU, H.
1839	3512*	2897*
SHEARER, R.W.	SHIGEMATSU, T.	SHISA, H.
4800*	1697, 5212	5168
SHEARER, W.T.	SHIKHODYROV, V.V.	SHISHKIN, S.S.
4751*	100	2182*
SHEARMAN, D.J.C.	SHILS, M.E.	SHIU, G.
248	1502	3835
SHEDD, D.P.	SHIMANO, M.	SHIVELY, J.N.
3395*	1997	4584*
SHEEHAN, R.	SHIMANOVSKAYA, K.B.	SHIVERS, B.R.
56	6149*	4668
SHEFER, S.S.	SHIMAOKA, K.	SHKLAR, G.
368*	1422*	56, 57
SHEIN, H.M.	SHIMIKIN, M.B.	SHKRABA, L.D.
1194*, 1750	2981	5274
SHEININ, R.	SHIMIZU, K.	SHKROB, O.S.
4587*	4211*	6189*
SHEKOLOOKIN, V.F.	SHIMIZU, M.	SHLYAKEVICH, M.A.
461	3707	5398
SHELBURNE, J.D.	SHIMIZU, T.	SHLYAKHOVENKO, V.O.
2064*	1402	5210
SHELDON, R.	SHIMIZU, Y.	SHMUNES, E.
1766*	3094	1961
SHELDON, S.	SHIMKIN, M.B.	SHOAF, W.T.
142*	377*, 4828*	2892*
SHELLABARGER, C.J.	SHIMOJO, H.	SHOEMAN, D.W.

- 3322*
SHOFF, W.H.
4750*
SHOHAM, J.
4613
SHOJI, K.
1355*, 4154*
SHOOTER, K.V.
5181
SHOPE, R.E.
3163
SHOPE, T.
3118
SHORE, B.
996*, 1820
SHOU-SIN SUNG, M.
5147
SHOYAB, M.
2085*, 4860
SHRAMEK, G.
5282*
SHUANGSHOTI, S.
1090*, 4959*
SHUBIK, P.
2940, 2999, 3690
SHUBIN, A.S.
2578*, 5927*
SHUBLADZE, A.K.
5289*
SHUSTER, J.
5972
SHUSTOVA, M.N.
1602
SHVARTSMAN, A.L.
5670*
SHVEDOVA, V.N.
572*
SHYAMALA, G.
4406
SIBAL, L.R.
5979
SICCARDI, F.J.
4672
SICILIANO, M.J.
5464*
SIDDHICHAJ, P.
3008
SIDDIQI, M.A.
2988
SIDOROV, K.A.
4107*
SIDRANSKY, H.
1586
SIEGEL, B.V.
4559
SIEGEL, M.
5843*
SIEGENTHALER, G.
5701
SIEGENTHALER, W.
5701
SIEGERT, W.
3068
SIEGFRIED, L.M.
2873
SIEGISMUND, G.
5955*
SIEGLER, R.
4794
SIERKO, S.
6213*
SIEVERS, B.-U.
4294*
SIGEL, M.M.
4531
SIGMAN, E.
2356
SIGNORELLI, C.
2096*
SIGURDSON, A.
2080*
SILBER, R.
447*
SILFVERSWAERD, C.
2720, 3546*
SILK, M.
2356
SILOBRICIC, V.
2588*
SILVA, A.J.
996*
SILVA, N.
3395*
SILVA SOSA, M.
924*, 1163*
SILVER, H.
2629
SILVERBERG, S.
598*
SILVERBERG, S.G.
2109*, 3393*, 4225*, 4927*,
5471*, 5475*
SILVERMAN, B.B.
2820
SILVERMAN, D.A.
1815
SILVERMAN, D.J.
2896*
SILVERMAN, N.A.
5554*
SILVERS, W.K.
.152
SILVERSTEIN, S.
1230*
SILVERSTEIN, S.C.
1318
SILVESTRE, D.
1403*
SILVESTRINI, B.
252, 641
SILVIA, G.
770
SILVIS, S.E.
193*
SILYANOVSKA, YE.
6159*
SIMAGA, D.
204, 2796*, 3280*
SIMAN-TOV, R.
5627*
SIMARSKI, J.
365*
SIMES, R.J.
5649*
SIMKOVIC, D.
689, 737*
SIMMONS, E.L.
2328, 4492
SIMMONS, R.L.
3199, 4682, 5993*
SIMMS, D.
2551
SIMMS, E.S.
4677
SIMON, K.
1857*, 5355
SIMON, L.
2053*
SIMON, L.N.
2022
SIMONE, J.V.
5666*
SIMONS, M.J.
3890, 4683, 5912
SIMONS, P.J.
122, 685, 730*, 4534
SIMONS, R.L.
2968
SIMONSEN, L.O.
1176*
SIMPSON, E.
1509, 2603
SIMPSON, J.S.
3493*
SIMPSON, M.J.C.
1102, 1103
SIMPSON, R.W.
1343
SIMS, H.L.
3764
SIMS, P.
62, 1260, 1533, 2304, 2984,
3709, 4445, 5774, 5841*
SIN, Y.M.
3922*
SINCLARI, N.R.ST.C.
3227*
SINGAL, D.P.
1804
SINGER, A.M.
6342*
SINGER, B.
2449*
SINGER, D.B.
3387*
SINGER, S.

1264
 SINGER, S.H.
 2811
 SINGER, S.J.
 2614, 4915*
 SINGER, Z.
 1796, 2619, 5378*
 SINGH, S.
 3888, 3942, 4623, 4685
 SINGH, S.B.
 2604
 SINGH, S.P.
 4876*
 SINHA, S.N.
 4955*
 SINKEY, J.R.
 818*
 SINKOVICS, J.G.
 1401, 4701
 SINKS, L.F.
 2150*, 4230*
 SINNATHURAY, T.A.
 1424*
 SINNHUBER, R.O.
 80*, 376*, 5827*
 SIOU, G.
 5027
 SIPERSTEIN, M.D.
 536, 1968
 SIRACKA, E.
 6369*
 SIRACKY, J.
 2863, 6369*
 SIRAGUSA, G.
 770
 SIRICA, A.E.
 829
 SIRISHINHA, S.
 3158
 SIRISINHA, S.
 4677
 SIRSAT, S.M.
 4299*
 SIRTORI, C.
 328*
 SISKEN, J.E.
 3458*, 5606*
 SISKIND, V.
 261*
 SISSONS, H.A.
 215*
 SIVAK, A.
 75, 2418*, 3002
 SJODIN, L.
 1605*
 SJOEGREN, H.O.
 453, 4612, 4649, 4671
 SJOGREN, H.O.
 723, 1828
 KACHKOV, A.P.
 5291
 KALBA, P.

3595*
 SKARIN, A.T.
 3233
 SKINNER, G.R.B.
 711, 713
 SKINNER, M.
 3035
 SKINNIDER, L.F.
 2141*
 SKODA, V.
 864*, 5679*
 SKOGLUND, R.W., JR.
 6321*
 SKREB, N.
 263*, 3462*
 SKROCHOWSKA, M.
 4602*
 SKROVINA, B.
 3530*
 SKRYABIN, A.S.
 2663*
 SKURSKA, Z.
 173*
 SKURZAK, H.M.
 3869, 5888
 SLACK, N.H.
 828*, 2246*
 SLADE, T.A.
 2414*, 3671
 SLATER, E.E.
 590*
 SLATER, T.F.
 1614*
 SLAVIN, M.
 5492*
 SLEDZIEWSKA, E.
 2400*
 SLEPOV, M.I.
 3663
 SLESERS, A.
 1986, 3403*
 SLESINSKI, R.S.
 2448*
 SLIFKIN, M.
 584*, 709, 1054, 1134*,
 3717*, 5772
 SLINCHENKO, N.Z.
 970*
 SLOMSKA, J.
 3415*, 6275*
 SLONINSKA, B.
 1677*
 SLUTZKY, R.
 2786*
 SMALLEY, E.B.
 45
 SMETANA, K.
 3358*
 SMETANIN, E.YE.
 650*, 1603*, 1607*
 SMETS, L.A.
 845

SMIRNOV, G.A.
 2450*, 3011, 3652
 SMIRNOV, N.M.
 3479*
 SMIRNOVA, I.A.
 5210
 SMIRNOVA, N.B.
 3294
 SMIRNOVA, YE.A.
 6140*
 SMITH, B.H.
 5650*
 SMITH, C.A.
 4546
 SMITH, C.J.
 200
 SMITH, C.K.
 5877
 SMITH, C.S.
 2012
 SMITH, D.F.
 2731*
 SMITH, E.C.
 1367*
 SMITH, E.K.
 2040*
 SMITH, G.H.
 4577
 SMITH, G.S.
 5727*
 SMITH, H.
 240
 SMITH, H.G.
 4074*
 SMITH, H.S.
 720, 4526, 5915
 SMITH, J.
 2822
 SMITH, J.A.
 1392, 4351*, 4813, 5388*
 SMITH, J.B.
 2144*
 SMITH, J.G., JR.
 4919*
 SMITH, J.K.
 4086*
 SMITH, J.L.
 5811
 SMITH, J.M.
 3685, 4394, 4437
 SMITH, J.P.
 1401
 SMITH, J.W.
 249, 2535, 2604, 4691
 SMITH, L.D.
 2990, 3710
 SMITH, L.L.
 3928*
 SMITH, M.
 884*
 SMITH, M.C.
 4700

SMITH, P.
2057*
SMITH, P.G.
1094, 3744
SMITH, R.A.
2022
SMITH, R.D.
4572
SMITH, R.G.
2333, 3790, 5445, 5906
SMITH, R.K.
3153*, 4572
SMITH, R.T.
2692*
SMITH, S.B.
170*
SMITH, S.E.
6015*
SMITH, S.H.
3754
SMITH, T.C.
4484*, 6300*
SMITH, T.R.
603
SMITH, W.
278*
SMITH, W.E.
4425
SMITHERS, D.W.
4359*
SMOL'YANNIKOV, A.V.
1089*
SMOLAK, K.
2033*, 6358*
SMOLER, D.
1706, 5233
SMOLYANSKAYA, A.Z.
4181*
SMORON, G.L.
4500*
SMUCKLER, E.A.
1294*, 4800*, 5150, 5171
SMYK, B.
1539, 4446
SNART, R.S.
1648*
SNELL, G.D.
1516
SNELL, K.C.
4883*
SNELL, L.M.
3268
SNODGRASS, M.J.
4618
SNYDER, F.
2379*, 4237*
SNYDER, R.
1750
SNYDER, R.N.
5508*
SNYDER, S.
1013

SNYDER, S.P.
1699, 2612, 5264
SO, B.T.
2958
SOANES, W.A.
1377, 2626, 3177
SOBCZAK, E.
740*
SOBEL, H.
4240*
SOBEL, H.J.
2010
SOBEL, J.
1040
SOEDERBERG, G.
3529*
SOERENSEN, R.
3219*, 3842
SOEROWIDJOJO, M.
6002*
SOFINA, Z.P.
6250*
SOGA, J.
2886*
SOHIER, R.
166, 397, 4663
SOIHET, S.
3551*
SOKOL, F.
1346, 5230
SOKOLOV, A.V.
5398
SOKOLOV, M.I.
3753
SOKOLOV, P.P.
5270
SOKOLOVSKIY, R.M.
5751*, 5752*
SOKOVA, O.I.
70, 1913*
SOLAD, P.B.
3434*
SOLCIA, E.
2343, 5618*
SOLER OBRADORS, M.
4978*
SOLETO SAEZ, E.
6249*
SOLHEIM, O.P.
5823*
SOLITARE, G.B.
3269
SOLNIK, C.
2515
SOLOFF, B.L.
267*, 2078*
SOLOIMSKAYA, Y.
366*
SOLOIMSKAYA, YE.A.
5930*
SOLOMON, A.
890*

SOLOMON, G.F.
3920*
SOLOMON, J.J.
5284*
SOLOMAR, W.K.
4966*
SOLOV'EV, G.YA.
3760
SOLOV'EV, V.D.
5289*
SOLOVEV, V.V.
5968
SOLTER, D.
263*, 3462*
SOLYMOSS, B.
1138*, 1566, 1571
SOMER, P. DE
1872*, 2497
SOMERS, K.
1729
SOMMERS, S.C.
63
SOMOGYI, A.
976*, 1566, 1571
SONENSHEIN, G.E.
5205
SONLEY, M.J.
875*
SONTAG, J.M.
5335
SOPER, R.T.
5461*
SOPHER, R.L.
2765
SOPHOCLES, A.M.
7*
SORENSEN, G.D.
3498*, 4951*
SORIANO, R.Z.
555
SORM, F.
4466*
SOROF, S.
5102, 5807
SOROKIN, C.
2511
SOROKINA, YU.D.
5784, 5850*
SORSBY, A.
5704
SOSNIK, H.
4131*
SOTHERN, R.B.
4863
SOUCHARD, M.
1275*
SOULE, E.H.
4058*, 5565*
SOUREK, J.
1775*
SOUTH, M.A.
1068*

SOUTHAM, C.M.
 908, 1817, 3868
 SOVOSTJYAND, G.A.
 3044
 SOVOVA, V.
 1792, 3093, 5889
 SPAHN, G.F.
 4553
 SPAHN, G.J.
 3080, 4665, 5254, 5331
 SPANEDDA, R.
 4275*
 SPANOS, P.K.
 4192*
 SPARAGANA, M.
 2470*
 SPARKES, R.S.
 249
 SPARSHOTT, S.M.
 1555
 SPEAR, P.G.
 3050, 3821
 SPEARS, G.F.S.
 811
 SPECKHARD, M.E.
 3610
 SPEHLER, H.
 576*, 4116*
 SPELSBERG, T.C.
 5771
 SPENCER, E.S.
 3884
 SPENGLER, G.A.
 4706*
 SPICER, C.C.
 789
 SPIEGELBERG, H.L.
 4699
 SPIEGELMAN, S.
 1343, 1352*, 1696, 1704,
 2489, 3131, 3769, 3774,
 3803, 3804, 5214, 5229,
 5233, 5234, 5926
 SPIELMANN, J.
 6072*
 SPIERS, A.S.D.
 6117, 6354*
 SPIERS, P.S.
 3275
 SPINA, A.
 770
 PINELLI, M.
 4184*
 PIRA, G.
 5333, 5359
 PIRCHEV, V.B.
 3597*
 PIRICHEV, V.B.
 6272*
 PIRO, R.H.
 5521*
 PITLER, L.E.

4652
 SPITSA, A.I.
 231
 SPITZNAGEL, J.K.
 3478*
 SPIVACK, M.
 1849*
 SPJUT, H.J.
 336, 5074
 SPOHN, W.H.
 1064, 4617
 SPOONER, M.E.
 3326*
 SPOOR, H.J.
 2764
 SPORN, M.B.
 3685, 4394, 4437, 5174
 SPRATT, J.L.
 1279*
 SPRATT, J.S.
 195*, 364, 1954
 SPRATT, J.S., JR.
 2242*, 3980*, 4822
 SPRECHER-GOLDBERGER, S.
 2526
 SPRENT, J.
 1860*, 2629, 3853
 SPRINGER, G.F.
 133*, 4764*
 SPRINZ, H.
 289*
 SPRYSHKOVA, N.A.
 1416*, 6251*
 SPURE, ZH.ZH.
 5883
 SPYCHALSKI, E.
 4250*
 SPYCHER, M.A.
 241
 SQUARTINI, F.
 2237*
 SREBO, Z.
 606
 SREBRO, Z.
 332*, 5551*
 SRIVASTAVA, B.I.S.
 4571
 SRIVASTAVA, V.K.
 1190*
 ST-ARNEAULT, G.
 4653, 4719*
 ST. BERCEANU
 5867*
 ST. PIERRE, J.A.
 73
 STABINSKY, C.
 4793
 STACKHOUSE, L.
 1679*
 STACKPOLE, C.
 5944*
 STACKPOLE, C.W.

1378
 STADLER, U.C.
 5810
 STAFFELDT, E.
 934, 1244, 5084, 5115
 STAFFORD, M.A.
 4867
 STAHL, J.
 1429
 STALSBERG, H.
 1955, 2787*
 STAMBROOK, P.J.
 3458*, 5606*
 STAMPFER, M.
 4967*
 STANEEZEK, W.
 5420
 STANISLAWSKI, M.
 1859*
 STANKOV, G.
 6095*
 STANKOVIC, P.
 3056
 STANLEY, A.J.
 2039*
 STANLEY, E.R.
 2097*
 STANLEY, M.A.
 790*
 STANLEY, N.F.
 1368*
 STANSFELD, A.G.
 6365*
 STANTON, M.F.
 3676, 4383
 STANULLA, H.
 5656*
 STARKE, W.R.
 4926*
 -STARLING, K.A.
 1068*
 STARR, J.
 3607
 STARZL, T.E.
 759, 5728*
 STASCH, M.J.
 3464*
 STASEK, V.
 6101*
 STASTNY, B.
 3114
 STASZEWSKI, J.
 3274, 3319
 STAUFFACHER, W.
 868*
 STAVEM, P.
 2067*
 STAVROU, D.
 2222*, 4258*, 5088
 STEDMAN, R.L.
 651*, 4408
 STEEL, C.M.

1488*, 2593*, 2831, 4032
 STEEL, G.G.
 2216, 3303, 3887, 4234*,
 6104*
 STEEL, R.
 514
 STEELE, H.D.
 2460*
 STEELE, M.W.
 1473*
 STEENBECK, L.
 342 *
 STEER, A.
 1530*, 1687*, 3027, 3412*
 STEEVES, R.A.
 406, 440*, 2506, 3122
 STEFANI, S.
 2470*
 STEFANO, H.S. DI
 2521
 STEFANELLI, N.
 1552
 STEGNER, H.-E.
 5036*
 STEGNER, H.E.
 6262*
 STEIN, G.
 1209
 STEIN, J.J.
 3527*, 5578*
 STEIN, U.
 2124*
 STEINBERG, A.D.
 1853*, 3764, 4553
 STEINBERG, D.
 2087*
 STEINBERG, S.M.
 2166*
 STEINDEL, H.J.
 2036*
 STEINER, G.C.
 2116*
 STEINER, G.M.
 3490*
 STEINER, L.A.
 2810
 STEINHOFF, D.
 2339
 STEINITZ, R.
 3248, 3254, 3967, 3970
 STEINMAN, H.G.
 2098*, 2667*
 STEINMANN, J.
 5857*
 STEINMULLER, D.
 5802
 STEJSKAL, R.
 1056, 2632
 STELL, P.M.
 2962
 STELMACHOWSKA, A.
 173*

STEMBERGER, H.
 778*
 STENBACK, F.
 88*
 STENBACK, W.A.
 414, 467, 476, 703
 STENDARDO, B.
 4185*
 STENGER, R.J.
 4451*
 STENHOUSE, N.S.
 3274
 STEPANKOVA, M.
 5866
 STEPANOV, E.A.
 6239*
 STEPANOVA, L.G.
 3760, 5208
 STEPANOVA, YE.I.
 3624*
 STEPHANESCU, D.T.
 389
 STEPHENS, P.J.
 4097*
 STEPHENSON, H.E., JR.
 2273*
 STEPHENSON, J.R.
 3096, 3135, 3808, 4533,
 4535, 5232, 5935*
 STEPHENSON, M.L.
 3788
 STEPINA, V.N.
 3870
 STEPLEWSKI, Z.
 4315
 STERLING, T.D.
 2769
 STERN, H.
 1527*
 STERNBERG, S.S.
 1532, 5128
 STERNBERG, W.H.
 1140*, 1177*
 STERUP, K.
 581*
 STEUDEN, J.
 3193
 STEVEN, L.M.
 5238
 STEVENS, D.A.
 764, 1700, 2232*, 5402,
 5969
 STEVENS, D.F.
 4016
 STEVENS, J.G.
 729*
 STEVENS, L.C.
 188
 STEVENS, M.B.
 5969
 STEVENS, R.H.
 4709*

STEVENS, R.S.
 1496*
 STEVENS, T.
 2537
 STEVENSON, A.C.
 1292*
 STEVENSON, P.A.
 4063*
 STEWARD, J.K.
 4731*, 6083
 STEWART, A.
 2210, 5559*
 STEWART, A.M.
 2471*, 3032*
 STEWART, B.W.
 1587, 5123
 STEWART, F.W.
 3419*
 STEWART, H.L.
 509, 1201
 STEWART, M.J.
 6343*
 STEWART, S.E.
 2483, 2493
 STEWART, T.H.M.
 1641*
 STEYN, J.H.
 2722
 STEYN, M.
 1255
 STICH, H.F.
 1596
 STIFFEL, C.
 1573
 STILLER, D.
 1085, 2384*, 4080*, 4272*
 STILLMAN, R.M.
 4496*
 STIRLING, G.A.
 3441*
 STITES, D.P.
 2695*
 STITH, W.J.
 4861
 STITT, D.
 756, 3118
 STJERNHOLM, R.L.
 4706*
 STJERNSWAERD, J.
 155, 156, 482
 STJERNSWARD, J.
 5069*
 STOBO, D.
 3179
 STOCCHI, G.
 5647*
 STOCK, J.A.
 1625*
 STOCK, N.D.
 119, 405, 1008, 4735*
 STOCKERT, E.
 1841, 5336

STOCKINGER, L.
1552
STOECKER, E.
3242*
STOEHRER, G.
2972
STOIAN, M.
1037*
STOKER, M.G.P.
5964
STOKER, T.A.M.
5636*
STOKINGER, H.E.
4403
STOLDT, H.
5860*, 6045*
STOLER, B.
4659
STOLL, P.
6396*
STONE, D.
4695
STONE, L.E.
1309*
STOOLMILLER, A.C.
237
STORA, C.
338
STORCK, H.
6094*
STOTSKAYA, L.N.
2191*
STOUT, M.G.
2022
STOWELL, R.E.
2040*
STOYANOV, S.
3894
STRAAT, P.A.
1572
STRAIGHT, S.
265*
STRAIN, W.H.
3648
STRAND, M.
1016
STRANDBERG, J.D.
1723, 3895
STRASSER, F.F.
1654*
STRASSER, K.
2124*
STRATULAT, L.
2780*
STRAUB, D.C.
5940*
STRAUB, R.F.
2317
STRAULI, P.
549
STRAUSBAUCH, P.H.
665*

STRAUSS, B.S.
5605*
STRAZHEVSKAYA, N.B.
1976
STREETER, D.
2022
STREIFF, F.
2805*
STRICKLAND, R.G.
4781
STRIFE, A.
1447*
STRIZHACHENKO, N.M.
2591*, 5939*, 5945*
STROBEL, E.
3598*
STROBER, S.
3909
STROHL, W.A.
3798
STROM, R.
2830, 5987*
STROMBERG, K.
2567*, 2967, 3106
STROMBERG, K.J.
1709
STRONG, E.W.
2138*
STRONG, F.M.
45
STRONG, L.C.
3238, 3451*, 4047
STRONG, R.P.
3605
STROUK, V.
2569*
STRUCK, R.F.
3660
STRUM, S.B.
6205*
STRYCKMANS, P.A.
1962, 4013
STRZINEK, R.A.
4939*
STUART, A.
1916
STUART, D.W.
5494*
STUART, J.
3493*, 4949*
STUBBS, M.
4857
STUCKEY, W.J.
403, 6346*
STUTMAN, D.
477, 5352
STUTZMAN, L.
2246*
SU, L.Y.
2085*
SUAREZ, G.
98*

SUAREZ, F.G.
327*, 1116, 2574*, 5205
SUAREZ, R.S.
2786*
SUAU, E.
2233*
SUBAK-SHARPE, J.H.
2541
SUBHAMANI, B.
2768, 3008
SUBJECK, J.
6330*
SUDA, M.
5524*, 5539*, 6126
SUDO, H.
2634
SUEMASU, K.
5523*
SUESS, R.
5857*
SUGA, S.
3378*
SUGAHARA, T.
4494
SUGANO, H.
1021, 1052, 1087, 1431,
1831, 4452*, 4576, 5098
SUGAR, J.
6054*
SUGAR, R.
4622
SUGARBAKER, E.V.
757, 787, 2076*, 3935*
SUGAWARA, H.
6214*
SUGAWARA, K.
1051, 1322
SUGDEN, B.
5893
SUGIHARA, R.
3695, 6367*
SUGIHARA, S.
4372, 4385, 5183
SUGIMOTO, H.
4740*
SUGIMOTO, T.
1256, 4415
SUGIMURA, T.
984*, 1293*, 3677, 3840,
4095*, 4211*, 5143, 5510*,
5545*, 5556*
SUGINO, Y.
2530
SUGIYAMA, T.
3010
SUHR, N.H.
233
SUIT, H.D.
3730, 4188*, 4686
SUK, W.A.
3080, 3713
SUKENO, T.

4012
 SUKHENKO, V.M.
 3952*
 SUKHORUKOV, B.I.
 1289*
 SULITZEANU, D.
 2712*, 4620
 SULLIVAN, K.A.
 4688, 5307
 SULLIVAN, P.D.
 1947*, 4809, 5429*
 SUMEGI, I.
 5585*
 SUMI, T.
 5434
 SUMIE, H.
 4376
 SUMMERS, D.F.
 4015
 SUMNER, M.R.
 758, 782*
 SUMNET, M.R.
 760
 SUN, C.N.
 4560
 SUN, S.-C.
 1797
 SUNDELL, L.
 1928
 SUNDERMAN, F.W., JR.
 4377, 5801
 SUNDQUIST, B.
 1713
 SUNG, M.
 5587*
 SUNG, SH.-S.
 2423*, 2427*
 SURALA, U.
 568*
 SURIANO, J.R.
 1805
 SURIKOVA, N.I.
 3147*
 SUSMANO, D.
 505*
 SUSS, R.
 266*
 SUSSENBACH, J.S.
 1715, 3819
 SUTER, L.
 5351
 SUTHERLAND, E.W.
 2048*
 SUTHERLAND, R.M.
 3186
 SUTNICK, A.I.
 1834
 SUTTON, P.M.
 1600
 SUZUKI, E.
 4458*, 4470*
 SUZUKI, F.

4494
 SUZUKI, H.
 1649*, 2965, 3442*, 4154*,
 5837*
 SUZUKI, I.
 1278*, 5369*
 SUZUKI, M.
 1168*, 4745*, 4748*
 SUZUKI, S.
 582*, 4745*, 4748*
 SUZUKI, T.
 4892*
 SVANES, K.
 1988
 SVEDMYR, E.A.J.
 3226*, 3888, 4623
 SVEHAG, S.E.
 1058
 SVEJDA, J.
 6107*
 SVEJGAARD, A.
 2678*
 SVET-MOLDAVSKIY, G.YA.
 5270
 SVOBODA, D.
 5543*
 SVOBODA, D.J.
 2351, 2352, 4954*
 SVOBODA, J.
 3093, 5748*, 5916
 SVOBODOVA, J.
 3114
 SWAIM, W.R.
 3856
 SWAIN, A.P.
 651*, 1581, 4408
 SWAN, D.
 3845
 SWANBECK, G.
 4313
 SWANN, A.
 1816
 SWANN, P.F.
 342, 965, 2320
 SWARM, R.
 293*
 SWART, C.
 2586*
 SWARTZ, M.
 4902*
 SWARTZ, M.J.
 208
 SWEELEY, C.C.
 4778*
 SWEET, R.W.
 3073
 SWENBERG, J.A.
 1589, 5363, 5789
 SWERN, D.
 2981
 SWIATNICKA, J.
 1938*

SYDNOR, K.L.
 4365
 SYDORYK, YE.P.
 4440
 SYDOW, G.
 980*, 4442
 SYKES, J.A.C.
 4024
 SYLLA, S.
 821*
 SYLVEN, B.
 2845
 SYMES, M.O.
 457, 3213
 SYMONS, R.H.
 5895
 SZABO, S.
 5194*
 SZABOCSEK, J.M.
 3087
 SZACKI, J.
 3438*, 3439*, 6027*
 SZAGA, B.
 2615
 SZAJMAN, S.M.
 5807
 SZALATY, H.
 173*
 SZANTO, J.
 134*
 SZENDE, B.
 670*
 SZEPESEI, K.
 6135*
 SZEPESENWOL, J.
 2365*
 SZEWCZYK, Z.
 2657*
 SZIRMAI, E.
 332*, 334*
 SZKUDLAREK, J.
 3193
 SZMIGIEL, Z.
 4708*
 SZNAJD, J.
 1517, 2167*, 2240*, 2794*,
 3518*, 4158*, 6161*
 SZUR, L.
 1966
 SZWAGRZYK, E.
 4810
 SZWED, K.
 2400*
 SZYROKI, L.
 4447
 TABAR, L.
 4805*
 TABBARA, W.S.
 2262*, 5684*
 TACA, H.
 4160*
 TACCONI DE ALANIS, M.J.

4206*
 TACHE JALAK, M.
 4142*
 TACHIBANA, T.
 1049, 1052, 1110
 TACHIKAWA, K.
 1660, 1687*
 TADA, M.
 361, 2341
 TADATOMO, Y.
 1372
 TADDEI, S.
 2726*
 TAFELSHTEIN E.YE.
 5790
 TAGASHIRA, T.
 1577
 TAGASHIRA, Y.
 5141
 TAGAYA, I.
 1073*
 TAGI-ZADE, S.B.
 1466*, 4000
 TAGLIAVINI, R.
 3468*
 TAGUCHI, F.
 438
 TAGALELE, E.
 6399*
 TAGHISIAN, T.N.
 1000*, 5601*
 TAGI, H.T.
 4546
 TAGIMA, T.
 4811
 TAGADA, K.
 438
 TAGADA, M.
 1021, 1049, 1052, 1382,
 1431
 TAGAGI, M.
 4154*, 6317*
 TAGAHASHI, G.
 2370*
 TAGAHASHI, K.
 2354
 TAGAHASHI, T.
 1049, 1845*, 4555
 TAGAHASHI, Y.
 4010, 4922*, 4987*, 5509*
 TAGAKI, R.
 5104
 TAGAKU, K.
 1022
 TAGAMIZAWA, H.
 5086
 TAGANE, T.
 5086
 TAGAND, K.
 5770
 TAGANO, T.
 2875

TAKACKA, T.
 360, 4211*, 5796
 TAKASHIMA, M.
 2897*
 TAKASU, T.
 1023
 TAKASUGI, M.
 5346
 TAKASUGI, N.
 3298
 TAKATSU, K.
 3863, 5368*
 TAKAYAMA, S.
 47, 1388, 1598, 2322, 2332
 TAKAYASU, H.
 1123
 TAKEICHI, N.
 2570*
 TAKEMORI, N.
 3820
 TAKEMOTO, K.K.
 2508, 3871, 5260
 TAKENAKA, S.
 4471*
 TAKENOSHITA, M.
 3440*
 TAKEUCHI, J.
 4852, 4899*
 TAKEUCHI, M.
 2711*
 TAKEUCHI, S.
 1396
 TAKIGUCHI, T.
 2692*
 TAKII, M.
 5104
 TAKIZAWA, K.
 4576
 TAKIZAWA, S.
 587*, 4382, 4422
 TAKSDAL, S.
 1955
 TALAGERI, V.R.
 3474*
 TALAL, N.
 1853*, 4803*
 TALAVDEKAR, R.V.
 867*, 4298*
 TALERMAN, A.
 882*, 4935*
 TALIB, H.
 6327*
 TALWALKAR, G.V.
 526*
 TALWAR, G.P.
 3932*
 TAMAMOTO, T.
 5244
 TAMANCI, I.
 4497*
 TAMADOKI, B.
 1977

TAMADOKI, T.
 2864, 3480*
 TAMBOURIN, P.
 2507
 TAMBOURIN, P.E.
 4503
 TAMM, I.
 5717
 TAMPLIN, A.R.
 107*
 TAMURA, Z.
 3378*
 TAN, H.K.
 4970*
 TAN, K.B.
 5230
 TAN, K.K.
 2748
 TANABE, S.
 1020, 1059, 4713*
 TANABE, Y.
 6222*
 TANAKA, K.
 3223*, 5555*
 TANAKA, K.K.
 4917*
 TANAKA, N.
 1293*
 TANAKA, T.
 4201*, 4746*, 5204, 5539*,
 5868*, 5904, 6126
 TANAKA, Y.
 2700*, 5517*
 TANDLER, B.
 228, 2135*
 TANDON, P.L.
 616*
 TANENBAUM, B.
 3333*
 TANI, E.
 235, 1174*, 4852, 4985*
 TANIOKU, K.
 2398*
 TANIUCHI, K.
 5539*, 6126
 TANIZAWA, O.
 2416*
 TANNEBERGER, ST.
 2288*
 TANNENBAUM, M.
 928*, 2134*
 TANNENBAUM, S.R.
 1544
 TANNOCK, I.F.
 2719, 3730
 TANTICHARDENYOS, P.
 1613*
 TAPER, H.S.
 236
 TAPP, E.
 2858
 TAPPEINER, G.

4684
TARANGER, L.A.
3162
TARBA, M.M.
1675*
TAPIKAS, F.
861*
TARIN, D.
3945
TARKKANEN, J.
4797*
TARTAROGU, N.
3456*
TASCA, C.
5779
TASHIRO, H.
3522*, 4051*
TASHJIAN, A.H., JF.
2836*, 3351*, 4847
TASKAR, S.P.
2391*
TASSI, G.C.
3850
TATA, J.R.
1294*
TATEISHI, R.
5403, 5509*
TATSUNO, T.
2354
TAUCHI, H.
6322*
TAUFFER, M.
5190*
TAURASO, N.M.
3178, 4724*, 5932*
TAVITIAN, A.
2496
TAYLOR, B.
4034
TAYLOR, B.A.
1262, 2647
TAYLOR, C.W.
2875, 6111
TAYLOR, D.J.
3156
TAYLOR, D.D.
324*
TAYLOR, D.O.N.
696, 799*, 1771*, 4513,
4608*
TAYLOR, G.
1794, 2621, 4731*
TAYLOR, G.N.
1104
TAYLOR, H.B.
3240, 3331*
TAYLOR, J.F.
891*, 6279*
TAYLOR, J.M.
2553, 3110
TAYLOR, J.S.
3718*

TAYLOR, M.W.
1971
TAYLOR, N.J.
101
TAYLOR, W.
4083*
TAZAWA, K.
2886*, 3985
TCHEN, P.
3065
TCHEN, T.T.
4271
TCHERNIA, G.
5598*
TCHORZEWSKI, H.
6125
TEBENS, B.D.
97*
TEDESCHI, F.
6171*
TEGTMEYER, H.
133*
TEGTMEYER, P.
3768, 5216, 5227, 5879
TEICH, N.
1018
TEICHMANN, B.
991*
TEILLET, F.
899*
TEITZ, Y.
701
TELLER, M.N.
2972
TELLESCHI, S.
6264*, 6265*, 6267*, 6268*
TELLESKI, S.
4261*
TEMESI, M.
5869*
TEMESREKASI, D.
234
TEMIN, H.M.
1345, 1745, 2556, 3040,
4511
TEMPLETON, A.C.
400, 814, 891*, 1918, 4214,
4818, 4890*, 4988*
TENNANT, J.R.
1047, 3142, 3923*, 5309
TENNANT, R.W.
1702, 3204, 3947, 4046,
4618, 5245
TENNEY, D.N.
3074
TEOH, E.S.
1987
TEPLITZ, R.L.
1024, 2865, 3941
TER-GRIGOROV, V.S.
445*, 2532
TERADA, M.

4025
TERASAKI, F.I.
302, 5347
TFRASHI, S.
5119, 5781
TERASHI, S.I.
5782
TERAYAMA, H.
1256, 4415
TERENIUS, L.
503*
TERENTYEV, L.I.
562*
TERRACINI, B.
4456*, 5814*
TERRY, W.D.
748, 5976
TERZ, J.J.
1415, 1972
TESSMANN, D.
6218*
TESSMER, C.F.
2115*, 5432
TESTA, M.C.
5614*
TETZLAFF, I.
2618
TEUFEL, G.
1153*
TEVETHIA, S.S.
2604, 4582*
TEW, P.H.
460
TEXIER, M.
2475*
TEXLER, M.
3953*
TEYSSIE, A.R.
2415*
TEYSSIER, P.
3993
THACKRAH, T.
4411
THAMM, R.
4289*
THAMPI, N.S.
3301
THANG, D.C.
2373*
THANGAVELU, M.
6200*
THAYER, E.A.
1524*
THE, T.H.
6038*
THEILFN, G.H.
1320, 1493*, 4524
THEOLOGIDES, A.
6009*
THERMAN, E.
5824*
THEWS, G.

3582*
 THIAM, A.-A.
 3157
 THIEBLEMONT, M.
 5006
 THIELEN, G.H.
 1014
 THIERIOT-PREVOST, G.
 2947
 THIES, D.
 1719
 THIES, H.J.
 6045*
 HILLY, J.E.
 1544
 THIRUMALACHARY, C.
 1249
 THIRY, L.
 2526
 THOM, W.
 5859*
 THOMA, P.E.
 2006
 THOMAN, M.
 4656
 THOMAS, B.S.
 745
 THOMAS, C.
 3724*, 5120, 5146, 5763
 THOMAS, D.B.
 463, 1178*, 4772*
 THOMAS, E.D.
 500*, 776*, 3172, 5843*
 THOMAS, F.B.
 2115*, 5432
 THOMAS, J.A.
 1701, 1728, 3632*
 THOMAS, J.D.
 212*
 THOMAS, J.F.
 97*
 THOMAS, K.
 4795*
 THOMAS, L.B.
 3994
 THOMOPOULOS, D.
 2143*
 THOMPSON, D.
 1681*
 THOMPSON, E.
 5957, 6301*
 THOMPSON, E.E.
 294*, 4896*
 THOMPSON, J.H.
 4242*
 THOMPSON, M.H.
 2364*
 THOMPSON, M.W.
 875*
 THOMPSON, N.W.
 5567*
 THOMPSON, A.E.R.

5491*
 THOMSON, J.A.
 1673*
 THOMSON, J.W.W.
 1211*
 THOMSEN, R.
 3056
 THONIER, M.
 4642
 THORBECK, R.
 3787
 THORBECKE, G.J.
 5239
 THORBJARNARSON, B.
 2920*
 THORMANN, TH.
 6051
 THORMAR, H.
 5898
 THORN, V.
 971*
 THORNE, M.G.
 6007*
 THORNELL, E.W.
 4701
 THORNES, R.D.
 3205
 THORNTON, M.
 5964
 THORPE, N.O.
 2614
 THORSBY, E.
 484*, 1053, 1844*
 THOULESS, M.E.
 713
 THRASHER, T.V.
 4233*
 THUMM, K.
 4367
 THURMAN, G.B.
 1104
 THURSTON, J.R.
 3649
 THUST, R.
 1268, 1409, 4856, 5005,
 5109
 TIBBLE, D.M.
 865*
 TICHY, M.
 6020*
 TICLETE, V.
 1889
 TIDINGS, J.
 1422*
 TIDWELL, T.
 3359*
 TIEDEMANN, R.N.
 2920*
 TIGERSTROM, R.G. VON
 2980
 TIGGELBECK, D.
 2922*

TILCH, G.
 3256
 TILL, M.M.
 1825
 TILLACK, T.W.
 4743*
 TILLEY, J.
 3732
 TILLMAN, L.
 1690*
 TILLMANN, U.
 2184*
 TILSON, H.B.
 3419*
 TILTMAN, A.J.
 2360
 TILZ, G.P.
 5349
 TIMBRELL, V.
 385*
 TIMBURY, M.C.
 1724
 TIMKO, J.
 5512*
 TIMMS, D.
 76
 TIMOFEEVA, N.G.
 5671*, 6373*
 TIMPERLEY, W.R.
 1175*, 3425*
 TING, A.
 3890
 TING, C.C.
 485*, 724
 TING, C.-C.
 3835, 3871
 TING, R.C.
 1374, 3742, 3790, 3871,
 4603*, 4676, 4687
 TING, R.C.Y.
 5325
 TING, S.M.
 4485*
 TIO, F.O.
 6068*
 TITTLE, K.
 3919*
 TLOLKA-PLUSZCZYK, J.
 2394*
 TOBE, T.
 3491*
 TOBON, H.
 5467*
 TODARO, G.J.
 450, 699, 2498, 2867, 3867,
 4523, 5250, 5970
 TODD, C.W.
 4648, 4689, 5327, 5976
 TODD, D.
 5729*
 TODD, E.F.
 49

TODD, E.P.	TOMII, S.	2639
677*	4462*	TOTH, M.A.
TODD, R.	TOMINAGA, T.	2890*
4622	1295*	TOTH, S.
TODD, A.	TOMINGAS, R.	1138*
1447*	3617	TOTH, T.
TODOROV, I.	TOMITA, M.	59
6159*	2583*, 3840, 6006*	TOTTEN, R.S.
TODOROV, S.	TOMITA, Y.	3960*
136*, 2598*	4924*	TOUCHARD, J.
TODOROV, T.	TOMKINS, G.M.	1216*
6037*	287*, 5688*, 6127, 6186*	TOUDIC, L.
TODOROVA, KHR.	TOMLINSON, A.H.	1199*
6159*	3123	TOURNIAIRE, J.
TOFT, D.O.	TOMLJANDVIC, M.	1481*
5771	299*	TOUSSAINT-ARAGON, E.
TOGNELLA, S.	TONELLI, F.	2005
4712*, 6030*, 6031*, 6032*,	6259*	TOW, S.H.
6033*	TONG, M.J.	809
TOH, K.	1797	TOWNE, W.
722	TONGIER, M., JR.	2061*
TOH, Y.-C.	224	TOWNSEND, D.E.
2338, 2347	TONI, R.	249
TOJO, S.	2592*, 3875	TOY, S.T.
2068*	TOOLE, A.L.	5979
TOKAJI, G.	1527*	TOYNE, P.H.
4432	TOPOREK, M.	4364
TOKARZ, J.	5530*	TOYOSHIMA, K.
2713*	TORELLI, G.M.	2402*, 2985
TOKITA, N.	834	TRACK, N.S.
5985*	TORELLI, U.L.	868*
TOKUDA, S.	834, 843	TRAINER, A.L.
2690*	TORGUSHINA, N.S.	247
TOKUDA, Y.	4121*	TRAININ, Z.
6167*	TORISU, T.	4717*
TOKUE, A.	1562	TRAKA, T.S.
1123	TORLINSKI, L.	3865
TOKUNAGA, T.	4126*, 4128*	TRANEUS, A.
4746*	TORPIER, G.	3546*
TOKUOKA, S.	1036*	TRAUB, F.
1632*	TORRE, G.C.	319*, 1150*
TOKUZEN, R.	6156*	TRAVERSAC, M.F.
4594*	TORRES AGUERO, M.	2284*
TOLEN, S.J.	6360*	TRAYNOR, B.L.
3466*	TORRES, F.O.	5213
TOLLE, D.V.	3982*	TRAYNOR, J.E.
1000*	TORTA, R.	390*
TOLMACH, L.J.	3376*	TREADWELL, P.E.
2463*	TOSETTI, D.	5511*
TOMA, B.	4120*	TREICHEL, R.
1871*	TOSI, P.	3256
TOMAN, R.	5460*, 6060*	TREMBLAY, G.
209*	TOSSOU, H.	6281*
TOMASHEFSKY, P.	821*	TREMBLAY, M.
2134*	TOT, F.	5485*
TOMASINO, R.M.	445*	TRENDELENBURG, F.
2746*	TOTA, G.	6397*
TOMATIS, L.	6060*	TRENTIN, J.J.
660*, 962, 3658, 4456*,	TOTH, B.	414, 467, 476, 703
5791	69, 940, 2307, 2349, 3692,	TRENTINI, G.P.
TOMICH, C.F.	5842*	6061*
1086	TOTH, F.D.	TRICHOPOULOS, D.

3971
 TRIDENTE, G.
 112
 TRIDON, P.
 1200*
 TRINCI, M.
 4255*
 TRIPATHI, R.C.
 1886
 TRISKA, J.
 2911*
 TRITSCH, H.
 1159*
 TRLIFAJOVA, J.
 1775*
 RODAHL, J.N.
 4056*
 RCITSKAYA, L.P.
 6236*
 ROLL, W.
 4368, 4434, 5844*
 RONICK, S.R.
 5257
 RONNIER, H.
 2271*
 ROUILLAS, P.
 626*, 2225*, 3558*, 5362,
 5962, 6142*
 ROVALUSCI CRATERI, P.
 2239*
 RUBCHENINOVA, L.P.
 1285*
 RUDEL, P.J.
 406
 RUELCVE, S.C.
 6337*
 RUJILLO, J.M.
 1179*, 3360*, 4020, 4514
 RUMP, B.F.
 2064*
 RUSSOVA, N.F.
 3418*
 RYFIATES, G.P.
 943, 4036
 S'O, P.O.P.
 1572
 SAKRAKLIDES, B.
 1088
 SANEV, R.
 2910
 SAREV, B.M.
 5602*
 S, M.O.M.
 5891
 S, P.O.P.
 5845*
 SUBARA, Y.
 1977
 SUBOTA, T.
 3773, 4595*, 4974*
 SUBURA, E.
 3696, 4010, 4384

TSUBURA, Y.
 2985
 TSUCHIDA, H.
 4292*
 TSUCHIDA, N.
 3745
 TSUCHIYA, T.
 4497*
 TSUCHIYA, Y.
 145*, 1073*, 1347
 TSUEI, D.
 1714
 TSUGAWA, S.
 4693, 5526*
 TSUIKI, S.
 544, 1452*, 4012, 5490*
 TSUJI, H.
 2985
 TSUJI, K.
 4722*
 TSUJI, T.
 5678*
 TSUKADA, K.
 2945
 TSUKADA, Y.
 2602, 2931, 3477*
 TSUKAHARA, I.
 6176*
 TSUKAMOTO, K.
 2530
 TSURUHARA, T.
 687
 TSURUMI, N.
 2443*
 TSURUD, T.
 4923*, 4924*
 TSUTSUI, Y.
 4388
 TSUTSUMINO, R.
 2443*
 TSYSINA, E.N.
 3146*, 5209
 TU, A.T.
 3621
 TU, S.M.
 1049
 TU, S.-M.
 1382, 1431
 TU, S.M.
 2540
 TUBIANA, M.
 301, 493, 3725
 TUCA BARCELO, L.
 2737*
 TUCHWEBER, B.
 2034*, 3379*
 TUCKER, O.F.
 3901
 TUCKERMAN, E.
 3785
 TUFFERY, A.A.
 122

TUKEI, P.M.
 3744
 TULUNAY, O.
 4143*
 TULUSAN, A.H.
 5116
 TUMANOV, V.P.
 3000
 TUMILOWICZ, J.J.
 4850
 TUNCBILEK, E.
 1139*
 TUNELL, W.F.
 3446*
 TUOMINEN, F.W.
 2510, 4585*
 TURBERVILLE, C.
 966
 TURBINER, S.
 57
 TURIAF, J.
 5709
 TURNEULL, R.E.
 583*
 TURNER, C.N.
 4166*
 TURNER, H.C.
 584, 2500, 3902, 4663, 5331,
 5886
 TURNER, M.D.
 5320, 5371*
 TURNER, P.
 1175*
 TURNER, W.
 3064, 3102, 3104, 3111,
 3800
 TURPEINEN, O.
 77
 TURUSOV, V.
 350, 962, 3658, 4456*, 5791
 TURUSOV, V.S.
 5186*
 TUTELAYAN, V.A.
 5075
 TUTELAYAN, V.A.
 1621*
 TUYEN, V.VAN
 3085
 TUYNS, A.J.
 218*
 TWADDLE, E.
 1959, 2159*
 TWEDELL, K.S.
 5218
 TWOMEY, J.J.
 2024*
 TYIHAK, E.
 670*
 TYLDESLEY, W.R.
 1232*
 TYNDALL, R.L.
 4046, 4530

TYRAWSKA-SPYCHALOWA, D.	5785, 5983*	6330*
2462*	UMANSKY, YU.O.	UYS, C.J.
TYROU, D.	5348	4912*
3348*	UMEDA, M.	UZMAN, E.G.
TYRRELL, S.	1282*	586*
4538	UMEHARA, S.	UZUNOV, P.
TYUFANDV, A.V.	2602	6159*
5939*	UNDERDOWN, E.J.	VAAGF, J.
TYURINA, V.P.	4753*	2616, 3169, 3931*, 4673,
5398	UNDERWOOD, J.C.E.	4681
UBERTINI, T.F.	3965	VACZI, L.
3125	UNGAR, B.	2639
UCCINI, S.	4781	VACZI, P.
2970	UNGARO, P.C.	6255*
UCHIDA, H.	2654*, 5306	VADLAMUDI, S.
1396	UNGER, F.	4679
UCHIDA, K.	3256	VAGGI, L.
4892*	INTERMAN, D.H.	329*
UCHIDA, T.	4231*	VAGO, J.
4197*	UPCHURCH, H.F.	365*
UCHIYAMA, C.	3374*	VAHERI, A.
4975*	UPDIKE, R.D.	5533*
UEDA, G.	1287*	VAILLE, C.
2416*, 2900*	UPHOFF, D.E.	1275*
UEDA, K.	2652*, 3228*	VAINIO, H.
4104*	UPTON, G.V.	5832*
UEHLINGER, E.	847	VALCO, Z.
6378*	URAGUCHI, K.	1024
UEKI, H.	2354	VALDES, E.
2398*, 3512*	URASINSKI, I.	2252*, 4114*
UENOYAMA, K.	3018*	VALDIMARSSON, H.
3511*, 5607*	URBACH, F.	6117
UETANI, T.	4812	VALDIVIA, E.
1434	URBAN, J.	3551*
UEYAMA, H.	5512*	VALENCAK, E.
5674*	URBAN, J.A.	4113*
UGRYUMOV, E.P.	4224*	VALENSI, G.J.
5289*	URICH, H.	6320*
UHLENBRUCK, G.	1195*, 2287*	VALENTINI, F.
1863*, 5029	URIEL, J.	5614*
UHLIR, K.	762, 5300	VALERIO, M.G.
4848	URIZ, N.	1337, 2811
UI, M.	3635*	VALERIOTE, F.A.
5434	URSU, E.	3466*
UJHAZY, V.	1027	VALLADARES, Y.
2422*, 6019*, 6371*	USHIJIMA, R.N.	5744*
UJIKI, G.T.	3161, 3817	VALLE, R.T.
2061*	USLENGHI, C.	642
UKITA, T.	6145*	VALLEE, G.
2583*, 3840, 4923*, 4924*,	USTACELEBI, S.	2050*
4968*, 6006*	2527	VAN AS, D.
ULDRIKIS, J.R.	UTHMAN, S.M.	105*
3723*	2753	VAN DE BOGART, R.
ULFELDER, H.	UTKIN, O.B.	3704, 5156
2345	5790	VAN DE VELDE, R.L.
ULRICH, K.	UTSUMI, K.R.	5570*
2548, 4629	2021	VAN DEN BOGAERT, P.
ULTMANN, J.E.	UTZ, D.C.	4148*
6016*	4014, 5579*	VAN DEN BORGHE, H.
UMALY, R.	UTZINGER, W.	4502
780*	2136*	VAN DEN BRENK, H.A.S.
UMANSKIY, YU.A.	UYDESS, I.	523*, 4167*

VAN DEN EECKHAUT, J.
4135*

VAN DER HOEDEN, P.
4160*

VAN DER MAATEN, M.J.
3737

VAN DER NOORDAA, J.
4510

VAN DER VEEN, J.
734*

VAN DER VLIET, P.C.
3819

VAN DILLA, M.A.
1440

VAN DUUREN, P.L.
75, 1541, 3647, 5072

VAN FURTHER, R.
4690

VAN HAAGEN, A.
4510

VAN HOYE, W.
4148*

VAN NIEUWSTADT, A.P.
734*

VAN NOORD, M.J.
5686*

VAN NOSTRAND, A.W.P.
5522*

VAN PELT, A.
5202

VAN RIJSSEL, TH.G.
4489

VAN SCOTT, E.J.
4940*

VAN SLYCK, E.J.
4891*

VAN SCHEREN, H.
4510

VAN THIEL, D.H.
295*

VAN VAERENBERGH, P.M.
853

VANA, S.
676*

VANDENABEELE, B.
6130

VANDENBROUCK, C.
3344*

VANDEVOORDE, J.P.
6014*

VANHA-PERTTULA, T.
2039*

VANHOUCHE, J.
1962

VANKY, F.
155, 156, 482

VANTRAPPEN, G.
2220*

VANWIJCK, R.F.
4074*

VARELA NUNEZ, A.
6063*

VARET, B.
2485

VARGA, G.
2074*

VARGA, M.
4157*

VARGA, S.
1138*

VARIAKOJIS, D.
6205*

VAPMUS, H.E.
686, 2553, 3086, 3778

VARTERESZ, V.
3212

VAS, S.I.
2648

VASCONCELOS, E.
6363*

VASIL'EV, YU.M.
5400

VASIL'EVA, N.N.
5106

VASIL'YEV, Y.M.
1468*

VASIL'YEVA, N.N.
70

VASILENKO, I.V.
1162*

VASILENKO, V.KH.
3954*

VASILIEV, I.S.
2663*

VASILIEV, J.M.
281*, 2825

VASILIEV, JU.M.
5834*

VASSALLO, G.
5618*

VASUDEVAN, D.M.
3932*

VASYUTINSKAYA, L.A.
3167

VATTER, A.E.
5447

VAUGHAN, M.H.
1473*

VAUGHAN, M.H., JR.
542

VAUPEL, P.
3581*, 3582*, 4115*

VAWTER, G.F.
2421*, 4060*

VAZQUEZ ARNEDO, M.
6160*

VAZQUEZ, M.
3961*

VEAZEY, R.A.
1283*, 2941

VECCHIO, G.
5347

VECCHIONE, R.
4561

VEDRENNE, C.
6216*

VEDRENNE, CL.
4151*

VEIGEL, J.
6254*

VEISELIER, Y.K.
2663*

VEKSLER, S.A.
3987

VELASCO, M.
3842

VELENA, A.H.
3723*

VELKOV, G.
5423

VENDERLY, C.
3012

VENDRELY, C.
5057*

VENITT, S.
5181

VENKATESAN, N.
642, 1578, 5105

VENKITASUEPAMANIAN, T.A.
1277*

VENNART, G.P.
4911*

VENUAT, A.-M.
3537*, 4041

VENUTA, S.
3128

VEPREK, L.
742*

VERESHCHAGINA, G.V.
3418*, 3485*

VERGAU, W.
517*

VERGER, C.
2606

VERHAGEN, A.
6387*

VERIN, P.
3174

VERIN, PH.
3914*

VERKATSKYY, P.P.
5943*

VERKHATS'KYY, P.P.
5210

VERKHATSKYY, P.P.
5348

VERLEY, J.M.
5015

VERMA, D.P.S.
1684*, 2458

VERMA, I.M.
1012, 5219

VERMA, K.
4273*

VERMEIL, C.
1818

VERNAGE, S.
 2087*
 VERNADAKIS, A.
 2924
 VERNAPELLI, A.
 3564*
 VERNIE, L.N.
 4393, 5166
 VERNIER, P.L.
 1885
 VERNON, L.
 2495
 VERPNLN, N.L.
 3902
 VERNESI, U.
 1227*, 4675
 VERRDUST, P.
 3900
 VESELY, J.
 4466*
 VESKOVA, T.
 1172*
 VESSEL INOVITCH, S.D.
 2326, 4412, 4492, 5152
 VESSEY, M.P.
 1600, 4824
 VESTERGAARD, B.F.
 3864
 VETRAK, J.
 1765*
 VEYS, C.A.
 5012
 VIANNA, N.J.
 6074
 VICK, N.A.
 735*
 VICKER, M.G.
 5905
 VIDA, L.N.
 6128
 VIDINS, E.I.
 3437*
 VIETTI, T.J.
 4352*
 VIEU, F.
 5598*
 VIGANOTTI, G.
 3592*
 VIGIER, P.
 441*, 2552, 2555, 3801,
 5003, 5946*
 VIGLIANI, E.C.
 1288*
 VIGLIANO, E.M.
 3394*
 VIGNAL, J.
 801*
 VIKARI, S.J.
 4065*
 VIKHEPT, A.M.
 6138*
 VIKLICKY, V.
 3905
 VILA, J.
 5624*, 5680*
 VILA-PORCILE, E.
 573*
 VILADIU QUEMADA, P.
 3635*
 VILAIN, C.
 1701, 3632*
 VILCEK, J.
 1038*
 VILDE, F.
 3555*
 VILDOSCLA, J.
 4207*
 VILENCHIK, M.M.
 1284*
 VILKAS, E.
 2330
 VILLA, A.
 473
 VILLA-KOMAROFF, L.
 4583*
 VILLA, M.L.
 1075*
 VILLANUEVA, N.D.
 2024*
 VILLEGARS, J.E.B.
 391*
 VINAS, J.
 5392*
 VINCENT, C.
 2660*
 VINCENT, M.M.
 4724*
 VINCENT, P.C.
 4013
 VINNITSKAYA, V.K.
 5983*
 VINOGRAD, J.
 1444, 4546
 VINOGRADOV, V.N.
 6131*
 VINTER, V.G.
 6351*
 VIOLANTE, A.
 866*, 2239*
 VIRELLA, G.
 176*
 VISEK, W.J.
 2420*
 VISFELDT, J.
 1122, 1995, 5617*
 VISHNYAKOVA, V.V.
 5501*
 VISWANATHAN, L.
 1277*
 VITAK, M.J.
 6077
 VITRY, F. DE
 2725*
 VIVAPELLI, F.
 2714*, 2715*
 VIVIAN, A.D.
 1954
 VIZA, D.
 4522
 VLADIMIROV, Y.A.
 5790
 VLAEMINCK, M.N.
 362, 4139*, 6187*, 6285*
 VLAHAKIS, G.
 4577
 VLCKOVA, I.
 3042
 VCEIKOV, V.L.
 2058*, 4866
 VOFLKEL, E.F.
 3351*
 VOGEL, C.L.
 891*, 3166, 3865, 4644,
 4657, 4882*
 VOGEL, F.
 1619*
 VOGEL, H.H., JR.
 941
 VOGEL, H.H. JR.
 2454
 VOGELPOEL, L.
 4912*
 VOGLER, W.R.
 546*, 5511*
 VOGT, M.
 5235
 VOGT, P.K.
 1707, 1743, 2522, 3052
 VOIGT, W.-H.
 5203
 VOLEGOV, A.I.
 3195
 VOLFSON, N.I.
 5751*
 VOLKERS, S.A.S.
 1971
 VOLKOVA, M.A.
 4182*
 VOLM, M.
 3589*, 6243*
 VOLOBOYEVA, A.O.
 5210
 VON ARDENNE, M.
 6181*
 VON BOEHMER, H.
 4696
 VON ESCH, A.M.
 634
 VON GRAWERT, H.
 5431
 VON HAAM, E.
 5083
 VON HEYDEN, H.W.
 3746
 VON KLEIST, S.
 475, 4624, 4755*

ON SANDERSLEBEN, J.
 4268*
 ONKA, V.
 3042, 3101
 ORNGVITSKAYA, G.I.
 4845
 ORONINA, F.V.
 5997*
 ORONOV, S.A.
 6374*
 ORONOVA, L.A.
 3292
 ORWALD, A.J.
 2333
 ORWERK, P.
 6081
 OSE, B.M.
 5332
 OSS, H.J.
 5553*
 OTRIN, I.I.
 2182*, 4840
 OUTSADAKIS, A.
 5390*
 OZNESENSKII, A.N.
 5465*
 RANA, M.
 1786, 5323
 RIES, J.E. DE
 2710*
 ROUSOS, C.
 2912*
 RILLAUME, M.
 3402*
 RILLEMIN, P.
 2912*
 RILKOV, I.
 2083*
 ROPID, P.
 4627
 RORI, J.
 4065*
 RORI, J.V.A.
 2798*
 RETKOVA, O.P.
 5348
 RSHESLAVOVA, M.YA.
 2442*
 RALKES, T.P.
 631
 RCHER, A.
 2093*
 RCHTEL, S.S.
 152
 RCKER, A.
 66, 3444*
 RDA, A.
 4987*
 RDELL, W.R.
 6329*
 RDELL, G.
 1070*, 4563, 5986*

WADSWORTH, E.M.
 5351
 WAGES, B.
 4970*
 WAGGENER, J.D.
 5469*
 WAGGONER, D.E.
 764
 WAGGONER, D.F.
 5969
 WAGHE, M.A.
 4731*
 WAGNER, H.
 4667, 5211
 WAGNER, H.P.
 3391*
 WAGNER, J.C.
 386*, 3651, 4303
 WAGNER, M.M.F.
 3651
 WAGNER, V.
 3215
 WAGNEROVA, M.
 3215, 4118*
 WAHAL, P.K.
 1423*
 WAHEED, W.A.
 1034
 WAHI, P.N.
 96*, 4828*
 WAHLBERG, J.E.
 4475*
 WAHREN, B.
 1848*, 5066*, 5069*
 WAISMAN, J.
 1078*, 3372*
 WAITE, R.G.
 4996*
 WAKEFIELD, J.ST.J.
 4431
 WAKONIG-VAARTAJA, T.
 5723*
 WALBOOMERS, J.M.M.
 4510
 WALBORG, E.F., JR.
 2731*, 4864
 WALBURG, H.E., JR.
 4999*, 5113
 WALDENSTROEM, J.
 489*
 WALDER, B.K.
 2642
 WALDMANN, T.A.
 748
 WALES, J.H.
 376*, 5827*
 WALFORD, R.L.
 1843*, 5727*
 WALIGUNDA, J.
 4091*
 WALKER, E.M.
 2363

WALKER, I.R.
 4781
 WALKER, J.L.
 693, 2517
 WALKER, M.
 5729*
 WALKER, T.A.
 2563*
 WALL, R.
 430
 WALLACE, A.C.
 1846*, 2617, 3924*
 WALLACE, D.C.
 250
 WALLACE, R.E.
 3872
 WALLACE, W.C.
 4379
 WALLACE, W.F.M.
 1102
 WALLCAVE, L.
 2978, 3690
 WALLER, D.K.
 5977
 WALLER, R.E.
 5018
 WALLING, M.J.
 1694, 4556
 WALLIS, C.
 2694*
 WALLIS, V.J.
 4666
 WALSH, E.OOF.
 2319
 WALSKI, M.
 2029*
 WALTER, C.A.
 5629*
 WALTERS, J.L.
 3946
 WALTERS, M.K.
 694
 WALTERS, M.N-I.
 1368*
 WANDSCHNEIDER, G.
 6258*
 WANE, A.-B.
 3157
 WANG, C.C.
 4094*
 WANG, C.H.
 664*, 1049, 1052
 WANG, C.S.
 3738
 WANG, D.Y.
 2636
 WANG, F.
 5086
 WANG, I.Y.
 4362, 5835*
 WANG, J.J.
 4230*, 4737*

WANG, T.Y.
4090*, 4841
WANGEL, A.G.
5386*
WAPNICK, S.
6079
WAKABIGKA, K.
3491*
WAKBRICK-SMITH, D.
1273
WARD, D.C.
4017
WARD, P.A.
2688*
WARD, P.
3105
WARFIELD, D.T.
1359*
WARMAAR, S.O.
4539
WARNER, G.A.
4671
WARNER, N.L.
2629, 3180, 3853, 5314,
5978
WARRAM, J.H., JR.
2783*
WARREN, L.
1738
WARREN, S.
674, 1302, 2457
WARTIOVAARA, J.
4797*
WARWICK, G.P.
958, 1514
WARZOK, R.
1409, 1888, 4102*, 4856,
5111, 5118, 5765, 5830*
WASHIDA, F.
4104*
WASHINGTON, L.P.
2196*
WASHINGTON, S.L.A.
3441*
WASHIO, M.
6154*
WASSERMAN, A.E.
2321
WATABE, H.
955, 3320
WATANABE, H.
4936*
WATANABE, K.
5119, 5523*, 5781, 5783
WATANABE, M.
1983, 4388, 4986*, 5165,
5540*
WATANABE, S.
4811, 5312
WATANABE, T.
1554, 4704
WATANBE, H.

199
WATERHOUSE, C.
1171*
WATERHOUSE, J.A.H.
524*, 5426
WATERS, H.
5727*
WATERS, L.C.
2565*
WATERS, T.D.
3740
WATKINS, D.K.
2480*
WATKINS, E., JR.
1864*
WATNE, A.L.
3203
WATRAS, J.
3030
WATSON, E.S.
4668
WATSON, F.R.
195*, 4822
WATSON, J.
4656, 4868
WATSON, J.D.
1017
WATSON, K.F.
1352*, 3769, 5214, 5233,
5234
WATSON, R.E., JR.
6307*
WATTENBERG, L.W.
369*, 2302
WATTENBERG, L.W.
3689
WATTERS, C.
1130
WATTRE, P.
5301
WAWRZENCZYK, B.
6184*
WAYMIRE, J.C.
4998*
WAYSS, K.
3589*, 6243*
WEAVER, C.
3126
WEAVER, C.A.
1330
WEBB, M.
3702, 3706, 4448
WEBB, S.J.
1169*
WEBB, T.E.
4943*, 5620*
WEBER, C.
5601*
WEBER, G.
578*, 4857, 4989*, 5516*,
6141*
WEBER, J.

705, 3039
WEBER, M.
3128
WEBER, M.J.
5248
WEBNER, D.L.
3143
WEBSTER, J.
2246*
WEBSTER, R.G.
1781
WECHSLEP, H.L.
192*, 3533*
WECHSLER, W.
1491*, 1588, 1589, 2070*,
5167, 5277, 5363, 5789
WEDDERBURN, N.
1801
WEE, G.B.
3890
WEGNER, K.
519*, 1550
WEHNER, H.
3453*
WEHNER, I.
3453*
WEIDENBACH, W.
4258*
WEIDER, R.
2981
WEIDNEROVA, K.
3114
WEIGENT, C.E.
4192*
WEIGLE, W.O.
2653*
WEIKEL, J.H., JR.
4193*
WEIL, R.
434, 2560, 3534*, 5051*,
5503*
WEILAND, L.H.
880*, 4889*
WEILER, J.
6195*
WEILER, O.
3100, 3214
WEIN, A.J.
1507
WEINBERG, F.
5262
WEINBERG, R.A.
4539
WEINBREN, K.
3441*
WEINBURG, A.
402
WEINDLING, H.K.
2473*
WEINER, F.
4027
WEINER, L.P.

4517
 WEINERMAN, B.
 3185
 WEINFELD, H.
 541
 WEINHOUSE, S.
 624*, 5011, 5339, 5538*
 WEINSTEIN, A.J.
 3764
 WEINSTEIN, C.
 5455
 WEINSTEIN, I.B.
 3705, 3772, 4017, 5810
 WEINTRAUB, B.
 295*
 WEINTRAUB, L.R.
 4039
 WEINZIERL, S.
 4448
 WEINZIERL, S.M.
 3706
 WEISEROT, I.M.
 4793
 WEISBURGER, J.H.
 304, 969, 2704*, 4626,
 4732*, 5335
 WEISBURGER, J.J.
 3670
 WEISE, W.
 571*, 6197*
 WEISE, W.-R.
 4286*
 WEISENTHAL, L.M.
 3999
 WEISER, R.S.
 2673*
 WEISGERBER, C.
 899*
 WEISGERBER, CH.
 4176*
 WEISS, B.
 1750
 WEISS, B.G.
 2463*
 WEISS, D.W.
 4620
 WEISS, E.
 3700
 WEISS, L.
 753, 1969, 1996, 2086*,
 2881, 3382*
 WEISS, M.
 3207
 WEISS, M.C.
 242, 2056*, 4190*, 4259*,
 4849
 WEISS, M.H.
 5560*
 WEISS, R.A.
 1707, 1742, 3778
 WEISS, R.B.
 4937*

WEISS, W.
 1109*, 1942*
 WEISSBACH, A.
 680, 1958, 3766, 5220,
 6286*
 WEISSBERG, M.
 5145
 WEISSLEDER, H.
 4081*
 WEISSMAN, B.
 1308*
 WEISSMAN, S.M.
 1358*
 WEITZNER, S.
 2452, 6296*
 WEKSLER, M.E.
 3394*
 WELCH, R.
 306
 WELCH, R.M.
 5133
 WELFLE, H.
 1429
 WELLER, T.H.
 3605
 WELLINGS, S.R.
 4804*
 WELLS, D.G.
 1795
 WELLS, R.D.
 3073
 WELSCH, C.W.
 1300*, 2306, 2344
 WELSH, I.R.H.
 3478*
 WELSH, R.A.
 3948
 WENDEL, H.A.
 5775
 WENDER, M.
 6170*
 WENDLING, F.
 2507, 4503
 WENGLER, G.
 2189*
 WENK, R.
 63
 WENZEL, G.
 3242*
 WEPSIC, H.T.
 5561*
 WERDER, H.
 6094*
 WERNER, D.
 2169*
 WERNER, P.-E.
 3057
 WERRINGLOER, J.
 1138*
 WESCH, H.
 6243*
 WESCOTT, W.B.

1518*
 WESSEL, W.
 3724*
 WESSELY, Z.
 4435
 WEST, W.L.
 6114
 WESTERMARK, P.
 1442, 1952, 3420*
 WESTON, B.J.
 4666
 WESTPHAL, H.
 5030*
 WETLI, C.V.
 3409*
 WETTER, O.
 2090*, 3222*, 6040*, 6044*,
 6386*
 WETZER, K.
 5658*
 WEXLER, H.
 854
 WEYLAND, P.
 5076
 WEZYK, J.
 5593*
 WHANG-PENG, J.
 160, 227, 4021, 4172*
 WHEATLEY, D.N.
 4414
 WHEELER, G.P.
 2368*, 4068*
 WHEELOCK, E.F.
 5979
 WHERRETT, J.R.
 4587*
 WHIMSTER, W.F.
 3253
 WHITAKER, R.H.
 1450*
 WHITE, A.
 5549*
 WHITE, J.E.
 4827*
 WHITE, J.L.
 2685*
 WHITE, M.
 1348
 WHITE, M.H.M.
 2592*
 WHITECAR, J.P.
 1395
 WHITEHEAD, E.D.
 6320*
 WHITEHEAD, R.
 6337*
 WHITEHEAD, T.P.
 240
 WHITEHOUSE, J.M.A.
 3860, 5319
 WHITFIELD, J.F.
 2001

WHITFORD, T.W., JP.
 4212*
 WHITLOCK, J.P.
 4443
 WHITMIRE, C.E.
 2500, 2964, 3848, 5149,
 5331
 WHITMORE, W.F., JR.
 512
 WHITNEY, R.B.
 3186
 WHITTEN, H.D.
 4668
 WHITTY, A.J.
 5640*
 WIBLIN, C.N.
 4562
 WICKER, R.
 2574*, 2585*, 3092, 4568
 WICKLIFFE, C.
 2580*
 WICKRAMASINGHE, S.N.
 1975
 WICKS, W.D.
 4011
 WIDDOP, B.
 938
 WIDEL, M.
 3030
 WIDMAIER, R.
 5764
 WIEBEL, F.J.
 348
 WIECKOWSKA, Z.
 1938*
 WIEDERMANN, G.
 778*
 WIENER, N.
 4998*
 WIER, K.A.
 1668
 WIERCINSKI, J.
 4131*
 WIERNIK, P.H.
 2635
 WIGAND, R.
 6002*
 WIGZELL, H.
 3226*
 WIKMAN, J.
 1064
 WILBANKS, G.D.
 3815
 WILBERT, S.M.
 2513, 3063, 3088
 WILBUR, J.
 2115*, 5432
 WILBUR, J.P.
 158, 401, 1697
 WILCHEK, M.
 665*
 WILDE, R.A. DE

3517*
 WILDNER, G.P.
 1550, 4442
 WILFONG, R.F.
 5277
 WILHELM, G.
 1170*
 WILHELM, J.A.
 588*, 589*
 WILKIE, N.M.
 2541
 WILKINS, R.J.
 2464*
 WILKINSON, R.
 3009
 WILKINSON, T.
 4325*
 WILLIAMS, A.E.
 240
 WILLIAMS, A.O.
 1392, 3983*
 WILLIAMS-ASHMAN, H.G.
 5516*
 WILLIAMS, C.E.
 1644*
 WILLIAMS, D.
 5731*
 WILLIAMS, D.E.
 3198, 3896
 WILLIAMS, D.F.
 29*
 WILLIAMS, D.R.
 1504
 WILLIAMS, E.H.
 3744
 WILLIAMS, G.H.
 1414
 WILLIAMS, G.M.
 969, 4389, 4626
 WILLIAMS, J.F.
 2527
 WILLIAMS, K.
 371*
 WILLIAMS, P.D.
 36
 WILLIAMS, R.
 6301*
 WILLIAMS, R.E.O.
 611
 WILLIAMS, S.N.
 42
 WILLIAMS, T.
 3957*
 WILLIAMS, W.C.
 3784, 5212
 WILLIAMSON, A.R.
 4709*
 WILLIAMSON, E.O.
 3467*, 4220*
 WILLIAMSON, J.G.
 5621*
 WILLSON, M.A.

2109*, 3393*
 WILLSON, R.L.
 2465*
 WILMANN, W.
 4282*
 WILSON, C.B.
 4200*
 WILSON, D.E.
 2494
 WILSON, F.D.
 101
 WILSON, H.E.
 6308*
 WILSON, H.R.
 3729
 WILSON, J.B.
 5690*
 WILSON, J.D.
 1829
 WILSON, J.F.
 3763
 WILSON, J.S.P.
 4350*
 WILSON, K.J.
 3775, 4089*
 WILSON, P.D.
 6335*
 WILSON, R.B.
 940
 WILSON, R.E.
 4074*
 WILSON, S.H.
 3103, 6288*
 WILSON, S.K.
 2611
 WINAWER, S.J.
 3239
 WINKELMANN, R.K.
 3786, 4215*
 WINKELSTEIN, A.
 2140*
 WINKLER, H.
 6035*
 WINKLER, K.
 3986
 WINNACKER, E.L.
 726
 WINOCOUR, E.
 2491, 3816, 4539
 WINTERS, A.L.
 3046
 WINTERSGILL, C.J.
 5898
 WIRJADI, J.H.
 2757
 WIRTHLIN, L.S.
 3788
 WISCH, N.
 2129*
 WISEMAN, C.
 4235*
 WISEMAN, N.

2185*	6279*	WOODS, W.A.
ISEMAN, R., JR.	WOLFE, L.G.	2549, 3064
1283*	1320, 1339, 3153*, 3806,	WOODSIDE, N.
ISSEMAN, C.L., III	4532, 4572, 5282*	1694
6077	WOLFENSTEIN, C.	WOODWARD, A.H.
ISSLER, R.W.	2674*	5565*
3211	WOLFF, E.	WOODY, H.B.
ITHERS, H.R.	2822	1140*, 1177*
106*	WOLFF, G.	WOOLF, A.
ITKOWSKI, R.	3426*	4584*
246	WOLFF, G.L.	WOOLNER, L.B.
ITSCHI, H.	4836*, 5000*, 5514*	214*
5192*	WOLFF, J.A.	WOOLUM, J.C.
ITSCHI, H.P.	306	2366*
1538	WOLFF, J.P.	WORANOOJ, U.
ITTCLIFF, J.L.	2840	4884*
6116	WOLFF, J.-P.	WOROWSKI, K.
ITTE, I.	3629*	859*, 3471*, 5450
2927	WOLFF, M.	WORST, P.
ITTE, S.	1091*, 2973, 5628*	6049*
181*, 1148*, 3364*, 4141*	WOLKE, R.E.	WORTH, A.J.
ITTER, R.L.	4506	5794
5282*, 5284*	WOLLEMAN, M.	WOSORNU, J.L.
ITTING, U.	3443*	3257
6395*	WOLLENBERGER, A.	WOSTMANN, B.S.
ITTLIFF, J.L.	980*	2689*
5513*	WOLLOCH, Y.	WOTKE, R.
ITZ, I.P.	4982*	6107*
3862	WOLMAN, S.R.	WOYKE, S.
IVEL, N.A.	46, 3469*	2028*, 2157*, 2197*, 3497*,
2492, 5880	WOLTER, J.R.	5592*, 6207*
OGAN, G.N.	865*, 3549*	WOZNIAC, A.K.
511, 954, 2767, 2768, 3008,	WOO, J.	4283*
3673, 4418, 5152, 5153,	4711*	WOZNIAKOWSKA, Z.
5174, 5335	WOO-MING, M.	3415*
OHLENBERG, C.	3253	WRAY, G.
1810, 4581*	WOOD, M.L.	6330*
OHLENBERG, H.	3686	WRAY, V.L.
5108, 5162	WOOD, N.	4557
OHLRAB, F.	6009*	WRAY, V.P.
6220*	WOOD, R.	4864
OHLRAB, W.	4918*	WRBA, H.
4179*	WOOD, S., JR.	2707*
ODDALSKI, J.	2908, 4962*, 6310*	WRENCH, C.
6213*	WOOD, W.S.	3676, 4383
ODJAROWSKA, M.	6029*	WRIGHT, C.-S.
2011	WOODBURY, J.W.	3928*
ODKE, P.A.	2277*	WRIGHT, D.H.
4865	WOODING, W.L.	907
OLANSKY, D.	1613*	WRIGHT, E.B.
571*	WOODLIFF, H.J.	2447*
OLF, C.	5448	WRIGHT, P.W.
1067*	WOODMAN, R.J.	458, 715, 3909
OLF, G.	829	WRIGHT, R.C.
4378	WOODROFFE, A.J.	1110*
OLF, H.	3520*	WRIGHT, R.G.
5908	WOODRUFF, J.D.	4592*
OLF, H.G.	1445, 3940, 6324*	WRIGLEY, N.G.
101	WOODRUFF, M.F.A.	1353*
OLF, M.	5315	WU, Y.H.
1067*, 3588*, 5420	WOODS, D.A.	5195*
OLFE, L.	96*	WUEST, G.P.

6398*
 WUNDERLICH, J.R.
 162, 3861, 4674
 WUNDERLICH, V.
 2618, 5024
 WURNIG, P.
 5428*
 WYBRAN, J.
 6017*
 WYKLE, R.L.
 2379*
 WYLLIE, A.H.
 5020
 WYNDER, E.L.
 512, 2901, 2958, 3604, 3668,
 4478*, 5010
 WYS, W.D. DE
 2855
 WYS, W.D. DE
 3377*
 WYSS, M.
 3173
 XAVIER, R.G.
 1141*
 XERRI, L.
 2308
 YABE, Y.
 4579*
 YABLONOVSKAYA, L.Y.
 1416*
 YABLONOVSKAYA, L.YA.
 1606*
 YABLONSKI, M.
 3260
 YABUKI, Y.
 1373
 YACHNIN, S.
 3224*
 YAGI, Y.
 4704
 YAKOVLEVA, M.P.
 1161*
 YAKULIS, V.
 4765*, 4766*
 YAKULIS, V.J.
 773*
 YAM, C.
 5480*
 YAM, L.T.
 2091*, 4950*, 6332*
 YAMADA, K.
 1434
 YAMADA, R.
 1123
 YAMADA, S.
 2960, 2965, 5089
 YAMAGATA, T.
 297*
 YAMAGUCHI, N.
 4589*, 5253
 YAMAKAWA, M.
 3094, 3133
 YAMAMOTO, H.
 2529
 YAMAMOTO, K.
 1025
 YAMAMOTO, N.
 4395, 4419
 YAMAMOTO, R.S.
 969, 3670, 4389, 4732*
 YAMAMOTO, S.
 2564*, 5243, 5909
 YAMAMOTO, T.
 1660, 1937*, 2575*, 3633*,
 4589*, 4816, 5253, 5678*
 YAMAMOTO, Y.
 1372, 1373, 3429*
 YAMAMURA, Y.
 3696, 4010, 4384, 4922*,
 5505*
 YAMANAKA, Y.
 2888*
 YAMANE, Y.
 2982
 YAMANISHI, Y.
 3528*, 5600*, 5604*
 YAMANOUCHI, K.
 135*, 5923
 YAMAOKA, T.
 838
 YAMASAKI, T.
 4382
 YAMASHINA, I.
 5534*
 YAMASHITA, H.
 4722*
 YAMASHITA, J.
 2015, 3304
 YAMASHITA, T.
 1335
 YAMASHITA, U.
 3863
 YAMAURA, H.
 1168*
 YAMSKOVA, V.P.
 368*
 YANAGI, S.
 1551, 5539*, 6126
 YANAGIDA, H.
 6223*
 YANAGIHARA, E.
 5532*
 YANAGIMACHI, K.
 1278*
 YANAI, R.
 154, 2305, 2975
 YANG, C.-P.
 2087*
 YANG, C.S.
 1049
 YANG, C.-S.
 1382, 1383
 YANG, C.S.
 2540
 YANG, M.G.
 4330*
 YANG, S.S.
 3742, 3790
 YANG, T.J.
 2648
 YANG, W.-K.
 2565*
 YANIV, A.
 5214, 5233, 5234
 YANKEE, R.A.
 3861
 YANYSHEVA, N.YA.
 3021*, 5002
 YAP, E.H.
 4683
 YARINGTON, C.R., JR.
 917*
 YARINGTON, C.T., JR.
 2790*, 4358*
 YARKONI, E.
 2330
 YASUHIRA, K.
 2370*
 YASUKAWA, S.
 4453*
 YASUZUMI, G.
 6367*
 YATANI, R.
 1306, 1676*
 YATES, V.J.
 111, 1314, 3130, 4506
 YAU, P.K.S.
 6364*
 YAU, T.M.
 5248
 YAVELOV, V.A.
 6131*
 YAVUZ, H.
 5648*
 YAVUZGIL, C.
 3456*
 YAZDI, E.
 244, 1428, 4425
 YEGHIAYAN, E.
 51
 YEH, S.
 1087
 YELTON, D.B.
 5261
 YENOKHOVICH, V.A.
 6151*
 YEOMANS, F.
 5479*
 YERMAKOVA, G.L.
 4180*
 YEUNG, D.
 1611*
 YEVIICH, P.P.
 4808
 YEVSEYEVA, N.K.
 100

YIELDING, K.L.	4683	5370*
1536, 5139	YU, W.L.	ZAMCHEK, N.
YGEESWARAN, G.	877*	1839, 1869*
4587*	YUASA, S.	ZAMECNIK, P.C.
YGO, H.	2783*	1705, 3788
838	YUDIN, I.YU.	ZAMORAND, L.
YHN, D.S.	5602*	6146*
705, 708, 3039, 3066, 4710*,	YUHAS, J.M.	ZANAMWE, L.N.D.
5267, 5292	5418	6079
YKOCHI, T.	YUKAS, J.M.	ZANARDI, S.
5098	4618	3016*
YKOMURA, E.	YUMINER, B.	ZANDANELL, E.
3094, 3133	313*	4150*
YKOTA, Y.	YUNDA, I.F.	ZANELLA, A.
1432, 1433, 4361, 4372,	3952*	3084
4385	YUNICHEVA, R.KH.	ZANETTI, M.
YKOYAMA, M.	5425	1344, 2236*
1123, 3318	YUNIS, A.A.	ZANG, K.D.
YKOYAMA, T.	1446*	2876
4721*	YUNIS, E.J.	ZANJANI, E.D.
YNGCHAIYUDHA, S.	477, 1435, 3960*, 6009*	1849*
198	YURKIVS'KA, T.M.	ZANKL, H.
YNKERS, A.J.	4440	2876
4358*	YURLOVA, T.I.	ZARAPICO, M.
YOO, T.J.	2577*, 3826*	2248*
784*	YUS, E.S.	ZARZYCKI, D.
YOSHIDA, H.	257*	4602*
3460*	YUTOKU, M.	ZATSEPIN, N.I.
YOSHIDA, O.	5312	3167, 3200
32*, 305	YUZHANINA, T.A.	ZATSEPIN, S.T.
YOSHIDA, T.O.	6256*	1467*
1049, 1052, 1382, 2021,	ZABEL-LANGHENNIG, R.	ZATZ, M.M.
3869, 5204, 5904	1888	5549*
YOSHIDA, Y.	ZABEL, R.	ZAUDERER, M.
438	246, 600*	4238*
YOSHII, Y.	ZACARIAN, S.A.	ZAVADA, J.
1141*	4695	4771*
YSHIKAWA-FUKADA, M.	ZACCHEROTTI, L.	ZAVADINA, S.P.
423	3949	1568
YSHIKURA, H.	ZACHO, A.	ZAVADOVA, H.
837, 4567	384*, 1290*, 2385*	3042
YSHIMURA, Y.	ZADOR, S.	ZAVADSKAYA, YU.S.
960	2247*	572*
YSIDA, T.H.	ZAGURY, D.	ZAVALA, C.
2015, 5525*, 6295*	5365	4243*
YOUN, J.K.	ZAHN, R.K.	ZAWIDZKA, Z.Z.
1003	411	5531*
YOUNG, C.W.	ZAJDEL, S.	ZAWIRSKA, B.
21*	4794	5085
YOUNG, D.	ZAJDELA, F.	ZAWROCKA-WRZOLKOWA, T.
435	39, 338, 2265*, 3699	2889*
YOUNG, L.	ZAJICEK, J.	ZBAR, B.
3067	2080*	3877, 4650, 4655
YOUNG, S.	ZAKHAROV, A.F.	ZBARSKIY, I.B.
3006	3310	6236*
YOUNGHUSBAND, H.B.	ZAKHAROVA, A.V.	ZBARSKYY, I.B.
1005, 1353*	562*	5700*
U, C.T.	ZALDIVAR, R.	ZBINDEN, G.
277*	941, 1892	920*
U, L.C.	ZALUSKY, R.	ZERANCA-TOPORAS, E.
4943*	1849*	5594*
U, M.	ZAMCHECK, N.	ZECCHIN, R.

4288*	ZIL'BERT, N.I.	ZUCKER, S.
ZECHNER, G.	3578*	4039
2268*	ZILJFYAN, V.N.	ZUCKERMANN, C.
ZEDECK, M.S.	3831*	5597*
5128	ZILLIKEN, F.	ZUELCH, K.J.
ZEE, Y.C.	5552*	1156*, 5719*
101	ZIMBER, A.	ZULAWSKA, M.
ZEFIROVA, N.P.	2420*	4251*
4121*	ZIMBER, P.	ZULCH, K.J.
ZEIGEL, R.	5512*	5107, 5110
2086*, 2881, 5924	ZIMMER, M.	ZUMPFT, M.
ZEIGER, E.	5860*	753
636, 4381	ZIMMERER, J.	ZUNINO, F.
ZEITLIN, B.R.	6243*	2504, 3787
5795	ZIMMERMAN, D.H.	ZUR HAUSEN, H.
ZEITOUN P.	2048*	5225
5365	ZIMMERMAN, H.A.	ZVEKOTKINA, L.S.
ZELECHOWSKA, J.A.	4075*	2842
5591*	ZIMMERMAN, L.E.	ZWAN, A. VAN DER
ZELIKSON-SINGER, S.	4076*, 5643*	3436*
2758	ZIMMERMANN, K.G.	ZWART, P.
ZELJVIN, B.M.	5701	3513*
2156*	ZINNEMAN, H.H.	
ZELLER, E.	603	
1843*	ZINTL, F.	
ZELLER, W.J.	2682*, 3847	
5144	ZIPP, P.	
ZELLJADT, I.	169*	
138*, 1694	ZIPPIN, C.	
ZEMAN, R.C.	1304, 2114*, 3273	
1000*	ZIPRIN, R.	
ZEMAN, V.	1858*	
676*	ZIPURSKY, A.	
ZEMBUROWA, K.	1804	
1076*	ZIRONI, A.	
ZEMSKOV, V.M.	4341*	
2663*	ZISSIADIS, A.G.	
ZER, M.	3577*	
4982*, 6357*	ZITTOUN, R.	
ZHELEZNOV, B.I.	4079*, 5062*, 6163*, 6164*	
5058*	ZLOTNICK, A.	
ZHEMALETDINOV, F.G.	5492*	
6185*	ZOBL, H.	
ZHIRNOVA, N.E.	5266, 5955*, 5956*	
5095	ZOIDIS, T.	
ZHIVKOV, V.	6111	
5499*, 5500*	ZORINA, L.A.	
ZHUBANOVA, A.A.	3367*	
4845	ZORRILLA, E.	
ZHUKHINA, G.YE.	2378*	
5044*	ZOTTER, S.	
ZIDERMANE, A.A.	5211	
3723*	ZOTTER, ST.	
ZIEGLER, I.	5884	
3991	ZOUPANOS, G.	
ZIEGLER, J.L.	1482*	
400, 781*, 891*, 1094, 2906,	ZSCHIESCHE, W.	
4657, 4786, 4789	1545	
ZIEVE, F.J.	ZSIGMOND, G.	
4380	1138*	
ZIFF, M.	ZUBERI, S.	
1778*	6306*	

SUBJECT INDEX

- ABDOMINAL
TUMOR, CHILDREN (2005)
- ACANTHOMA
HISTOLOGY, NAEVUS-SEBACEOUS-LIKE
FORMATIONS, CASE REPORTS (4111)*
ICHTHYOSIS, LOWER LIMBS, HISTOLOGY,
CASE REPORTS (4215)*
- 2-ACETAMIDOFLUORENE
BINDING
LIVER, NUCLEIC ACID,
3-METHYLCHOLANTHRENE,
DIET, RAT (1283)*
NUCLEAR ACIDIC PROTEIN, LIVER,
RAT (0936)
LIVER CARCINOMA, PHENOBARBITAL,
RAT (1244)
- 2-ACETAMIDONAPHTHALENE
METABOLISM, DOG (5092)
- 4-ACETAMIDOSTILBENE
RING METHYLTHIO-SUBSTITUTED
DERIVATIVE, SYNTHESIS (0950)
- N-ACETOXY ACETYLAMINOFLUORENE
DNA REPAIR, LYMPHOCYTE, PYRIMIDINE
ISOSTICHS, THYMIDINE LABELING, HUMAN
(1297)*
- N-ACETOXY-N-2-ACETYLAMINOFLUORENE
POLYADENYLIC ACID, INTERACTION
(0388)*
- N-ACETOXY-2-FLUORENYLACETAMIDE
DNA BINDING, LIVER (5825)*
NEOPLASTIC TRANSFORMATION, CLONED
CELL LINES, MOUSE (5770)
- N-ACETOXY-N-2-FLUORENYLACETAMIDE
MUTATION, TRANSFORMATION, MAMMALIAN
CELLS (3646)
- N-ACETYL-4-AMINOBIIPHENYL
MITOCHONDRIAL INTERACTION, RAT LIVER
(3675)
- ACETYLAMINOFLUORENE
HEPATOCARCINOGENESIS, PHENOBARBITAL
PROMOTION, RAT (0934)
- N-ACETYLAMINOFLUORENE
TOBACCO, CYTOKININ (1612)*
- N-ACETYL-2-AMINOFLUORENE
MUTAGENIC PROPERTIES, MOLECULAR
MECHANISM, CARCINOGENESIS,
DROSOPHILA (2340)
- N-2-ACETYLAMINOFLUORENE
RNA MODIFICATION, CIRCULAR DICHROISM,
PROTON MAGNETIC RESONANCE (3705)
- 2-ACETYLAMINOFLUORENE
HEPATIC ACTIVITIES OF 1-CARBON ENZYMES
RAT (3022)*
HYPERPLASTIC NODULE FORMATION,
REGENERATING LIVER, RAT (5848)*
INDUCED TUMORS, EFFECT OF FATTY ACIDS,
RAT (2442)*
LIVER
ADENYL CYCLASE, ADRENALIN RESPONSE
RAT (5125)
CHOLANGIOCARCINOMA, HAMSTER
(0087)*
DNA-BINDING, RNA-BINDING, CARCINO-
GENESIS, 3-METHYLCHOLANTHRENE,
RAT (2941)
LIVER TUMORS, INDUCTION MECHANISM, RAT
(3716)*
METABOLITES, MUTAGENICITY, SALMONELLA
(5787)
PHENOBARBITAL, LIVER TUMOR, RAT (5084)
URINARY BLADDER CARCINOGENESIS,
HAMSTER (4376)
- 4-ACETYLAMINOFLUORENE
PANCREAS, ACINAR CELL, RAT (5169)
- N-ACETYLNEURAMINIC ACID
LECITHIN MONOLAYER, INTERACTION,
CATIONS, MALIGNANT BEHAVIOR EFFECTS
(0853)
PROTEOLYTIC PRODUCTS, TUMOR CELL
MEMBRANES (3509)*
- ACIDITY
DEPENDENCE, GLYCOLYSIS, EHRlich
ASCITES TUMOR, MOUSE (1170)*
GROWTH, CONTACT INHIBITION INDUCTION,
HUMAN (1115)
- ACNE
THYROID CANCER, EPIDEMIOLOGY
(1422)*
- ACTINOMYCIN D
ACID PHOSPHATASE INDUCTION, LEUKEMIA,
CELLS, MOUSE (5698)*
ARYL HYDROCARBON HYDROXYLASE,
POLYCYCLIC HYDROCARBON,
RAT LIVER (1241)
AUTORADIOGRAPHY, CELL CULTURE, CELL
SIZE AND PROLIFERATION, LEUKEMIC
CELLS, RNA SYNTHESIS (0545)
CELL CYCLE PHASE PROGRESSION,
LEUKEMIC CELL, MOUSE (1630)*
7,12-DIMETHYLBENZ(A)ANTHRACENE, SKIN,
TUMOR INHIBITION, PERSISTENCE, MOUSE
(5072)
7,12-DIMETHYLBENZ(A)ANTHRACENE-INDUCED
TUMORS, RAT (2395)*
KERATOACANTHOMA, VITAMIN A,
ACTINOMYCIN D, RABBIT (0869)*
MOLONEY VIRUS, CELL TRANSFORMATION,
IN VITRO (0339)
NEOPLASTIC CELLS, PROLIFERATION,
DEVELOPMENT (3366)*
PROTEIN METABOLISM, NUCLEOLUS, HELA
CELL (1127)
RNA DEGRADING ENZYMES, ACTIVITY
CHANGES, EHRlich ASCITES CELLS,
MOUSE (2980)
RNA SYNTHESIS, INHIBITION, LEUKEMIA,
HUMAN (0226)
THYROXINE, TUMOR CELL MITOTIC
ACTIVITY, IN VITRO (0231)
- ADENINE
PROTEIN SYNTHESIS, NORMAL CELLS,
TUMOR CELLS, RAT (5583)*
- ADENOACANTHOMA
PANCREAS, HUMAN (3412)*
- ADENOCARCINOMA
BREAST, WOMEN UNDER 30, CLINICAL STUDY
(6195)*
CARCINOEMBRYONIC ANTIGEN, HUMAN (3846)
CERUMINOUS GLANDS, ULTRASTRUCTURE,
CASE REPORT, HUMAN (3409)*
CHRON'S DISEASE, INTESTINE,
CASE REPORT (1149)*
COLON, MULTIPLE PRIMARY CANCER,
FAMILIAL STUDY (4902)*
ENDOMETRIUM
DNA METABOLISM, KARYOTYPE,
ULTRASTRUCTURE, HUMAN (5681)*
HYPERPLASIA, CHROMOSOMAL ANOMALIES
HUMAN (4253)*
PSAMMONA BODIES, HISTOLOGY,
ULTRASTRUCTURE, CASE REPORT
(3330)*
ESOPHAGUS, EPITHELIUM, CASE
REPORT (0887)*
ESTROGEN-RECEPTOR, MAMMARY GLAND,
RAT (6116)
GASTRIC CARDIA, CLINICAL AND PATHO-
LOGIC FEATURES, HUMAN (3380)*

ADENOCARCINOMA - CONTINUED

GLANDULAR STOMACH;
 N,N'-2,7-FLUORENYLENEBISACETAMIDE,
 X-RAY, RAT (2960)
 GROWTH, LYMPH NODE, HISTOLOGY,
 MOUSE (0782)*
 GUANINE METABOLISM, INHIBITION,
 ADENOSINE ANALOGUE (0265)*
 HERPESVIRUS, REPLICATION, KIDNEY, FROG
 (5238)
 INDUCTION, MAMMARY, INTESTINAL,
 GENETIC FACTORS, HAMSTER (2318)
 LUCKE, KIDNEY, HERPESVIRUS ANTIGEN
 DETECTION, INDIRECT IMMUNO-
 FLUORESCENCE, FROG (3035)
 LUNG, PSAMMOMA BODIES, HUMAN (4231)*
 MAMMARY GLAND
 ESTROGEN, MONKEY (3669)
 IMMUNITY, PLAQUE-FORMING RESPONSE,
 SPLEEN, LYMPH NODE, MOUSE (0758)
 MESONEPHRIC, CERVIX, HUMAN (2111)*
 METHYLNITROSOUREA, SMALL INTESTINE,
 RABBIT (5767)
 NASAL CAVITY
 HUMAN PATHOLOGY (0880)*
 SINUSES, INCIDENCE, ENGLAND, WALES
 (2751)
 OPTIC DISC, LUNG CANCER METASTASIS,
 HUMAN (6176)*
 RENAL
 HERPESVIRUS, FROG, REVIEW (5737)*
 HERPESVIRUS CONTENT, FROG (3061)
 VIRAL ETIOLOGY, FROG, REVIEW
 (4343)*
 RETE TESTIS, CASE REPORT (6320)*
 SPONTANEOUS, STOMACH, DOG (0324)*
 SUBMAXILLARY GLAND, METABOLISM, MOUSE
 (0654)*
 THYROID, MICROSCOPIC LUNG METASTASIS,
 AUTOPSY STUDY, HUMAN (4987)*
 UTERINE BODY, INTRAUTERINE CONTRA-
 CEPTIVE DEVICE, CASE REPORT (4495)*
 UTERINE CERVIX, CASE REPORTS (4793)
 VAGINA
 MATERNAL SYNTHETIC ESTROGEN
 THERAPY, CASE REPORTS (3477)*
 STILBESTROL, HUMAN, REVIEW (3610)
 VAGINAL ADENOSIS, CASE REPORT
 (1093)*

ADENOID

CYSTIC CARCINOMA, LACRIMAL GLAND,
 CASE REPORT (6194)*
 EPSTEIN-BARR VIRUS, SERA, ANTIGEN,
 HUMAN (1065)*
 HERPES-TYPE VIRUS, LYMPHOBLASTOID CELL
 LINE, HUMAN (1023)

ADENOMA

ACIDOPHIL, INTRACYTOPLASMIC
 FILAMENTOUS AGGREGATES, ULTRA-
 STRUCTURE, HUMAN (5694)*
 BASAL CELL, SALIVARY GLAND, ULTRA-
 STRUCTURE, HUMAN (2019)
 C-CELL THYROID, CALCITONIN ACTIVITY,
 HUMAN (4874)*
 CYSTOPAPILLARY, SIDEROSIS, KIDNEY,
 CASE REPORT (6136)*
 FOLLICULAR, THYROID, ULTRASTRUCTURE,
 HUMAN (4910)*
 GLYCOGEN-RICH, PAROTID GLAND, CASE
 REPORT (4898)*
 HISTOLOGY, EPIDEMIOLOGY, GREECE
 (0530)*
 IODINE DEFICIENCY, ULTRASTRUCTURE,
 HUMAN (6269)*

LIVER, ULTRASTRUCTURE, HUMAN
 (0894)*

LUNG, URETHAN-INDUCED, CELLULAR
 IMMUNITY, MOUSE (2326)

ADENOMA - CONTINUED

MORPHOLOGY, SALIVARY GLAND, HUMAN
 (4062)*
 NIPPLE, DEVELOPMENT, HUMAN (2130)*
 OVARY, HYPERPLASIA, DEVELOPMENT, MOUSE
 (3943)
 PAPILLARY, HUMAN (3524)*
 PARATHYROID, ULTRASTRUCTURE, MAN
 (0539)
 PAROTID CLEAR-CELL, POSSIBLE
 MYOEPIHELIAL ORIGIN, CASE REPORT
 (4797)*
 PAROTID GLAND, BASAL CELL, HUMAN
 (2108)*
 PROSTATE, EPITHELIAL GROWTH IN VITRO,
 (4155)*
 PROSTATIC, TESTOSTERONE METABOLISM,
 CARCINOMA TISSUE (6169)*
 RETINAL PIGMENT EPITHELIUM, ULTRA-
 STRUCTURE, CASE REPORT (4076)*
 SEBACEOUS GLANDS, REVIEW (2917)*
 STOMACH, ARGENTAFFIN CELLS, HUMAN
 (4936)*
 THYROID, LUNG METASTASIS, HISTOLOGY,
 CASE REPORT (4288)*
 TOXIC, THYROID, THYROIDECTOMY,
 HUMAN (1481)*
 TUMOR PRODUCTION, HUMAN, HAMSTER,
 PROSTATE (0832)
 VAGINA, MESONEPHRIC RESIDUES, HISTO-
 PATHOLOGY, CASE REPORT (6267)*

ADENOMATOID

MESOTHELIOMA, ULTRASTRUCTURE, HUMAN
 (2110)*

ADENOMATOSIS

MEDIASTINAL ENDOCRINE NEOPLASM, CASE
 REPORTS (3521)*
 MULTIPLE ENDOCRINE, MEDIASTINAL
 ENDOCRINE NEOPLASM, CASE REPORTS
 (5576)*
 PAPILLARY ADENOMA, CLINICOPATHOLOGIC
 STUDY, HUMAN (3524)*

ADENOSINE 3'-5'-CYCLIC MONOPHOSPHATE
 CELL PROLIFERATION, FIBROBLASTS, HUMAN
 (6303)*

ADENOSINE MONOPHOSPHATE

FORMATION, DEGRADATION, ISLET
 CELL TUMOR, HAMSTER (1459)*
 REGULATION OF MORPHOLOGY AND GROWTH,
 FIBROBLASTS, MOUSE, HAMSTER (3314)

ADENOSINE 3',5'-MONOPHOSPHATE
 TRANSFORMATION CONTROL, MUTATION,
 ROUS SARCOMA VIRUS (1737)

ADENOSINE 3',5'-PHOSPHATE
 TUMOR IMMUNITY, MOUSE (3836)

ADENOSINE TRIPHOSPHATE
 DEFICIENCY, HEPATOMA, MITOCHONDRIA,
 RAT (0280)*

S-ADENOSYLMETHIONINE
 NEUROBLASTOMA, HUMAN (1146)*

ADRENAL

ADRENOCORTICAL CARCINOMA,
 ADENYL CYCLASE, HORMONE
 RECEPTOR, RAT (1486)*
 FUNCTION, CANCER, EVOLUTION, HUMAN
 (4971)*

7-HYDROXYMETHYL-12-METHYLBENZ(A)-
 ANTHRACENE, FETAL RAT (1569)

NECROSIS, 7,12-DIMETHYLBENZ(A)-
 ANTHRACENE, SUPPRESSION, STEROID,
 RAT (1566)
 TUMOR CELL CULTURES, PYRIDINE
 NUCLEOTIDES, MOUSE (4913)*
 ADRENAL GLAND
 ADRENALECTOMY, LEUKEMIA INCIDENCE,
 THYMUS, MOUSE (0872)*
 ADRENOCORTICAL CARCINOMA
 GUANYL CYCLASE, RAT (0239)
 METABOLIC REGULATION, ULTRASTRUCTURE,
 CELLS, RAT (3531)*
 ORIGIN, HUMAN (1414)
 ADRENOCORTICAL NECROSIS
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 ESTRADIOL, RAT (0976)*
 ANILIN E, LIPID, RAT (0051)
 ASCITES TUMOR DEVELOPMENT,
 PATHOGENESIS, MOUSE (0502)*
 CARCINOMA, HORMONE, THYMIDINE
 KINASE, RAT (1437)
 CORTEX, CARCINOMA, HISTOPATHOLOGY,
 CASE REPORTS (4112)*
 7,12-DIMETHYLBENZ(A)ANTHRACENE, LIVER,
 CARBON TETRACHLORIDE, RAT (4414)
 MYELOLIPOMA, CASE REPORTS (3335)*
 PROTEIN SYNTHESIS, DIMETHYLNITROSAMINE
 RAT (5171)
 TUMORS
 ADENYLATE CYCLASE, ADRENOCORTICO-
 TROPHIC HORMONE (6119)
 ANDROGEN BIOSYNTHESIS, HUMAN
 (3294)
 ADRENALECTOMY
 MAMMARY TUMOR,
 7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT
 (1546)
 ADRENALIN
 RESPONSE, ADENYL CYCLASE, LIVER,
 2-ACETYLAMINOFLUORENE, RAT (5125)
 DRIAMYCIN
 DUANOMYCIN, BREAST CARCINOMA,
 FIBROADENOMA, RAT (2343)
 AFLATOXIN
 ALBUMIN
 INTERACTION
 CHROMATOGRAPHY (0989)*
 SPECTROPHOTOMETRY (0990)*
 ASPERGILLUS FLAVUS
 PARANASAL ASPERGILLOMA
 HUMAN (0035)*
 SUDAN (0655)*
 AUTOPSY, UNKNOWN DISEASE,
 THAILAND (1276)*
 B1
 ACUTE TOXICITY, MONKEY (1613)*
 CARCINOGENICITY, LASIOCARPINE
 LIVER, RAT (2351)
 CYTOTOXIC ACTION, LYMPHOCYTES,
 PHYTOGEMAGGLUTININ CULTURE
 (3018)*
 HEPATOCARCINOGENICITY, MOUSE
 (5152)
 HEPATOCELLULAR CARCINOMA, ALPHA-
 FETOPROTEIN, RAT (5335)
 LIVER MICROSOMAL METABOLISM,
 SALMONELLA TYPHIMURIUM (4386)
 LIVER PARENCHYMA INJURY, ULTRA-
 STRUCTURE, RAT (1635)*
 METABOLISM
 MONKEY (5153)
 MOUSE, RAT (1255)
 NEOPLASTIC TRANSFORMATION, CLONED
 CELL LINES, MOUSE (5770)
 NUCLEOLAR MODIFICATION, FISH LIVER
 SNAIL (5116)
 RNA POLYMERASE, SELECTIVE INHIBI-
 TION, LIVER, RAT (5150)
 TOXICITY, DIET, RAT (1558)
 B1 ACTIVITY, SALMONELLA TYPHIMURIUM,
 LIVER, RAT (2412)*
 B2, DNA, BINDING (0346)
 BIOCONCENTRATION, BIOTRANSFER (1556)
 AFLATOXIN - CONTINUED
 CARCINOGENICITY, TOXICITY, LIVER,
 ANIMALS, REVIEW (5059)*
 CHEMICAL STRUCTURE, PANCREAS,
 DEOXYRIBONUCLEASE, COW (1254)
 COMPLEMENT ACTIVITY, BLOOD TITERS,
 GUINEA PIG (3649)
 DIET, BLOOD FACTORS, LIVER, PIG
 (0042)
 DIETARY
 HUMAN LIVER CANCER, HEPATOMEGALY,
 INCIDENCE, THAILAND (3008)
 INCIDENCE, THAILAND (2768)
 EXCRETIONS, ASPERGILLUS FLAVUS, FROGS
 (3650)
 FOOD, INCIDENCE, THAILAND, HONG KONG
 (2767)
 HEPATOMAS, SOCKEYE SALMON (5827)*
 HUMAN LIVER CANCER, INCIDENCE,
 THAILAND (4418)
 LABELING, SPECIFIC ACTIVITY (0094)*
 LIVER
 CHOLESTEROL-LIPID ANOMALY,
 DUCKLING (1622)*
 TOXICITY, ULTRASTRUCTURE, RAT
 (0954)
 LIVER CYST, TRANSFORMATION, HUMAN
 (1555)
 LIVER LYSOSOME, RAT (1621)*
 LIVER REGENERATION, RAT (1557)
 METABOLISM, RAT (1640)*
 MITOMYCIN C, LYSOSOMAL ENZYMES, LIVER,
 RAT (5075)
 MUCOR DIVERGENCE, BILE, PLASMA,
 DUCKLING (1253)
 MUTAGENESIS, NEUROSPORA CRASSA (0044)
 NUCLEAR DNASE, LIVER, RAT (0043)
 NUCLEIC ACID, NUCLEAR PROTEIN,
 SYNTHESIS, LIVER, RAT (4374)
 OXYGEN PRESENCE, PROTOZOANS (0373)*
 POTENT FOOD POISONS, CARCINOGENIC
 COMPOUNDS, REVIEW (3621)
 PRODUCTION, CHEMICALLY DEFINED
 MEDIUM (1277)*
 REDUCED CARCINOGENICITY, PHENOBARBI-
 TONE, RAT (0084)*
 RNA POLYMERASE INHIBITION, CELLULAR
 RNA CONTENT CHANGES, DNA BINDING,
 HEPATOCYTES, RAT (5174)
 STERIGMATOCYSTIN, EFFECT ON PRIMARY
 CELL CULTURES (2959)
 STORED FOOD, CONTAMINATION, HEPATOMA
 INCIDENCE, UGANDA (0511)
 TOXICITY
 CARCINOGENICITY, RAT, DUCK (3673)
 TROUT (0080)*
 AGE
 EFFECT, ALLOANTIGEN RECOGNITION,
 SPLEEN CELLS, MOUSE (2692)*
 FACTOR
 BRAIN TUMOR, INCIDENCE
 (0518)*
 URETHANE SUSCEPTIBILITY, MOUSE
 EMBRYO (0367)*
 MATERNAL, CHILDHOOD LEUKEMIA,

- RADIATION DOSE, FRACTIONATION,
 TUMORIGENESIS, MOUSE (4492)
 TUMOR INCIDENCE, FAST NEUTRON
 RADIATION, RAT (4491)
 TUMORIGENICITY, AZOXYMETHANE, NERVOUS
 SYSTEM, RAT (5103)
 AGE FACTOR
 BREAST CANCER, SEX CHROMATIN, HUMAN
 (4281)*
 GASTRIC CARCINOMA, MORTALITY, HUMAN
 (6277)*
 AGGLUTINATION
 CELL SURFACE INTERACTION, RICINUS
 COMMUNIS (2651)*
 COMPLEMENT FIXATION, VIROLOGY (1948)
 CONCAVALIN A, TUMORIGENICITY,
 HAMSTER CELLS, CELL HYBRIDS (3694)
 POLYOMA VIRUS, TRANSFORMED CELLS,
 MOUSE (0132)
 TRANSFORMED CELLS, ROUS SARCOMA VIRUS,
 WHEAT GERM AGGLUTININ, CONCAVALIN
 A (5914)
 AGGREGATION
 CELL, NEURAMINIDASE, POLYOMA VIRUS,
 HAMSTER (5905)
 AGING
 CANCER INCIDENCE (0621)*
 NONCYCLING CELLS, MODEL (4919)*
 NUCLEIC ACID SYNTHESIS, LIVER, MOUSE
 (1639)*
 TISSUE, JUVENILE CANCERS (5559)*
 TUMOR CELLS, STEMLINE KARYOTYPE
 ALTERATION, RAT (6295)*
 AGRICULTURE
 LEUKEMIA, REVIEW (1520)*
 AIR POLLUTION
 ATMOSPHERIC CARCINOGENS, STANDARDIZA-
 TION, REVIEW (5002)
 CANCER MORTALITY, SWITZERLAND (6098)*
 CARCINOGENIC SUBSTANCES, STANDARDIZA-
 TION, INDUSTRIAL PREMISES (3720)*
 LUNG CANCER
 HUMAN (2408)*
 OCCUPATIONAL HAZARD, SMOKING,
 REVIEW (5018)
 ALBUMIN
 AFLATOXIN
 INTERACTION
 CHROMATOGRAPHY (0989)*
 SPECTROPHOTOMETRY (0990)*
 BILIRUBIN CONJUGATION, TOXICITY,
 HEPATOMA CELL CULTURE, RAT (6334)*
 CONTENT, HEPATOMAS, LIVER, RAT (5512)*
 HYPOALBUMINEMIC SUBSTANCE, EHRlich
 SOLID CARCINOMA (3512)*
 PROTEIN SYNTHESIS, NORMAL CELLS,
 TUMOR CELLS, RAT (5583)*
 SERUM PROTEIN PRODUCTION, LIVER, RAT
 (5530)*
 SYNTHESIS, FREE POLYRIBOSOMES,
 HEPATOMA, RAT (5607)*
 ALCOHOLIC BEVERAGE
 CARCINOGEN, TUMOR PROMOTION (5180)
 ALDOOLASE A
 HEPATOMA, IMMUNOLOGY, RAT (1949)
 ALURIN
 DIEHLKIN, BLOOD, HUMAN (0647)*
 ALKYLATING AGENT
 ANTINEOPLASTIC THERAPEUTIC, POTENTIAL
 CARCINOGENIC EFFECTS (2382)*
 CARCINOGENICITY, ANTI-METABOLITES,
 REVIEW (0004)
 CHEMICAL CARCINOGEN, REVIEW (2207)
 HEMATOPOIETIC AND LYMPHOMA CELL
 COLONIES, SURVIVAL, MOUSE (3466)*
 IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY,
 MOUSE (5968)
 N-METHYL-N-NITROSUREA, DIMETHYL
 SULFATE, DNA, ALKYLATION SITE,
 3-METHYLGUANINE (3674)
 MUSTARD GAS
 DNA TEMPLATE, INACTIVATION AND
 REPAIR, HELA CULTURE (2353)
 INTERSTRAND DNA CROSSLINKING,
 HELA CELLS (4397)
 ALKYLATION
 NUCLEIC ACIDS, ETHYLNITROSUREA,
 DIETHYLNITROSAMINE, LIVER, EMBRYO,
 RAT (5854)*
 TUMORS, MORPHOLOGY, NERVOUS SYSTEM,
 ANIMALS (5107)
 N-ALKYL-N'-NITRO-N-NITROSOGUANIDINE
 MUTAGENICITY, HIGHER PLANTS (1642)*
 ALLERGY
 CANCER PATIENT, ASSOCIATION, HUMAN
 (0261)*
 THYROID CANCER, EPIDEMIOLOGY
 (1422)*
 ALLOPREGNANEDIOL
 LIVER CANCER, P-DIMETHYLAMINOAZO-
 BENZENE, RAT (5769)
 ALPHA-AMANTIN
 ROUS SARCOMA VIRUS,
 REPLICATION INHIBITION,
 CHICK CELL (1344)
 SV40 SPECIFIC RNA SYNTHESIS, MONKEY
 CELLS (5893)
 ALPHA, BETA-UNSATURATED ALDEHYDES
 HISTOPATHOLOGY, KIDNEY, RAT (1542)
 5-ALPHA-DIHYDROTESTOSTERONE
 METABOLISM, PROSTATE CARCINOMA,
 ESTROGEN, HUMAN (4854)
 ALPHA FETOPROTEIN
 ASCITES HEPATOMA, RAT (3320)
 CHEMICAL CARCINOGENESIS, HEPATIC
 CARCINOMA, RAT (5098)
 HEPATOCELLULAR CARCINOMA
 AFLATOXIN B1, RAT (5335)
 DIAGNOSIS, UGANDAN PATIENTS (4644)
 IMMUNOFLOUORESCENT LOCALIZATION
 HEPATOCELLULAR CARCINOMA, HUMAN
 (1392)
 LIVER, HEPATOMA, HUMAN (1435)
 ISOLATION, CHARACTERIZATION, RAT
 (5561)*
 LIVER, MALIGNANCY, HUMAN (2144)*
 LIVER CANCER, HUMAN (3993)
 LIVER CARCINOGENESIS, 3'-METHYL-4-
 DIMETHYLAMINOAZOBENZENE, RAT (4626)
 LIVER CARCINOMA
 THOROTRAST CARRIERS (6048)*
 TRANSPLANTATION, HUMAN (0759)
 PRIMARY LIVER CANCER, INCIDENCE, HUMAN
 (4723)*
 PRODUCTION, YOSHIDA ASCITES SARCOMA,
 VARIANT STRAINS, RAT (2602)
 RADIOIMMUNOASSAY
 PRIMARY AND SECONDARY LIVER CANCER
 HUMAN (4627)
 SERUM, HUMAN (4637)
 SERUM, RAT (5972)
 SERUM LEVELS, DIETHYLNITROSAMINE
 POISONING, BARBOONS (5748)
 STOMACH CARCINOMA, LIVER METASTASES,
 HUMAN (1842)*
 SYNTHESIS
 INHIBITION, LIVER, RAT (5300)
 LIVER CARCINOMA, REVIEW (0901)

ALPHA GLOBULIN
 FETAL, ISOLATION, CHARACTERIZATION,
 HUMAN (3849)
 PLASMA, LYMPHOCYTE INHIBITION, COLON
 CANCER, HUMAN (3181)
 SERUM, 4-DIMETHYLAMINOAZOBENZENE,
 RAT (0955)
 ALPHA-NAPHTHYL-ISOTHIOCYANATE
 LIVER, STRUCTURAL CHANGES, MICRO-
 CIRCULATION, RAT (1552)
 ALVEOLAR CELL
 CARCINOMA, HUMAN (2139)*
 LUNG CARCINOMA, ULTRASTRUCTURE, HUMAN
 (3497)*
 ALVEOLI
 CARCINOMA, MALIGNANT CELL,
 CEREBROSPINAL FLUID, ULTRASTRUCTURE,
 HUMAN (1182)*
 MACROPHAGE, CIGARETTE SMOKING,
 RABBIT (1291)*
 AMELOBLASTOMA
 HISTOLOGIC VARIANTS, ULTRASTRUCTURE,
 CASE REPORTS (5634)*
 MANDIBLE
 LUNG METASTASIS, CASE REPORT
 (4051)*
 METASTASIS, LUNGS, LYMPH NODES,
 CASE REPORTS (3522)*
 O-AMIDOPHENOL
 CONVERSION FROM N-HYDROXY-2-FLUORENYL-
 ACETAMIDE, STEREOCHEMISTRY,
 MECHANISM, RAT LIVER (3712)
 AMINE
 AROMATIC, N-OXIDATION PRODUCT,
 BLADDER CANCER, DOG (1247)
 AMINO ACID
 ALANINE UPTAKE, TUMOR CELL, MOUSE
 (0877)*
 BLOOD, UTERINE CANCER, MALIGNOLIPIN,
 HUMAN (1143)*
 DELTA-AMINOLEVULINIC ACID EXCRETION,
 MALIGNANT LYMPHOMA, HUMAN (4202)*
 2-DEOXY-D-GLUCOSE, TRANSPORT, NORMAL
 AND MALIGNANT CELLS, REVIEW (3640)*
 DEPRIVATION
 NEOPLASTIC MAST CELL (1471)*
 SV40 TRANSFORMATION, DNA SYNTHESIS
 KIDNEY CELLS, HAMSTER (3063)
 HISTIDINE, TRANSPORT SYSTEM,
 S37 ASCITES TUMOR CELLS (4897)*
 INCORPORATION
 LIVER POLYRIBOSOME, DIMETHYL-
 NITROSAMINE, RAT (5166)
 PROTEIN, INHIBITION, MALIGNANT
 MELANOMA, HAMSTER (0270)*
 LEUCINE INCORPORATION, PROTEIN,
 INHIBITION, TUMOR-BEARING BLOOD, RAT
 (5524)*
 LEUKEMIC CELL REQUIREMENTS, HUMAN,
 IN VITRO (4091)*
 MALIGNOLIPIN, NINHYDRIN, THIN-LAYER
 CHROMATOGRAPHY (1173)*
 L-ORNITHINE METABOLISM, HEPATOMAS, RAT
 (5516)*
 PLASMA, ACUTE LEUKEMIA, HUMAN (0646)*
 PROTEIN FRACTIONS, TUMOR,
 UTERUS, HUMAN (0559)*
 RNA POLYMERASE REGULATION, EHRlich
 ASCITES TUMOR CELLS, MOUSE (6109)
 SERUM, ACUTE LEUKEMIA, HUMAN (4260)*
 SERUM COMPOSITION, MALE LEUKEMIA
 PATIENTS, FEMALE LEUKEMIA PATIENTS,
 (6062)*
 TRANSPORT, TYROSINE AMINOTRANSFERASE,
 MORRIS HEPATOMA, LIVER, RAT (4072)*
 MORRIS HEPATOMA, RAT (4271)*
 UPTAKE, POLYOMA-TRANSFORMED CELL,
 HAMSTER (1757)
 AMINOACETONITRILE
 DIMETHYLNITROSAMINE, LIVER
 CARCINOGENESIS, INHIBITION, RAT
 (0967)
 AMINOAZO DYE
 HEPATOMA, ANTIGENS, RAT (3170)
 METHEMOGLOBIN FORMATION, RAT (5195)*
 6-AMINONICOTINAMIDE
 METABOLIC AND MORPHOLOGICAL ALTERATION
 YOSHIDA ASCITES TUMOR CELLS (2377)*
 AMMONIUM HYDROXIDE
 MAMMARY TUMORIGENESIS, MOUSE (3692)
 AMNION
 TRANSFORMED CELL, STRAIN LONGEVITY,
 SV40, HUMAN (1756)
 AMYLOIDOSIS
 REOVIRUS, IMMUNOCOMPETENCE, MOUSE
 (1368)*
 RETICULOSARCOMA, SYNGENEIC CELL
 INOCULATION, MOUSE (4048)
 STROMA, THYROID CANCER, HISTOCHEMISTRY
 C CELLS (6352)*
 ANAL CANAL
 LEIOMYOMA, CASE REPORT (4955)*
 ANDROBLASTOMA
 OVARIES, RADIATION-INDUCED, MOUSE
 (5201)
 ANDROGEN
 STEROID, EXCRETION, MAMMARY CARCINOMA,
 HUMAN (0789)
 ANEMIA
 AREGENERATIVE, LEUKEMIA, BONE MARROW,
 HUMAN (4783)
 ERYTHROCYTES, RETICULOENDOTHELIAL
 SYSTEM (1997)
 HEMOLYTIC, TUMOR CELL EMBOLI, INTRA-
 VASCULAR COAGULATION, CASE REPORT
 (5557)*
 LEUKEMIA, OXYMETHOLONE, HUMAN (0082)*
 MYELOGENOUS LEUKEMIA, MOUSE (5443)
 PERNICIOUS, SMOKING HABITS, GASTRIC
 CANCER, HUMAN (2385)*
 RESISTANT, MYELO-MONOCYTIC LEUKEMIA,
 BLOOD PLATELETS, CLINICAL STUDY
 (6164)*
 SIDEROBLASTIC, MYELOID MONOCYTIC
 LEUKEMIA, CASE REPORTS (6163)*
 TRANSPLANTABLE LYMPHOID TUMOR, CHICKEN
 (5519)*
 ANGIOGENESIS
 TUMOR, THERAPEUTIC IMPLICATIONS (1895)
 ANGIOKERATOMA
 CIRCUMSCRIPTUM NAEVIFORME, CASE REPORT
 (5678)*
 ANGIOMA
 PAROTID, CASE REPORTS (3565)*
 ANGIOSARCOMA
 1,2-DIMETHYLHYDRAZINE DIHYDROCHLORIDE,
 MORPHOLOGY, HAMSTER (5842)*
 ANILINE
 ADRENAL, LIPID, RAT (0051)
 ANIONIC SITES
 ASCITES CELLS, EHRlich, TUMOR (2086)*
 ANTHANTHRENE
 DERIVATIVES, SKIN CARCINOGENESIS,
 MOUSE (4405)
 POLYNUCLEAR HYDROCARBON, SKIN
 CARCINOGENESIS, MOUSE (5142)
 ANTHRACIN
 TUMOR PROMOTION, MOUSE (1541)

ANTIBODY

ACTIVE SITE, AFFINITY LABELING, MYELOMA PROTEINS (2614)
 ACTIVITY, SERUM, MYELOMA, HUMAN (0784)*
 ACUTE BOVINE LYMPHOCYTIC LEUKEMIA, PRIMARY IMMUNE RESPONSE, E.COLI, COW (3197)
 AGGLUTINATION, RIBOSOMAL SUBUNITS, ANTISERA, NOVIKOFF ASCITES HEPATOMA, RAT (4617)
 ALLOGENEIC TUMORS, MOUSE, RAT (2704)*
 ANTICELLULAR, INHIBITORY EFFECTS ON COLONY FORMATION, LEUKEMIA CELLS, MOUSE (2648)
 ANTI-EMBRYONIC, HUMAN CARCINOMA ANTIGEN CROSS REACTIONS, RABBIT (3207)
 N-ANTIGEN, NASOPHARYNGEAL CARCINOMA, HUMAN (2609)
 T-ANTIGENS, SERA, ROUS SARCOMA, ADENOVIRUS TYPE 12, MONKEY (3200)
 ANTI-LYMPHOMA, GRAFT REJECTION, COMPLEMENT, MOUSE (3182)
 ANTINUCLEAR
 LEUKOCYTE REACTIVITY, BLOOD MALIGNANCY, HUMAN (1405)*
 MALIGNANCY, HUMAN (6011)*
 SERUM, NASOPHARYNGEAL CARCINOMA, HUMAN (1382)
 SUPPRESSION, RAUSCHER LEUKEMIA VIRUS, MOUSE (4559)
 ANTI-TYMIDINE, SELECTIVE INHIBITION, TRANSFORMED CELLS, HAMSTER (2819)
 ASPERGILLUS FLAVUS, PROLIFERATIVE DISEASE, HUMAN (1076)*
 ATPC+ ASCITES TUMOR CELLS, IMMUNO-FLUORESCENCE, MOUSE (5984)*
 AUTOANTIBODIES, RENAL CELL CARCINOMA, HUMAN (3203)
 AUTOIMMUNE-LIKE, LIGAND-BINDING SITES, MYELOMA PROTEINS, MOUSE (3158)
 BINDING, TA3 CARCINOMA SUBLINES, MOUSE (3874)
 BIOASSAY, TUMOR CELLS, TETANUS SPONES, HUMAN (2131)*
 BLOCKING, SERUM FACTOR, TUMOR HOST (1828)
 CARCINOEMBRYONIC ANTISERA, COLON TUMOR TISSUES, PREPARATION (3218)*
 CELL MEMBRANE, CYTOPLASM, MALIGNANT MELANOMA, HUMAN (5328)
 CELL PRODUCTION, PLAQUE-FORMING CELL, IDENTIFICATION (1851)*
 CELLULAR IMMUNITY, TUMOR (0011)*
 CIRCULATING, MAMMARY TUMOR VIRUS, IMMUNOSUPPRESSION, MOUSE (3857)
 COLD-ANTIBODIES, YOSHIDA HEPATOMA, BIPHASIC REACTION, RAT SERUM (4696)
 COMPLEMENT FIXING, SARCOMA 180, MOUSE BRAIN CELL (3163)
 CYTOSTATIC
 SV40
 ONCOGENESIS, INTERRUPTION, HUMAN FETAL ANTIGEN, HAMSTER (0717)
 TUMOR IMMUNITY, RAT (1042)
 CYTOTOXIC
 ACUTE LYMPHOCYTIC LEUKEMIA, HUMAN (5304)
 LEUKEMIA, BURKITT'S LYMPHOMA, INFECTIOUS MONONUCLEOSIS, HUMAN (0752)
 SHOPE FIBROMA VIRUS, IMMUNE SERUM,

RABBIT (2604)
 CYTOTOXICITY
 BLOCKING FACTOR, SARCOMA, MOUSE (0453)
 TUMOR, ADENOVIRUS, MOUSE, RAT (0479)
 DETECTION, ADENOVIRUS TYPE 12, INDIRECT PAIRED RADIOIODINE-LABELED ANTIBODY TECHNIQUE, HAMSTER (0708)
 DIPHTHERIA TOXIN CONJUGATES, HAPEN-COATED TUMOR CELLS, ANTITUMOR EFFECT RABBIT (5990)*
 ENHANCED RESPONSE, TUMOR-ASSOCIATED IMMUNITY, BYCOBACTERIUM BUTYRICUM, RAT (3156)
 EPSTEIN-BARR VIRUS
 BURKITT'S LYMPHOMA, AMERICAN PATIENTS (4630)
 CAPSID ANTIGEN, SOLUBLE ANTIGEN, INFECTIOUS MONONUCLEOSIS, HUMAN (3042)
 CHIMPANZEES (2628)
 CHRONIC LYMPHOCYTIC LEUKEMIA, LYMPHOCYTIC LYMPHOMA, HUMAN (2516)
 CHRONIC MYELOCYTIC LEUKEMIA, CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN (0764)
 CONNECTIVE TISSUE DISEASE, HUMAN (5969)
 IMMUNOFLUORESCENCE LCSE PRIMATES (4654)
 INCIDENCE, CHILDREN, UGANDA (3744)
 KIDNEY TRANSPLANT, HUMAN (3884)
 LYMPHOBLASTOID CELLS, LEUKOCYTE TRANSFORMATION, HUMAN (0756)
 MEMBRANE IMMUNOFLUORESCENCE, BURKITT LYMPHOMA (1046)
 NASOPHARYNGEAL CANCER (0161)
 SERUM
 CANCER PATIENT (3876)
 INDONESIA (1833)
 LYMPHOCYTIC LYMPHOMA, HUMAN (3814)
 VIRAL ILLNESS, LEUKEMIA, HUMAN (0403)
 FERRITIN LABELING, FFLINE SARCOMA VIRUS, CAT (0696)
 FIXATION, SV40, HAMSTER (0740)*
 FLUORESCENT, HERPES VIRUS, IDENTIFICATION, PRIMATE (3757)
 FOLIC ACID, RABBIT (0888)
 FORMALINIZATION, TUMOR CELL, IMMUNE RESPONSE, MOUSE (5306)
 FORMATION
 BONE MARROW, RADIATION, THYMUS, MOUSE (0750)
 CLONAL NATURE, POLY-O-ACETYL-D-SERINE, POLY-D-ALANINE (4739)*
 COMPLETE AND INCOMPLETE NEOPLASTIC DISEASE, HUMAN (3215)
 EHRLICH ASCITES TUMOR, MOUSE (1372)
 IMMUNOGENIC RNA STIMULATION, SPLEEN CELLS, RABBIT (2705)*
 SUPPRESSION, FRIEND LEUKEMIA VIRUS, MOUSE (1375)
 FORMING CELLS, PROLIFERATION, DIFFERENTIATION, LYMPH, SHEEP (1874)*
 ANTIBODY - CONTINUED
 GROUP-SPECIFIC
 AVIAN LEUKOSIS GROUP, DETECTION

(3039)
 AVIAN LEUKOSIS VIRUS, LEUKEMIA,
 HUMAN (0175)*
 HEPATITIS-ASSOCIATED, HEPATOCELLULAR
 CARCINOMA, HUMAN (3166)
 HERPES SIMPLEX VIRUS, NASOPHARYNGEAL
 CANCER PATIENTS (5973)
 HERPES SIMPLEX VIRUS TYPE 2,
 CERVICAL CARCINOMA, HUMAN (0712)
 HERPESVIRUS
 CERVICAL CANCER PATIENT, SERUM
 (2535)
 CERVICAL CARCINOMA, IN SITU,
 HUMAN (0462)
 NASOPHARYNGEAL CARCINOMA, HUMAN
 (2540)
 SERUM, HUMAN (4691)
 SERUM, SARCOIDOSIS PATIENTS
 (1848)*
 HERPESVIRUS HUMAN, ADENOVIRUS,
 CERVICAL CARCINOMA, HUMAN (3864)
 HERPESVIRUS TYPE 1 AND 2, HODGKIN'S
 DISEASE, NASOPHARYNGEAL CARCINOMA,
 HUMAN (2538)
 HL-A ANTIBODY, ANTILYMPHOCYTE SERUM,
 HUMAN (1871)*
 HUMORAL
 DIMETHYLAMINOAZOBENZENE,
 DIETHYLAMINOAZOBENZENE, RAT (0163)
 FELINE LEUKEMIA VIRUS, FELINE
 SARCOMA VIRUS, NEONATAL CAT (2612)
 FRIEND LEUKEMIA VIRUS, MOUSE (5979)
 HUMORAL IMMUNE RESPONSE, 3-METHYL-
 CHOLANTHRENE, MOUSE (4363)
 IGG, LIVER, PROSTATE CARCINOMA,
 RABBIT, HUMAN (1377)
 IGM, EPSTEIN-BARR VIRUS
 HUMAN (5977)
 INFECTIOUS MONONUCLEOSIS PATIENTS
 (6025)*
 IMMUNOSUPPRESSION, MALIGNANT MELANOMA,
 HUMAN (0179)*
 INDUCTION, GRAFFI VIRUS, MOUSE (2485)
 INHIBITION OF SPLEEN CELL PROLIFERA-
 TION, CHICKEN (4756)*
 INTERFERON PRODUCTION, RAUSCHER VIRUS-
 INFECTED, MOUSE (2639)
 I-LABELED TRANSPLANTATION, LOCALIZA-
 TION, RAT (2703)*
 LYMPH NODE CELLS, SURFACE DETECTION,
 MOUSE (2683)*
 LYMPHOCYTE, PROSTATE CARCINOMA, HUMAN
 (1865)*
 MACROPHAGE, WALKER CARCINOSARCOMA,
 GROWTH, RAT (1406)*
 MOUSE FETAL ANTIGEN, RAUSCHER LEUKEMIA
 CELLS, SERA (5344)
 NASOPHARYNGEAL CARCINOMA,
 SEROEPIDEMIOLOGY, HUMAN (1049)
 9H VIRUS, GROWTH PATTERN, HEPATITIS,
 LIVER, RAT (4544)
 NOVIKOFF ASCITES HEPATOMA CELL, GOAT
 (1064)
 GOAT CELL SURFACE ANTIGEN, PULMONARY
 CANCER PATIENTS (4693)
 PLAQUE FORMATION, SPLEEN, MYELOMA,
 MOUSE (4704)
 PLASMA CELL TUMORS, MOUSE (6022)*
 PRECIPITATING, C-TYPE VIRUS INTERNAL
 ANTIGEN, BOVINE LYMPHOSARCOMA,
 CATTLE (4763)*
 PRIMARY, FORMATION, ADJUVANT EFFECT
 OF ENDOTOXIN, IRRADIATED RATS (3212)
 PRODUCTION
 AVIAN LEUKOSIS VIRUS, CHICKEN
 (0455)
 BENZO(A)PYRENE, TUMOR,
 INCIDENCE, MOUSE (1573)
 C-TYPE VIRUS, RAT (4614)
 LEUKEMIA, GROWTH, MOUSE (0173)*
 PURIFICATION, MEMBRANE ANTIGENS,
 HAMSTER (2712)*
 RECEPTOR, INHIBITION, MACROPHAGE,
 LEUKEMIA, ISOANTIBODY, MOUSE (3854)
 RNA, IMMUNOGENICITY MECHANISM,
 IMMUNOLOGICAL TEMPLATE (1858)*
 RNA-DEPENDENT DNA POLYMERASE,
 INHIBITION, ANTIBODY, MURINE
 LEUKEMIA VIRUS (0450)
 SERUM
 AVIAN LEUKOSIS VIRUS, HUMAN (3178)
 HERPES-TYPE VIRUS, EPSTEIN-BARR
 VIRUS, HUMAN, MONKEY (1059)
 POLYOMA VIRUS, HAMSTER (3260)
 SMOOTH MUSCLE
 CANCER PATIENT, SERUM (5319)
 MALIGNANT DISEASE, HUMAN (3860)
 VIRAL INFECTIONS, MALIGNANT
 DISEASE, HUMAN, REVIFW (5739)*
 SPLEEN CELL PROLIFERATION, EHRlich
 TUMOR, MOUSE (3913)*
 SPONTANEOUS, MAMMARY TUMOR VIRUS,
 MOUSE (1043)
 SURFACE ANTIGEN BINDING, GROSS VIRUS,
 LYMPHOMA, RAT (3903)
 SV40, SERUM, POLIO IMMUNIZATION,
 HUMAN (1039)*
 SV40 INFECTION, HUMAN (3034)
 SV40-NEUTRALIZING, SERUM,
 GENITOURINARY CARCINOMA, HUMAN
 (3054)
 TUMOR, CHICK EMBRYO LETHAL
 ORPHAN VIRUS, ANTIGEN, HAMSTER
 (0476)
 TUMOR REGRESSION, FELINE SARCOMA
 VIRUS, CAT (1013)
 VIRAL CAPSID ANTIGEN, EARLY VIRAL
 ANTIGEN, EPSTEIN-BARR VIRUS,
 INFECTIOUS MONONUCLEOSIS, HUMAN
 (0456)
 VIRUS, NASOPHARYNGEAL CARCINOMA,
 HUMAN, TAIWAN (1383)
 ANTICOAGULANTS
 FIBRINOLYSIN, (1521)*
 ANTIGEN
 ABH ISOANTIGENS, EPITHELIAL, PRIMARY
 STOMACH TUMOR, METASTASES, HUMAN
 (1839)
 ACUTE LEUKEMIA
 CLINICAL STUDY (6008)*
 DETECTION, RABBIT (3908)
 ADENOVIRUS-12-INDUCED TUMOR CELLS,
 HAMSTER (4710)*
 ADENOVIRUS TYPES 2 AND 3, STRUCTURAL
 CORE PROTEINS (3095)
 ALPHA FETOPROTEIN, SERUM, RAT (0762)
 ALPHA1-GLOBULIN, FETUS, HEPATOMA,
 TERATOMA, MOUSE (0449)
 ANALYSIS, AVIAN LEUKEMIA-SARCOMA VIRUS
 PROTEIN (1708)
 ANTI-HL-A SERUM, LYMPHOCYTE, BLASTIC
 TRANSFORMATION, HUMAN (1879)*
 ASCITES HEPATOMA, PURIFICATION, RAT
 (5971)
 ASTROCYTOMA, IMMUNOLOGICAL SPECIFICITY
 IN VITRO (3929)*
 AUSTRALIAN
 FREQUENCY, LIVER CIRRHOSIS, CANCER

- AFRICANS (6000)*
 HEPATOCELLULAR CARCINOMA, HUMAN
 (4683), (4613), (5912)
 HEPATOMA, ASIA (5297)
 LIVER CANCER, INCIDENCE, AFRICA
 (3157)
 PRIMARY CARCINOMA, LIVER, REVIEW
 (0006)
 PRIMARY LIVER CANCER, HUMAN (3342)
 AVIAN LEUKOSIS VIRUS, TYPE SPECIFICITY
 CHICKEN CELL (5357)
 AVIAN MYELOBLASTOSIS VIRUS, VIRAL
 ENVELOPE (4570)
 BLOOD-GROUP ISOANTIGEN, LEUKEMIA,
 NEURAMINIDASE, HUMAN (0477)
 BOVINE TYPE C VIRUS, MURINE AND
 FELINE LEUKEMIA VIRUSES, ANTIGENIC
 COMPARISON (4651)
 BREAST, OVARIAN CARCINOMAS, HUMAN
 (6045)*
 CANCER, HUMAN, REVIEW (3628)*
 CAPSID, SOLUBLE, EPSTEIN-BARR VIRUS,
 ANTIBODY, INFECTIOUS MONONUCLEOSIS,
 HUMAN (3042)
 CARBOHYDRATE PORTION, SPLEEN CELLS,
 TUMOR CELLS, MOUSE (0139)
 CARCINOEMBRYONIC
 ADENOCARCINOMA, HUMAN (3846)
 ANIMALS, HUMAN, REVIEW (5742)*
 ANTIGEN, DIGESTIVE TRACT
 CARCINOMA, HUMAN (1869)*
 CANCER PATIENTS (0470), (4737)
 COLON, STOMACH, TUMOR, HUMAN
 (4664)
 COLON ADENOCARCINOMA, HUMAN (5327)
 COLON TUMOR, DIFFERENTIATION,
 HUMAN (4684)
 COLONIC CANCER, AMINO ACID
 SEQUENCING, HUMAN (5976)
 COLONIC CARCINOMA, RADIOIMMUNO-
 ASSAY, SERUM, HUMAN (5371)*
 DIGESTIVE SYSTEM
 HUMAN (5710)
 RADIOIMMUNOASSAY, HUMAN (5384)*
 DIGESTIVE TRACT, CARCINOMA
 PATIENTS (5992)*
 DIGESTIVE TRACT CANCER, HUMAN
 (4689)
 FECES, HUMAN (2621)
 GASTRO-INTESTINAL TRACT ADENO-
 CARCINOMA, HUMAN (0761)
 HUMAN COLONIC NEOPLASMS, HAMSTER
 (2630)
 IN VITRO SYNTHESIS, HUMAN COLONIC
 CANCER, HAMSTER (6014)*
 INFLAMMATORY BOWEL DISEASE, CASE
 REPORTS (5370)*
 LIVER, HETEROANTIGENS,
 DIETHYLNITROSAMINE, HEPATOMA,
 RAT (0488)*
 LYMPHOCYTE, GASTROINTESTINAL
 CARCINOMA, HUMAN (0483)*
 LYMPHOCYTE SENSITIZATION, MULTIPLE
 SCLEROSIS, HUMAN (5383)*
 RADIOIMMUNE ASSAY (4648)
 STRUCTURE, DETERMINANTS, COLONIC
 CARCINOMA, HUMAN (5320)
 TUMOR CELLS, HUMAN, REVIEW (5069)*
 WHOLE SERUM, TUMOR, HUMAN (5978)
 CARCINOGENIC, EMBRYO, HUMAN, REVIEW
 (2220)*
 CARCINOPLACENTAL, REGAN ISOENZYME,
 HUMAN (0486)*
 CELL SURFACE
 ALLO-, MURINE LEUKEMIA VIRUS,
 VIRAL GENOME, CHROMOSOMAL
 INTEGRATION (1041)
 GROSS LEUKEMIA VIRUS, SUPPRESSION,
 MOUSE (4694)
 GROSS VIRUS, RAUSCHER VIRUS,
 LEUKEMIA CELLS, MOUSE, RAT
 (3880)
 MOLONEY LEUKEMIA VIRUS,
 VIRUS RELEASE, MOUSE (1823)
 TOPOGRAPHY (1378)
 CHANGES
 GASTROINTESTINAL TUMOR,
 X-RAY, RODENT (1659)
 MAMMARY CARCINOMA, HUMAN (1786)
 CHICK EMBRYO LETHAL ORPHAN VIRUS,
 PROPERTIES (1353)*
 CHRONIC STIMULATION, MALIGNANT
 LYMPHOMA, PATHOGENESIS (0322)*
 CLONAL CELLS, 3-METHYLCHOLANTHRENE,
 MOUSE (4401)
 COLON CARCINOMA
 HUMANS (3910)*
 SALT EXTRACTED, EVALUATION OF
 TUMOR IMMUNITY, HUMAN (4749)*
 COLON TUMOR-SPECIFIC, HUMAN (1827)
 COMMON
 EGG-WHITE LYSOZYME, LEUKEMIA,
 CHICKEN, HUMAN (1040)
 MENINGIOMA-DERIVED CELL
 CULTURES, HUMAN (2650)
 COMPLEMENT FIXATION
 BURKITT'S LYMPHOMA, SERUM, HUMAN
 (4663)
 BURKITT'S LYMPHOMA CELLS,
 EPSTEIN-BARR VIRUS, HUMAN
 (0467)
 EPSTEIN-BARR VIRUS-INDUCED
 MEMBRANE, INTERIOR CELL,
 HUMAN (2644)
 LEUKOCYTE, EPSTEIN-BARR VIRUS,
 HUMAN (0694)
 PREPARATION, HERPES SIMPLEX
 VIRUS TYPE 2 (1359)*
 SERUM, BURKITT'S LYMPHOMA,
 INFECTIOUS MONONUCLEOSIS,
 MAN (0166)
 COUPLED TUMOR PROTEIN, TRANSPLANTED
 TUMOR GROWTH, MOUSE (1793)
 CROSS-REACTIVITY
 GLYCOPROTEIN, CARCINOEMBRYONIC
 ANTIGEN, TISSUE EXTRACTS, HUMAN
 (4755)*
 TUMOR CELL, FETAL CELL, MOUSE
 (5388)*
 C-TYPE RNA TUMOR VIRUS, PROLACTIN-
 INDUCED, TUMORIGENESIS, MOUSE (5316)
 C-TYPE VIRUS GROUP-SPECIFIC,
 3-METHYLCHOLANTHRENE TUMOR INDUCTION
 MOUSE (3848)
 ANTIGEN - CONTINUED
 DETECTION, IMMUNODIFFUSION, CANCER
 PATIENT URINE (3912)*
 DETERMINANTS, FELINE C-TYPE VIRUS,
 PROTEIN (0465)
 DETERMINATION, BLOOD GROUP, GROWTH,
 MOUSE (1178)*
 EMBRYONIC, HEPATOMA, SARCOMA, RAT
 (5332)
 ENVIRONMENTAL, MYELOMA PROTEIN, MOUSE
 (3190)
 EPIDERMIS, CARCINOMA, 3-METHYL-
 CHOLANTHRENE, MOUSE (5361)
 EPSTEIN-BARR VIRUS

ALENOID, HUMAN (1865)*
 INFECTIOUS MONONUCLEOSIS, ACUTE
 LYMPHOCYTIC LEUKEMIA, HUMAN
 (5402)
 LYMPHOID CELL, HUMAN (4635)
 MACROMOLECULAR SYNTHESIS,
 KAJI CELL (0466)
 EPSTEIN-BARR VIRUS-ASSOCIATED,
 5-BROMODEOXYURIDINE ACTIVATED,
 HUMAN CELLS (5387)*
 EPSTEIN-BARR VIRUS-RELATED, IMMUNO-
 ELECTRON MICROSCOPIC ANALYSIS,
 BURKITT LYMPHOMA CELLS, HUMAN
 (5369)*
 EXPRESSION
 EHRICH ASCITES TUMOR, HYBRID,
 L CELL (1386)
 RNA C-TYPE VIRUS, TUMOR, 3-METHYL-
 CHOLANTHRENE, MOUSE (2500)
 FELINE LEUKEMIA-SARCOMA GROUP-SPECIFIC
 PRESENCE IN TISSUE CULTURE CELLS,
 ULTRASTRUCTURE, HUMAN (3125)
 FELINE LEUKEMIA VIRUS, MURINE LEUKEMIA
 VIRUS, PROTEIN ASSAY (5358)
 FETAL, PAPOVA TUMOR VIRUS, DIMETHYL-
 BENZANTHRAcene, MOUSE (3835)
 FETAL CELL, RAUSCHER LEUKEMIA VIRUS,
 RECOVERY, SPLENOMEGALY, SUPPRESSION,
 MOUSE (3204)
 FETO-TUMOR SERUM, SEROLOGIC STUDIES,
 RAT (2679)*
 FORMATION, POLYOMA VIRUS, INHIBITOR,
 MOUSE (4567)
 FORSSMAN, PLASMA MEMBRANE,
 MONOSACCHARIDE COMPOSITION, POLYOMA
 VIRUS, HAMSTER (1044)
 FORSSMAN GLYCOLIPID, HEMATOSIS
 SYNTHESIS, CONTACT-DEPENDENT
 ENHANCEMENT, NIL CELLS (4773)*
 FORSSMAN HAPTEN, TUMORS, HUMAN (5994)*
 GAMMA FETOPROTEIN, MALIGNANT TISSUE,
 HUMAN (5323)
 GAZDAR MURINE SARCOMA VIRUS, HAMSTER
 (5886)
 GIX EXPRESSION, GENE, MURINE LEUKEMIA
 VIRUS, MOUSE (5336)
 GRAFFI VIRUS-INDUCED LEUKEMIA, RAT,
 MOUSE (5343)
 GROSS VIRUS, MURINE LEUKEMIA VIRUS,
 HISTOCOMPATIBILITY, MYELOMA CELL
 LINE, MOUSE (4615)
 GROUP-SPECIFIC
 AVIAN LEUKOSIS VIRUS, DETECTION
 (3039)
 AVIAN SARCOMALEUKOSIS VIRUS,
 ROUS SARCOMA VIRUS INDUCED
 TUMOR, HAMSTER, CHICK (1792)
 AVIAN TUMOR VIRUS, IMMUNO-
 ELECTROPHORESIS (3051)
 C-TYPE VIRUS
 LIFE SPAN, MOUSE (5331)
 SPONTANEOUS NEOPLASM, MOUSE
 (4665)
 HARVEY MURINE SARCOMA VIRUS,
 HAMSTER-SPECIFIC SARCOMA VIRUS
 (0767)
 INTERSPECIES SPECIFIC, IMMUNO-
 GLOBULINS, C-TYPE VIRUS (3875)
 MEMBRANE-BOUND, GRAFFI AND GROSS
 LEUKEMIAS, MOUSE, RAT (5342)
 MURINE LEUKEMIA VIRUS
 HUMAN (0699)
 MOUSE (0153)
 ROUS SARCOMA VIRUS, PERMISSIVE
 CELL, CHICKEN (0441)*
 TYPE-SPECIFIC, LEUKEMIA, FRIEND
 VIRUS, MAZURENKO VIRUS, RAUSCHER
 VIRUS, MOUSE (4631)
 GROUP-SPECIFIC C PARTICLE, ASCITES
 TUMOR, MOUSE (5389)*
 H-2
 ASCITES TUMOR, KARYOTYPE, MOUSE
 (0753)
 CELL SURFACE IMMUNOGLOBULINS,
 MODULATION, MOUSE (1845)*
 FRIEND LEUKEMIA VIRUS, REGRESSION,
 MOUSE (464),
 IGA, IMMUNE RESPONSE, GENETIC
 CONTROL, MOUSE (1813)
 LEUKEMIA VIRUSES, MOUSE (3870)
 LEUKEMOGENESIS, GROSS VIRUS,
 MOUSE (1316)
 TISSUE IMMUNOGENICITY, TUMOR
 GROWTH, MOUSE (0492)*
 TUMOR GROWTH RATE, RADIATION,
 MOUSE (3894)
 H-2 COMPLEX, MAMMARY CARCINOMA CELL,
 HYBRID, MOUSE (385A)
 H-7, IMMUNITY, TOLERANCE, MOUSE
 (0754)
 HAPTEN ISOLATION, NEOPLASM, RABBIT
 (3850)
 HEPATITIS-ASSOCIATED
 HEPATOCELLULAR CARCINOMA, HUMAN
 (3166)
 IMMUNOLOGY (1953)
 LIVER CELL CARCINOMA,
 TAIWAN (1797)
 PRIMARY HEPATOMA, CASE REPORT
 (5386)*
 HERPES SIMPLEX VIRUS, CAPSID,
 ENVELOPE, SOLUBLE, CROSS-REACTIVITY
 (4647)
 HERPES-TYPE VIRUS
 INFECTED CELL, IMMUNOFERRITIN
 (1051)
 HERPESVIRUS
 ACTIVATION, LEUKEMIC LYMPHOBLASTS,
 GUINFA PIG (5382)*
 DETECTION BY INDIRECT IMMUNO-
 FLUORESCENCE, LUCKE RENAL
 ADENOCARCINOMA, FROG (3035)
 HERPESVIRUS SAIMIRI, INFECTED LYMPHO-
 CYTE, MARMOSET (3806)
 HETEROGENIC TISSUE, ADENOVIRUS SARCOMA
 HAMSTER (5996)*
 HETERO-ORGANIC, ASCITES HEPATOMA, RAT
 (5366)*
 HISTOCOMPATIBILITY
 ALLOGENEIC TUMOR GROWTH, IMMUNO-
 LOGIC ENHANCEMENT, MOUSE (3909)
 BIOCHEMISTRY (1847)*
 CELL ACTIVATION, THYMUS, MOUSE
 (1860)*
 CELL MEMBRANE, TUMOR, REVIEW
 (1203)
 GENE, PARENTAL VARIANT (1821)
 IMMUNE RESPONSE, RELATIONSHIP,
 MOUSE, GUINEA PIG (2686)*
 LYMPHOMA, HUMAN (5337)
 HL-A
 ANTILYMPHOCYTE SERUM, ANTIBODY,
 HUMAN (1871)*
 CELL-SURFACE, CYTOTOXIC PLATING
 INHIBITION TEST, CULTURED TUMOR
 CELL, HUMAN (5346)
 CHORIOCARCINOMA, HUMAN (0776)*,
 (3172)

- CHRONIC MYELOID LEUKEMIA,
CHRONIC LYMPHOID LEUKEMIA, HUMAN
(1043)
FREQUENCY, MALIGNANT LYMPHOMA,
HUMAN (3891)
GESTATIONAL CHORIOCARCINOMA, HUMAN
(3892)
HODGKIN'S DISEASE
GROUP FIVE SYSTEM, HUMAN
(1789)
HUMAN (1053), (1060)
MULTIPLE MYELOMA, ANALYSIS
(3222)*
LEUKEMIA, SUSCEPTIBILITY,
HUMAN (0484)*
LOSS, OVARIAN ADENOCARCINOMA,
CASE REPORT (4722)*
LYMPHOBLASTIC LEUKEMIA,
PATIENTS' FAMILIES (1825)
LYMPHOGRAULOMATOSIS, MULTIPLE
MYELOMA, CLINICAL STUDY (6040)*
LYMPHOID TUMORS, CLINICAL STUDY
(6009)*
MALIGNANT BLOOD DISEASES, HUMAN
(3173)
MALIGNANT DISEASE (2608)
MALIGNANT DISEASE SUSCEPTIBILITY
HUMAN (1844)*
POLYMORPHISM, REVIEW (1204)
RETICULOSIS, HUMAN, REVIEW (1229)*
TROPHOBLASTIC NEOPLASIA,
CHORIOCARCINOMA, HUMAN (1061)
ULTRASTRUCTURAL LOCALIZATION,
CELL SURFACE (1403)*
- ANTIGEN - CONTINUED
- HL-A AND ABO TYPING, CHORIOCARCINOMA,
INVASIVE MOLE, HUMAN (2676)*
HL-A COMPATIBILITY, CYTOTOXICITY,
LYMPHOCYTE, HUMAN (3861)
HL-A DISTRIBUTION, CHINESE, MALAY,
INDIAN, SINGAPORE (3890)
HL-A FREQUENCY, MALIGNANT BLOOD
DISEASE, HUMAN (1807)
HL-A GENOTYPE, ACUTE LYMPHOBLASTIC
LEUKEMIA, HUMAN (1804)
HL-A MEMBRANE, HODGKIN'S DISEASE, MAN
(0480)
HL-A PHENOTYPES (2678)*
HL-A SPECIFICITIES, LYMPHATIC LEUKEMIA
ACUTE, CHRONIC, HUMAN (1843)*
HL-A SYSTEM
CANCER RESEARCH, REVIEW (5760)*
CHORIOCARCINOMA, HUMAN (2413)*
SUSCEPTIBILITY TO DISEASE RELATION-
SHIP (2687)*
HL-A TYPES, HODGKIN'S DISEASE (2677)*
HSU-2, BIOPSYED CERVICAL TUMOR CELLS,
LATENCY, HUMAN (3895)
HUMAN CARCINOMA, CROSS REACTIONS,
ANTI-EMBRYONIC ANTIBODIES, RABBIT
(3207)
HUMAN FETAL, SV40, ONCOGENESIS,
CYTOSTATIC INTERRUPTION, HAMSTER
(0717)
HUMAN LEUKEMIA ASSOCIATED, DETECTION,
LEUKEMIC SERUM, NORMAL EMBRYOS
(4622)
HYBRID, SV40-TRANSFORMED CELL,
CHROMOSOME, MOUSE, RAT (4510)
IMMUNE RESPONSE, TUMOR CELLS, HUMAN
REVIEW (5066)*
IMMUNE RESPONSE TO TUMORS, REVIEW
(0601)
IMMUNOFLOUORESCENCE, EPSTEIN-BARR
VIRUS, BURKITT LYMPHOMA (1045)
IMMUNOFLOUORESCENT, MAREK'S DISEASE,
LYMPHOID LESIONS, CHICKEN (0786)
IMMUNOLOGICAL INJURY, INHIBITION,
ENHANCEMENT, VIRUS INFECTION, RABBIT
(1810)
IMMUNOLOGICAL UNRESPONSIVENESS, MOUSE
(2653)*
INTESTINE, MUCINOUS CYSTADENOMA,
OVARY, HUMAN (1846)*
INTRACELLULAR AND CELL MEMBRANE,
HERPESVIRUS SAIMIRI, IMMUNO-
FLUORESCENCE, MONKEY (5345)
ISOMITIGEN, PANCREATIC CARCINOMA,
HUMAN (1056)
KIDNEY TUMOR, HUMANS (3924)*
LEUKEMIA
IDENTICAL TWINS (5325)
LYMPHOCYTE STIMULATION, HUMAN
(5966)
LIVER MICROSOMES
2',3-DIMETHYL-4-AMINOAZOBENZENE,
MOUSE (2930)
LYMPHOBLASTIC LEUKEMIC CELLS,
HYDROCORTISONE, IN VITRO (4736)*
LYMPHOCYTE, BINDING, SPECIFICITY
(1837)
LYMPHOCYTE SENSITIZATION,
ENCEPHALITOGENTIC FACTOR, BRAIN,
HUMAN (1050)
LYMPHOID CELL, MAMMARY TUMOR, SERUM
REACTIVITY, HUMAN (1374)
MACROPHAGE-BOUND, IMMUNOGENICITY
(4744)*
MAMMARY TUMOR, LYMPHATIC CELL, MOUSE
(2610)
MAMMARY TUMOR VIRUS, MURINE LEUKEMIA
VIRUS, MOUSE (5212)
MAREK'S DISEASE, VIRUS, FEATHER
FOLLICLE, CHICKEN (0451)
MASON-PFIZER VIRUS, MAMMARY CARCINOMA,
MONKEY (0138)*
MEMBRANE
COLON, CARCINOMA, HUMAN
(0475)
COLONIC CARCINOMA, NON-TUMORAL
COLONIC MUCOSA, NEW ISOLATION
METHOD, HUMAN (4743)*
DETECTION, EPSTEIN-BARR VIRUS-
ASSOCIATED, RADIOIODINE-LABELED
ANTIBODY TEST (4660)
DISTRIBUTION, DYNAMIC ASPECT,
HOST RESISTANCE, MOUSE (2670)*
EARLY, EPSTEIN-BARR VIRUS,
BURKITT'S LYMPHOMA CELLS
(0448)
LIVER, RAT CELL (3899)
PLASMACYTOMA IMMUNO-CHEMISTRY,
MOUSE (1859)*
MEMBRANE-SPECIFIC ERYTHROCYTE, FRIEND
VIRUS, TUMOR CELL (1831)
METHYLCHOLANTHRENE-INDUCED LIPOSARCOMA
GUINEA PIG (3838)
MIXED LYMPHOCYTE TUMOR REACTION,
NORMAL CELLS, NEOPLASTIC CELLS,
RAT (6043)*
MOLONEY LEUKEMIA VIRUS, MITOSIS, MOUSE
(0409)
MOLONEY VIRUS, TRANSFORMED LYMPHOCYTE,
IMMUNE LYSIS, CELL CYCLE-DEPENDENT,
RAT (1832)
MORRIS HEPATOMA 5123, PURIFICATION,
DEMONSTRATION (3211)
MOUSE MAMMARY TUMOR VIRUS, STRAIN

SPECIFICITY (1341)
MURINE LEUKEMIA VIRUS
CELLULAR, LEUKEMIA CELL, MYELOMA
CELL, MOUSE (4555)
CHEMICAL CARCINOGEN, THYMIC
LYMPHOMA, MOUSE, RAT (1062)
MAMMARY TUMOR VIRUS, MAMMARY TUMOR
MOUSE (3784)
N, ANTIBODY, NASOPHARYNGEAL CARCINOMA,
HUMAN (2609)
NASOPHARYNGEAL CARCINOMA, TUMOR CELL,
HUMAN (0468)
NEOANTIGENS, SV40, TRANSFORMED-
FIBROSARCOMA CELLS, HAMSTER (5349)
NEOPLASIA, HUMAN, EXPERIMENTAL,
REVIEW (0602)
NONVIRION
EPSTEIN-BARR VIRUS PRODUCTION,
BURKITT LYMPHOMA (3062)
PAPOVAVIRUS, REVIEW (1205)
NUCLEAR, HUMAN, CHICK, CHICK ERYTHRO-
CYTE (1808)
OAT CELL SURFACE, ANTIBODY, PULMONARY
CANCER PATIENTS (4693)
ONCOGENIC VIRUS RNA, CARCINOEMBRYONIC
ANTIGENS, GLIAL TUMORS, HUMAN (5362)
ORGAN SPECIFIC, METASTASIS, HUMAN
(2658)*
ANTIGEN - CONTINUED
PATTERN, TUMOR, ROUS SARCOMA VIRUS,
HAMSTER (4502)
PRIMARY ALLOANTIGEN RECOGNITION,
EFFECT OF AGE, SPLEEN CELLS, MOUSE
(2692)*
PRODUCTION
LEUKEMIC CELLS, EPSTEIN-BARR
VIRUS (0110)
SV40, ABORTIVE INFECTION,
DNA SYNTHESIS, MOUSE (0434)
PRODUCTION INHIBITION, ADENOVIRUS
TYPE 2, INTERFERON, HUMAN, MONKEY
(1054)
PROFILE, TUMOR, PARA(3CT)-ADENOVIRUS 7
MUTANT, HAMSTER (1712)
PROSTATE, MALIGNANT, BENIGN, HUMAN
(3187)
PROSTATE CELL, TRANSFORMATION, MOUSE
(3881)
RABBIT GAMMA-GLOBULIN, IMMUNOLOGICAL
TOLERANCE, WHOLE BODY IRRADIATION,
MOUSE (4497)*
RAUSCHER LEUKEMIA VIRUS, HAMSTER
LEUKEMIA VIRUS, IMMUNOFLUORESCENCE,
MOUSE (2551)
REACTION, SPLEEN, FRIEND VIRUS,
ROWSON-PARR VIRUS, MOUSE (0410)
RED CELL, MARMOSET (0282)*
RELATIONSHIPS, HERPES SIMPLEX VIRUS,
VARICELLA HERPES ZOSTER (1775)*
RENAL TUBULAR, KIDNEY TUMOR, HUMAN
(2617)
RNA TUMOR VIRUS, IMMUNITY, MOUSE
(4618)
ROUS SARCOMA VIRUS, EARLY INFECTION
(3044)
S, SV40, HAMSTER (5329)
SARCOMA, FRACTIONATION, MACROPHAGE
MIGRATION INHIBITION TEST, GUINEA
PIG (5351)
SARCOMA VIRUS, LEUKEMIA VIRUS,
PRODUCTION, HYBRID CELL, HAMSTER,
MOUSE (4565)
SARCOMA-SPECIFIC, AUTOLOGOUS SERA,
CYTOTOXICITY, HUMAN (4669)
SERUM, LEUKOTIC TUMOR, CATTLE (1384)
SKIN REACTION, CARCINOEMBRYONIC,
INTESTINE, CANCER, HUMAN (4697)
SOLUBLE, ADENOVIRUS TYPE 3, RABBIT
(5986)*
SOLUBLE MEMBRANE, CERVICAL CANCER,
HERPESVIRUS TYPE 2 ANTISERUM,
IMMUNOLOGY (5372)*
SPECIFIC DETERMINANT, IMMUNOGLOBULIN
IGG, MYELOMA PROTEIN, HUMAN (2611)
SPECIFICITY, IGG MYELOMA PROTEIN,
HUMAN (1838)
SPLEEN CELL, DEFECTIVE PROLIFERATIVE
RESPONSE, AGAMMAGLOBULINEMIC
CHICKENS (4757)*
SPONTANEOUS TRANSFORMATION, MOUSE CELL
(4629)
SURFACE
ANTIBODY BINDING, GROSS VIRUS
LYMPHOMA, RAT (3903)
GRAFFI VIRUS-INDUCED, LEUKEMIA
CELLS, RAT (5963)
LEUKEMIC CELL, MURINE LEUKEMIA
VIRUS, MOUSE (1814)
LYMPHOID CELL, NEURAMINIDASE,
HUMAN (3183)
POLYPSEUDOPODIA, POLYOMA VIRUS,
TRANSFORMATION, BHK 21 CELLS
(5964)
SV40, TUMOR, MOUSE (0485)*
TUMOR CELL, CELL CYCLE, MOUSE
(1400)
VIRUS RELEASE, FIBROBLAST,
MOLONEY LYMPHOMA CELL, HYBRID,
MOUSE (1784)
SURFACE MEMBRANE, DELETION, HEPATOMA,
4-DIMETHYLAMINOAZOBENZENE, RAT
(4678)
SV40, TRANSFORMED CELL, MONKEY (5333)
SV40 T SUPPRESSION, 5-BROMO-2-DEOXY-
URIDINE TREATMENT, TRANSFORMED
HAMSTER CELLS (4750)*
SYNTHESIS
INHIBITION, SV40, YABA VIRUS
MONKEY CELL (1347)
MURINE SARCOMA VIRUS, MOUSE,
RAT, HAMSTER, CHICKEN, HUMAN
(3065)
ONCORNAVIRUSES, CHROMATOGRAPHY,
CHICKEN, HAMSTER, MOUSE, CAT
(3144)
T, SYNTHESIS, GLYCOLYTIC ENZYMES,
POLYOMA VIRUS INFECTION, HAMSTER
MOUSE (5255)
THERMORESISTANT, FERRITIN,
LEUKEMIA, HUMAN (0515)
TISSUE ISOANTIGENS A,B, AND H,
STOMACH CARCINOMA, HUMAN (2632)
TISSUE TYPE SPECIFIC, BLADDER TUMOR,
3-METHYLCHOLANTHRENE, MOUSE, RAT
(3162)
ANTIGEN - CONTINUED
TRANSPLANTATION
IMMUNITY, TUMOR (0008)*
MURINE SARCOMA VIRUS, NONPRODUCER
TRANSFORMED CELL, MOUSE (3808)
TUMOR
ADENOVIRUS 12, TUMORIGENICITY,
TRANSFORMED CELL, HAMSTER (4519)
CARCINOGENESIS, MOUSE (6049)*
DETECTION, REGIONAL LYMPH NODES,
METASTASIS, HUMAN (3194)
FIBROSARCOMA, MIGRATION INHIBITION
MOUSE (4673)

- IMMUNE REACTION, REVIEW (0627)*
IMMUNOGENIC ACTIVITY, RETICULO
ENDOTHELIAL CELLS, MOUSE (2616)
ISOLATION, PURIFICATION, HUMAN
(6046)*
MACROPHAGE MIGRATION INHIBITION,
MOUSE (5974)
SPONTANEOUS MAMMARY TUMORIGENESIS,
SUPPRESSION, MOUSE (0747)
SV40, TUMOR, IMPRINT TEST, HAMSTER
(5321)
SV40-INDUCED, TRANSFORMED KIDNEY
CELLS, HAMSTER (5359)
SYNTHESIS
DEGRADATION, POLYOMA VIRUS,
MOUSE (1836)
SV40 TEMPERATURE-SENSITIVE
MUTANT, MOUSE (4526)
TRANSIENT IMMUNE RESPONSE, HUMAN
(1794)
VIRUS, CUTANEOUS HYPERSENSITIVITY,
HAMSTER (0705)
TUMOR CELL, YOSHIDA ASCITES HEPATOMA,
CELL ELECTROPHORESIS (1822)
TUMOR CELL A-LIKE, PROTEASE,
RESISTANCE, HELIX POMATIA (1863)*
TUMOR-ASSOCIATED
BREAST CARCINOMA, HUMAN (4675)
HARVEY MURINE SARCOMA VIRUS,
HAMSTER (4676)
HODGKIN'S DISEASE, HUMAN (0749)
PULMONARY NEOPLASMS, CLINICAL
STUDY (4729)*
TUMOR-ASSOCIATED TRANSPLANTATION,
ROUND CELL CARCINOMA, SPLEEN CELL,
MOUSE (5967)
TUMOR-SPECIFIC
CARCINOEMBRYONIC, IMMUNOLOGY
(4730)*
EMBRYONIC, AMINOAZO DYE, HEPATOMA,
RAT (3170)
HUMAN LYMPHOCYTIC AND MYELOID
LEUKEMIA CELLS, DETECTION
(5361)*
IMMUNOLOGICAL DETECTION METHODS
(6041)*
INDUCTION, CARCINOGEN-TREATED
CELLS, MOUSE (5353)
MALIGNANCY, ETIOLOGY (0326)*
MALIGNANT MELANOMA, HAMSTER (4652)
NORMAL CELL, VIRAL CARCINO-
GENESIS, MOUSE (1877)*
POLYOMA VIRUS TUMOR CELL, MOUSE
(3871)
SOLUBILIZATION, POTASSIUM
CHLORIDE, HEPATOMA, GUINEA PIG
(1074)*
TRANSFORMED CELL, ROUS SARCOMA
VIRUS, MOUSE (1057)
TRANSPLANTATION, FETAL TISSUE,
HAMSTER (1063)
TUMOR SPECIFIC CELL SURFACE,
H-2 HISTOCOMPATIBILITY, POLYOMA
VIRUS, MOUSE (0724)
TUMOR-SPECIFIC SURFACE,
SV40, HAMSTER, MOUSE (0715)
TUMOR SPECIFIC TRANSPLANTATION
ASSAY, SV40, MOUSE (0458)
ISOGRAFT GROWTH, RNA, SPLEEN CELL,
RAT (3160)
MYELOMA PROTEIN, MOUSE (4677)
REVIEW (0608)
RHABDOMYOSARCOMA, DIBENZANTHRACENE
IMMUNE REACTION, MOUSE (5317)
SCHMIDT-RUPPIN ROUS SARCOMA
VIRUS, IMMUNE RESPONSE, RAT
(0474)
TYPE-SPECIFIC SURFACE, HERPES SIMPLEX
VIRUS, INFECTED CELL, HUMAN (1719)
UMBILICO-PLACENTAL, MALIGNANT TUMOR,
HUMAN (5318)
UREA, SKIN, HYPERPLASIA, TUMOR, MOUSE
(4692)
VIRION SURFACE, ADENOVIRUS (4563)
VIRUS, SPONTANEOUS TRANSFORMATION, RAT
(3902)
VIRUS-ASSOCIATED, MAREK'S DISEASE
HERPESVIRUS, CHICK CELLS (2546)
VIRUS-CODED, LEUKEMIA, METHYL-
NITROSOUREA-INDUCED, MOUSE (2624)
WHITE BLOOD CELL, CHRONIC LYMPHOCYTIC
LEUKEMIA, HUMAN (4620)
YOSHIDA SARCOMA CELL, PERITONEAL
LYMPHOCYTE, ENHANCED CYTOTOXICITY,
RAT (2634)
ANTIGEN DETECTION
RAPID METHOD, RNA-VIRUS, ELECTRO-
PHORESIS, FELINE LEUKEMIA VIRUS
(2336)
ANTIGENICITY
ALTERATIONS, SPONTANEOUS PULMONARY
METASTASES, SARCOMA, MOUSE (3935)*
EHRlich ASCITES TUMOR, MOUSE (1372)
EHRlich CARCINOMA CELLS, LIVER, MOUSE
(6026)*
GS, CONTROL OF EXPRESSION, HORMONE,
C-TYPE RNA VIRUS, MOUSE (1007)
LEUKEMIA CELLS, DRUG-RESISTANCE, MOUSE
(4679)
MAMMARY TUMOR VIRUS-ASSOCIATED,
LEUKEMIA CELLS, MOUSE (3193)
MAMMARY TUMORS, MOUSE (4681)
PRESERVATION, TUMOR CELLS, FORMALIN
FIXATION, RABBIT (2654)*
RIBOSOMAL DIGEST PEPTIDE, EHRlich
ASCITES TUMOR, MOUSE (1373)
SKIN GRAFT REJECTION, GROSS LEUKEMIA,
TUMOR CELL, MOUSE (0769)
TUMOR, TRANSPLANTATION ANTIGEN (0030)*
TUMOR CELL, RAT (6004)*
ANTILYMPHOCYTE SERUM
HL-A ANTIGEN, ANTIBODY, HUMAN (1871)*
IMMUNOSUPPRESSIVE POTENCY, TUMOR
ALLOGRAFT GROWTH (4772)*
THYMECTOMY, TRANSPLANTATION, LEUKEMIA,
HAMSTER, HUMAN (5313)
ANTIMETABOLITE
5-FLUOROURACIL
6-MERCAPTOPYRINE, ALKYLATING
AGENTS, CARCINOGENICITY, REVIEW
(0004)
THYMIDYLATE BIOSYNTHESIS, LEUKEMIA
MOUSE (4439)
ANTIOXIDANT
TUMORIGENESIS INHIBITION, FORESTOMACH,
MAMMARY GLAND, SKIN, 7,12-DIMETHYL-
BENZ(A)ANTHRACENE, MOUSE, RAT (3689)
ANTISERUM
ANTILYMPHOCYTE, GROWTH ENHANCEMENT,
CARCINOSARCOMA, RABBIT (1387)
CONCENTRATION, CYTOTOXICITY, IMMUNE
LYMPHOCYTE, MOLONEY SARCOMA VIRUS,
MOUSE (3869)
FOLATE, FOLIC ACID BINDING, RABBIT
(0888)*
LYMPHOID MEMBRANE COMPONENT, IMMUNE
REACTIVITY, HUMAN (1819)
LYMPHOMA CELL, MIGRATION, INHIBITION,

MOUSE (3897)
 FRVL GROWTH FACTOR, ANTITUMOR
 ACTIVITY, MOUSE (3357)*
 REVERSE TRANSCRIPTASE INHIBITION,
 AVIAN VIRUS, MURINE VIRUS (3867)
 TUMOR METASTASIS, 9,10-DIMETHYLBENZ-
 1,2-BENZANTHRACENE, RAT (1876)*
 US
 CLOACAL CARCINOMA, ANAL CANAL,
 ULTRASTRUCTURE, CLINICAL-HISTOLOGIC-
 AL STUDY (4171)*
 IMPERFORATE, WILM'S TUMOR, TURNER'S
 SYNDROME, 45,XO CHROMOSOME, CASE
 REPORT (1139)*
 APOPTOSIS
 CELL DELETION, NEOPLASIA, REVIEW
 (5020)
 APPENDIX
 CARCINOMA, HISTOLOGY, HISTOGENESIS,
 HUMAN (6069)*
 RABINOFURANOSYL ADENINE
 DNA SYNTHESIS, INHIBITION, ROUS
 SARCOMA VIRUS, TRANSFORMATION, RAT
 (3754)
 RABINOSYL CYTOSINE
 TOLERANCE, LEUKEMIA, CIRCADIAN RHYTHM,
 MOUSE (4863)
 RABINOSYL-6-MERCAPTOPURINE
 ELASTOGENIC RESPONSE, LYMPHOCYTES,
 HUMAN (2397)*
 RGININE
 BIOSYNTHESIS, POLYOMA VIRUS, CELL
 INFECTION, MOUSE (3046)
 REQUIREMENT, MECHANISM, ADENOVIRUS
 SYNTHESIS (1713)
 STARVATION, GROWTH, SIMIAN ADENOVIRUS
 SA7 (5937)*
 ROMATIC AMINES
 CHEMICAL CARCINOGEN, REVIEW (2207)
 4-DIMETHYLAMINOSTILBENE,
 4-DIMETHYLAMINODIBENZYL,
 METABOLISM, RAT (0335)
 METABOLITES, MUTAGENICITY, SALMONELLA
 (5787)
 OCCUPATIONAL HAZARD, REVIEW (5012)
 ROMATIC HYDROCARBON
 ALIPHATIC CHAINS, MOLECULAR INTER-
 ACTIONS, HUMAN (2429)*
 BENZENE, TOLUENE, MOLECULAR
 INTERACTION (2428)*
 K AND L REGION THEORY
 CARCINOGENESIS, MOUSE (2427)*
 RADIOACTIVE INDICES (2423)*
 POLYCYCLIC, BINDING, DNA, RNA AND
 PROTEIN, TRANSFORMED CELLS, HAMSTER
 (3672)
 ROMATIC NITROGEN MUSTARD
 DERIVATIVES, MACROMOLECULE,
 HYDROLYSIS (1625)*
 RRHENOBLASTOMA
 MALE HORMONE PRODUCING TUMOR, YOUNG
 WOMAN, CASE REPORT (5690)*
 RSENIC
 CARCINOGENESIS, MITOSIS, DNA, REVIEW
 (0302)
 SBESTOS
 AMOSITE, CARCINOGENICITY, HUMAN,
 REVIEW (3601)
 ASBESTOSIS, LUNG, REVIEW (0916)*
 BENZO(A)PYRENE, LUNG, MORPHOLOGICAL
 CHANGES, RAT (5117)
 BODIES, LUNG, ENVIRONMENTAL FACTOR,
 MAN (0662)*
 CANCER, MORTALITY, INDUSTRY WORKERS,
 U.S.S.R. (6099)*
 CARCINOGENESIS, GUINEA PIG (2333)
 FLOOR-TILE INSTALLATION, LUNG, HUMAN
 (0983)*
 HEALTH HAZARDS, REVIEW (3616)
 INSULATION WORKER, OCCUPATIONAL
 HAZARD, CANCER MORTALITY,
 NORTHERN IRELAND (1103)
 LUNG, RADIOLOGY, HUMAN (0977)*
 LUNG CANCER, OCCUPATIONAL HAZARD,
 EPIDEMIOLOGY, REVIEW (4303)
 LUNG CARCINOMA, INCIDENCE, HUMAN
 (5782)
 MESOTHELIOMA
 CLINICAL STUDY (5823)*
 INCIDENCE, SCOTLAND (3270)
 MESOTHELIOMA INDUCTION, PLEURA, RAT
 (3676)
 MINING
 OCCUPATIONAL HAZARD
 CROCIDOLITE FIBER, DIAMETER
 (0385)*
 MESOTHELIOMA (0386)*
 OCCUPATIONAL HAZARD, LUNG
 ABNORMALITIES, INCIDENCE, BELFAST
 (1102)
 PARTICULATE EXPOSURE, ELECTROMOTIVE
 PHENOMENON, CANCER OCCURRENCE
 (1458)*
 PLEURA, MALIGNANT MESOTHELIOMA,
 LUNG CANCER (0320)*
 PLEURAL PLAQUE, JOINER, OCCUPATIONAL
 HAZARD, INCIDENCE (1111)*
 PLEURAL-PULMONARY MALIGNANCY,
 RELATIONSHIP, LIGURIA (3016)*
 TISSUE REACTION, FIBER DISTRIBUTION,
 ABDOMINAL GRANULOMAS, LYMPH NODES,
 RAT (3586)*
 ASBESTOSIS
 PLEURAL MESOTHELIOMA, HUMAN, REVIEW
 (5709)
 ASCITES
 EHRLICH CARCINOMA
 GROWTH KINETICS, ALTERED IMMUNO-
 LOGICAL CONDITIONS (5377)*
 MATERNAL DEPRIVATION, MOUSE (2685)*
 SURCUTANEOUS AND INTRAPERITONEAL,
 TRANSPLANT INTERACTION, ANTI-TUMOR
 ANTIBODY, MOUSE (2607)
 EHRLICH CARCINOMA CELLS, AGGREGATION
 EFFECT, CHEMICAL (3427)*
 EHRLICH CELLS
 IMMUNOGENICITY, HEAT TREATMENT,
 MOUSE (59A7)*
 RNA DEGRADING ENZYMES, ACTIVITY
 CHANGES, ACTINOMYCIN D, MOUSE
 (2980)
 EHRLICH-LETTRE CARCINOMA, NUCLEOTIDE-
 PEPTIDE ISOLATION, CHROMATOGRAPHY,
 CELLS (3353)*
 EHRLICH TUMOR
 ADENINE PHOSPHORIBOSYLTRANSFERASE
 ACTIVITIES, MOUSE (2992)
 CELL DEATH, EVALUATION (2877)
 CELLULAR PROLIFERATION, GROWTH,
 INTERFEROMETRIC MEASUREMENTS
 (6107)*
 CHICKEN EMBRYO LIVER, SPLEEN,
 TISSUE CULTURE STUDY (6187)*
 CYTOLOGY, MORPHOLOGY, ULTRASTRUCTURE,
 MOUSE (3536)*
 GLUCOSE REQUIREMENT, NUCLEOTIDES,
 IN VITRO (6240)*
 INHIBITION, EXOGENOUS RNA, MOUSE

(4099)*
 MONOAMINE OXIDASE ACTIVITY, MOUSE
 (2888)*
 PHOSPHATE PRECURSOR, BIOSYNTHETIC
 PRODUCTS (2379)*
 PYRIMIDINE SYNTHESIS, MAMMALIAN
 (2892)*
 RENAL METABOLISM, MOUSE (3431)*
 RNA SYNTHESIS INHIBITION,
 5-FLUOROURACIL, MOUSE (2422)*
 UREASE EFFECT, MOUSE (2423)*
 X-IRRADIATION, TETRAPLOID CELLS,
 MOUSE (2476)*
 EHRLICH TUMOR CELLS
 ADENOSINE KINASE, KINETIC STUDIES
 (3336)*
 ADENOSINE TRIPHOSPHATE ACTIVITY,
 TRACE CONTENT OF CULTURE MEDIUM
 (4901)*
 ANIONIC SITES, TOPOGRAPHY (2881)
 ENERGY METABOLISM CELL DIVISION
 INTERRELATIONS, AEROBIC/ANAEROBIC
 CONDITIONS (3428)*
 GLYCERALDEHYDE-3-PHOSPHATE DEHYDRO-
 GENASE, PROPERTIES (2816)
 HERBICIDAL EFFECT, 2,4-D, 2,4,5-T,
 MOUSE (2363)
 HYDROCORTISONE, CARBOHYDRATE
 METABOLISM (2435)*
 LANTHANUM-INDUCED ALTERATIONS,
 CELLULAR ELECTROLYTES, MEMBRANE
 POTENTIAL (4484)*
 METASTASIS, HISTOLOGY, ULTRASTRUC-
 TURE, EMBRYONATED CHICKEN EGG
 (6285)*
 MITOCHONDRIAL RIBOSOMES, MOUSE
 (6371)*
 NA⁺ AND K⁺ POTENTIAL, ACTIVE
 TRANSPORT, AMINO ACIDS (3432)*
 NA⁺(P)⁺ REDOX COMPARTMENTATION,
 MOUSE (3340)*
 NK/LY LYMPHOMAS, GROWTH, ENERGY
 EXCHANGE (3312)
 NORMAL RAT SERUM (6001)*
 NUCLEOLAR ALTERATIONS, SARCOLYSINE,
 MOUSE (2439)*
 PHOSPHORUS INCORPORATION (3447)*
 POLYNUCLEOTIDASE ACTIVITY, MOUSE
 (6370)*
 RNA POLYMERASE, ALPHA-AMANITIN
 SENSITIVE FORMS (6289)*
 RNA UPTAKE (6344)*
 FORMATION, LYMPHATIC OBSTRUCTION,
 MURINE OVARIAN CARCINOMA, MOUSE
 (3963)*
 HEPATOMA
 ALPHA FETOPROTEIN, RAT (3320)
 GLYCOGEN STORAGE, MECHANISM, RAT
 (5490)*
 GLYCOPEPTIDES, ISOLATION, ANALYSIS
 MICROSOMES, RAT (5534)*
 HETERO-ORGANIC ANTIGEN, RAT
 (5366)*
 SURFACE MEMBRANE, RAT (3404)*
 HEPATOMA 109A, SERUM GLYCOPROTEIN
 LEVELS, RAT (5385)*
 MYELOMA, IMMUNOGLOBULIN SYNTHESIS,
 ZONAL CENTRIFUGATION, MOUSE (6343)*
 SARCOMA 180, LACTATE DEHYDROGENASE
 ACTIVITY, MOUSE (2827)
 TUMOR CELL METABOLISM, CO₂ FORMATION,
 CATALASE, MOUSE (4289)*
 TUMOR CELLS
 ATPC+ ANTIBODY, IMMUNOFLUORESCENCE

MOUSE (5984)*
 60 S RIBOSOMES, POLYPEPTIDE
 SYNTHESIS (6284)*
 EXTERNAL ANIONS EFFECT, STEADY-
 STATE CHLORIDE EXCHANGE (3547)*
 NUCLEI ACID BIOSYNTHESIS,
 INHIBITION, MOUSE (2830)
 TUMOR DEVELOPMENT, ADRENAL GLAND,
 MOUSE (0502)*
 TUMOR GROWTH, AUTOREGULATION,
 INHIBITION, MOUSE (0831)
 TUMOR INHIBITION, CONCAVALIN A
 (2879)
 TUMORS
 CELL CULTURE, ULTRASTRUCTURE,
 MOUSE (4972)*
 RADIORESISTANT CELL POPULATION,
 OVARY, RAT (6185)*
 YOSHIDA TUMOR CELLS, METABOLISM,
 MORPHOLOGY, ALTERATIONS,
 6-AMINONICOTINAMIDE (2377)*
 ASCITES CELL
 EHRLICH, TUMOR, ANIONIC SITES (2086)*
 54MN UPTAKE (2075)*
 POLYADENYLIC ACID, MRNA, MOUSE (1974)
 SUSPENSION, ION PERMEABILITY, VICE
 (2058)*
 TUMOR, 67 GALLIUM, MICE (2082)*
 ASCITES TUMOR
 SP8, LYMPH NODE CELL, INFLAMMATORY
 MEDIATOR, ELECTROPHORESIS, MOUSE
 (1072)*
 DEVELOPMENT, POPULATION DENSITY, MOUSE
 (1469)*
 EHRLICH
 ANTIBODY FORMATION, MOUSE (1372)
 CALCIUM UPTAKE, MOUSE (1487)*
 CHLORIDE EXCHANGE, MOUSE (1176)*
 DNA POLYMERASE (1455)*
 DNA SYNTHESIS, CYTOCHEMICAL
 INVESTIGATION (2018)
 GLYCOLYSIS, PH-DEPENDENCE, MOUSE
 (1170)*
 GRAFT RESISTANCE, ADENOVIRUS,
 MOUSE (1037)*
 HYBRID, ANTIGEN EXPRESSION,
 L CELL (1386)
 LIPID ACCUMULATION, CYTOPLASM,
 GROWTH (0267)*
 LIVER, MORPHOLOGIC CHANGE, MOUSE
 (0279)*
 LYMPHOCYTE, MACROPHAGE, ANTITUMOR
 EFFECT, MOUSE (1398)
 NOVIKOFF
 PANCREATIC-LIKE RIBONUCLEASE
 ACTIVITY, MOUSE (5488)*
 PROTEIN SYNTHESIS, PEPTIDE
 ELONGATION, ENZYME, RAT
 (0277)*
 REPOPULATION, BONE MARROW CELL,
 MOUSE (1075)*
 RESISTANCE, IMMUNIZATION,
 SALMONELLA, MOUSE (1081)*
 RIBOSOMAL DIGEST PEPTIDE,
 ANTIGENICITY, MOUSE (1373)
 THYMUS-DERIVED CELL, HELPER
 ACTIVITY SUPPRESSION, MOUSE
 (3863)
 TRANSPLANT REACTION, MOUSE (1082)*
 TUMORIGENESIS INHIBITION, L CELL
 (1119)
 X-IRRADIATION, DNA, SINGLESTRAND
 BREAK REJOINING, MOUSE (5863)
 EHRLICH CARCINOMA, RESISTANCE

*INDICATES PLAIN CITATION WITHOUT ACCOMPANYING ABSTRACT

INDUCTION, RABBIT IMMUNE SERUM,
 MOUSE (4661)
 GLYCOLYSIS INHIBITION, 2-DEOXY-2-
 FLUORO-D-GLUCOSE, CELLS (5435)
 GROUP-SPECIFIC C PARTICLE ANTIGENS,
 MOUSE (5369)*
 INHIBITION, CARBOHYDRATE COMBINED WITH
 IMMUNIZATION, MOUSE (4727)*
 KREBS, PROTEIN CONTENT, RIBOSOME,
 MOUSE (1494)*
 METASTASES, INCIDENCE, MICE (2195)*
 NOVIKOFF, PROTEIN SYNTHESIS, NUCLEOLUS
 (4028)
 NOVIKOFF HEPATOMA, ANTIBODY, GOAT
 (1064)
 PASTEUR EFFECT PRODUCTION (1466)*
 REDUCTION CAPACITY, CYTOCHROME OXIDASE
 MOUSE (1499)*
 SERUM CHANGE, HAMSTER (4018)
 SUBLINES, TRANSFORMATION (2170)*
 TUMOR-SPECIFIC IMMUNITY, NONTUMOR-
 IGENIC TUMOR CELL, MOUSE (3885)
 ULTRASTRUCTURAL STUDIES, CULTURE,
 MOUSE (2152)*
 YOSHIDA SARCOMA, VARIANT STRAINS,
 ALPHA-FETOPROTEIN PRODUCTION, RAT
 (2602)
 ASCITES TUMOR CELL
 CHROMOSOME, RESISTANCE, DAUNORUBICINE
 (1995)
 ULTRASTRUCTURE, GLUCOSAMINE,
 MANNOSAMINE, 2-DEOXY-D-GLUCOSE, RAT
 (1534)
 ASCORBIC ACID
 N-NITROSO COMPOUNDS, NITROSATION
 INHIBITION (3690)
 ASIATICOSIDE
 CANTHARIDIN, 3-METHYLCHOLANTHRENE,
 SKIN, RETICULOSES, MOUSE (4391)
 L-ASPARAGINASE
 CARCINOGENIC ACTIVITY, MOUSE (3662)
 CELL CYCLE, NUCLEIC ACID SYNTHESIS,
 ACUTE LYMPHOBLASTIC LEUKEMIA, HUMAN
 (4026)
 LYMPHOMA, PLASMA MEMBRANE,
 GLYCOPROTEIN (4040)
 L-ASPARAGINE
 IN VITRO, LEUKEMIC CELLS (2190)*
 ASPERGILLUS FLAVUS
 ANTIBODY, PROLIFERATIVE DISEASE,
 HUMAN (1076)*
 ASPIRIN
 TUMOR METASTASIS, RABBIT (6310)*
 ASTROCYTE
 BRAIN, POLYPHOSPHOINOSITIDES, ROLENT
 (1194)*
 FIBROBLASTS, ULTRASTRUCTURE, HUMAN,
 MURINE (5447)
 TRANSFORMATION, VISNA VIRUS, HUMAN
 (5898)
 TRANSFORMED, SV40, ADENYLATE CYCLASE,
 PHOSPHODIESTERASE, HAMSTER (1750)
 ASTROCYTOMA
 BRAIN, MOUSE (1186)*
 ASTROCYTOMA CELLS
 GLYCOGENESIS, MEDIATION, RAT (2173)*
 ATOMIC BOMB
 CANCER MORTALITY, JAPAN (1687)*
 RADIATION
 LUNG CARCINOMA, HUMAN, REVIEW
 (2219)
 PROSTATE CARCINOMA, JAPAN (1657)
 SURVIVOR
 CANCER MORTALITY (1662)
 LEUKEMIA (1663)
 MALIGNANT LYMPHOMA INCIDENCE,
 JAPAN (1656)
 SALIVARY GLAND TUMOR, JAPAN (1660)
 SALIVARY GLAND TUMORS, REVIEW
 (4337)*
 STOMACH CANCER, JAPAN (1937)*
 ATP
 PROTEIN SYNTHESIS, NORMAL CELLS,
 TUMOR CELLS, RAT (5563)*
 ATP-SULFURYLASE
 MASTOCYTOMA, PROPERTIES, MOUSE (2085)*
 AUDITORY MEATUS
 TUMOR, ORGANOLOGY,
 N-2-FLUORETYLACETAMIDE, RAT (1553)
 AUSTRALIAN ANTIGEN
 HEPATOCELLULAR CARCINOMA, HUMAN (4813)
 HEPATOMA, ASIA (5297)
 LEUKEMIA, LYMPHATIC, PERIARTERITIS
 NODOSA, HUMAN (2087)*
 AUTOIMMUNE DISEASE
 GROSS MURINE LEUKEMIA VIRUS, MOUSE
 (0906)
 IMMUNOGLOBULIN-CARRYING CELLS,
 GAMMA GLOBULIN, NZB MICE (3185)
 AUTOIMMUNITY
 JUVENILE DIABETES, DELAYED-TYPE
 HYPERSENSITIVITY (2375)*
 SKIN, CHANGES, CARCINOMA (1856)*
 THYROIDITIS, METHYLCHOLANTHRENE, RAT
 (1815)
 AUTORADIOGRAPHY
 BLAST CELLS, PHAGOCYTOSIS, MATURATION,
 HUMAN (2123)*
 LEUKEMIC CELLS, PHA STIMULATION,
 TRANSFER OF RNA (0843)
 AUTOSOMES
 DOMINANT, GENETIC, HUMAN (2096)*
 5-AZACYTIDINE
 LIVER REGENERATION, METABOLIC
 ALTERATIONS, ENHANCED DNA SYNTHESIS,
 RAT (4466)*
 AZATHIOPRINE
 CARCINOGENIC ACTIVITY, MOUSE (3662)
 IMMUNOSUPPRESSION, ONCOGENICITY, MOUSE
 (2367)*
 AZO DYE
 CARCINOGENESIS
 LIVER, ACID PHOSPHATASE CHANGE,
 RAT (3714)
 POLYADENYLIC ACID, HYDROLASES,
 LIVER, RAT (3654)
 CHEMICAL CARCINOGEN, REVIEW (2207)
 AZOXYMETHANE
 TUMORIGENICITY, AGE DEPENDENCE,
 NERVOUS SYSTEM, RAT (5103)
 BACILLUS CALMETTE-GUERIN
 CANCER, LEUKEMIA, HUMAN, REVIEW (2213)
 CELL WALL, OIL DROPLET, TUMOR
 SUPPRESSION, HEPATOMA, GUINEA PIG
 (3877)
 CELLULAR IMMUNITY, MAMMARY,
 7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT
 (0637)
 EFFECTS, MAMMARY TUMOR, RAT (1990)
 HEPATOCELLULAR CARCINOMA, VACCINE
 IMMUNITY, GUINEA PIG (4655)
 IMMUNITY, BLOCKING ACTIVITY, MELANOMA,
 HUMAN (5330)
 IMMUNITY STIMULATION, POLYOMA TUMOR,
 SPONTANEOUS LEUKEMIA, MOUSE (1824)
 IMMUNIZATION
 LEUKEMIA, HUMAN (1781)
 UV TUMOR, MOUSE (1067)*

- IMMUNOTHERAPY, FRIEND DISEASE, MOUSE (3161)
 NEURAMINIDASE, 3-METHYLCHOLANTHRENE, TUMOR REGRESSION, MOUSE (3199)
 NEURAMINIDASE, FIBROSARCOMA REGRESSION, MOUSE (5993)*
 TREHALOSE-6,6-DIHYDROLYTE, URETHAN-INDUCED LUNG ADENOMA, SUPPRESSION, MOUSE (2330)
 TUBERCULIN ALLERGY, LEUKEMIA INCIDENCE, DENMARK (1923)
 TUMOR INDUCTION, RESISTANCE, RAT (3195)
 VACCINATION
 LEUKEMIA MORTALITY
 CHICAGO (6007)*
 CHILDREN, QUEBEC, GLASGOW (0766)
 INCIDENCE, SCOTLAND (2633)
- BACTERIA**
 BIOSYNTHESIS, BENZO(A)PYRENE (0988)*
 ESTROGEN, MAMMARY, DIET, EPIDEMIOLOGY, HUMAN, REVIEW (0611)
 INTESTINE, ESTRADIOL PRODUCTION (5182)
 MICROBIAL FACTOR, ACUTE LEUKEMIA, PATHOGENESIS, RAT (6070)*
 NITROSAMINE SYNTHESIS (5852)*
 N-NITROSATION, SECONDARY AMINES, CATALYST (2380)*
 STREPTOCOCCUS, CELL WALL, HEPATIC GRANULOMA INDUCTION, MOUSE (0263)*
 SURFACE MARKERS, MALIGNANT CELLS, MAMMALIAN (2837)
 TUMORS, HUMAN, GUINEA PIG, MOUSE (5479)*
- BACTERIOPHAGE**
 F2, RNA, INTERFERON INDUCTION (1765)*
 4-NITROQUINOLINE 1-OXIDE, MUTAGENICITY (1595)
 RNA, SYNTHESIS (5229)
- BASAL CELL ADENOMA**
 PAROTID GLAND, HUMAN (2103)*
 SALIVARY GLAND, ULTRASTRUCTURE, HUMAN (2019)
 CANCER, SCAR TISSUE, HUMAN (2196)*
 CARCINOMA
 AMYLOID-LIKE SUBSTANCE, HUMAN (5585)*
 SYNDROME, CASE REPORT (3517)*
 EPITHELIOMA, COLLAGENOLYTIC ENZYMES, SKIN, HUMAN (5600)*
 EPITHELIOMA, COLLAGENOLYTIC ENZYMES, ULTRASTRUCTURE, SKIN, HUMAN (5604)*
- BASAL CELL CARCINOMA**
 CULTURE, KERATINIZATION, HUMAN (3234)
- BASALIOMA**
 METASTASES, CONNECTIVE TISSUE (2184)*
- BASIC LEAD ACETATE**
 KIDNEY TUMOR, RAT (5183)
- BASEMENT MEMBRANE**
 EPIDERMIS-DERMIS, CARCINOGENESIS, HUMAN, REVIEW (5705)
- BENIGN**
 TUMOR, SURGERY (1955)
- BENIGN LESION**
 ATYPICAL CHARACTERISTIC, CANCER RISK, HUMAN (1881)
- BENZACRIDINES**
 SYNTHESIS, 5-AMINOBENZO(B)SELENOPHEN (0092)*
- BENZ(A)ANTHRACENE**
 ARYL HYDROCARBON HYDROXYLASE
 CELL HYBRID, MOUSE, HAMSTER, HUMAN (4409)
 INDUCTION, GENETICS, MOUSE (0349)
 ARYL HYDROCARBON HYDROXYLASE STIMULATION, HUMAN LYMPHOCYTES (4443)
 DERIVATIVES, ADRENOCORTICOLYTIC, CARCINOGENIC (0961)
 DIBENZ(A,H)ANTHRACENE, K-REGION DERIVATIVE, TRANSFORMATION, HAMSTER (0062)
 EPOXIDES, FRAMESHIFT MUTAGENS, SALMONELLA (2984)
 MACROMOLECULAR BINDING
 K-REGION EPOXIDE, HAMSTER CELL (3709)
 TRANSFORMED CELL (5774)
- BENZENE**
 EXPOSURE, CHROMOSOME CHANGE, HUMAN (1288)*
 HEMOGLOBIN, HUMAN (0661)*
 INDUCED HYPOPLASTIC ANEMIA, ACUTE LEUKEMIA DEVELOPMENT, CASE REPORT (4473)*
 LIVER POLYRIBOSOMES, RAT (0943)
 OCCUPATIONAL HAZARD, ACUTE LEUKEMIA, CASE REPORTS (2976)
 POISONING, BLOOD DISORDER, HUMAN (0974)*
 TOLUENE, AROMATIC HYDROCARBONS, MOLECULAR INTERACTION, CARCINOGENS (2428)*
- BENZENE HEXACHLORIDE**
 HEPATOMA DEVELOPMENT, MOUSE (4462)*
- BENZIDINE**
 HEPATOTROPIC EFFECT, MOUSE (0052)
- BENZO(E)(1)-BENZOTHIOPYRANO(4,3-B)INDOLE**
 POLYCYCLIC PSEUDOAZULENES, CARCINOGENICITY, MOUSE (0039)
- BENZOFLAVONE**
 ARYL HYDROCARBON HYDROXYLASE ACTIVITY, DMBA-INDUCED ADRENAL NECROSIS, LUNG TUMORIGENESIS, POLYCYCLIC HYDROCARBONS TOXICITY, HAMSTER, RAT (2991)
- 7,8-BENZOFLAVONE**
 ARYL HYDROCARBON HYDROXYLASE, INHIBITION, SKIN TUMORIGENESIS, 7,12-DIMETHYLBENZ(A)ANTHRACENE, MOUSE (3678)
 TUMORIGENESIS INHIBITION, 7,12-DIMETHYLBENZ(A)ANTHRACENE, BENZO(A)PYRENE, MOUSE (2928)
- BENZO(A)PYRENE**
 ANILINE HYDROXYLATION, LIVER, ACIDITY, RAT (0657)*
 ASBESTOS, MORPHOLOGICAL CHANGES, LUNG, RAT (5117)
 BACTERIAL BIOSYNTHESIS (0988)*
 CARBON BLACK, PHYSICAL PROPERTIES (3015)*
 CARCINOGENICITY
 IODINE, MOUSE (1577)
 NICKEL SULFIDE, INTERACTION, RAT (5801)
 OINTMENTS, COAL-TAR (3000)
 CONTACT SENSITIVITY INDUCTION, TOLERANCE, GUINEA PIG (2937)
 DIMETHYLBENZANTHRACENE
 3-METHYLCHOLANTHRENE, NUCLEIC ACIDS, MOLECULAR CHARACTERISTICS, CARCINOGENIC HYDROCARBON MECHANISM (0639)
 7,12-DIMETHYLBENZ(A)ANTHRACENE
 COMBINED ACTION, SKIN, MOUSE (5186)*
 METABOLISM, HAMSTER EMBRYO CELLS, IN VITRO (1568)

PROTEIN, NUCLEIC ACID, INTERACTION,
 RAT (1261)
 TOBACCO, TUMOR PROMOTER, MOUSE
 (0075)
 DISTRIBUTION IN SOIL, U.S.S.R. (2450)*
 DNA BINDING, MOUSE (2961)
 DNA-BINDING METABOLITE, MICROSOMES,
 LIVER, HAMSTER (5835)*
 DNA LINKAGE, MUTAGENICITY,
 TRANSFORMATION INHIBITION, DNA
 TEMPLATE INHIBITION (1572)
 DNA REPAIR INHIBITION, TRANSFORMING
 ACTIVITY, MUTATION FREQUENCY (5845)*
 DRUG OXIDATION, CONJUGATION, TISSUES,
 RAT (5832)*
 EFFECT, LIVER MITOCHONDRIA, RAT (2313)
 EMBRYO CELL, HUMAN (1575)
 ENVIRONMENTAL HAZARD, AIRPLANE ENGINE
 SOOT, MOUSE (3011)
 ENVIRONMENTAL POLLUTION, AIRCRAFT
 ENGINES (3652)
 PEROXASE OXIDE, CARCINOGENESIS, LUNG,
 HAMSTER (2312)
 FREUND'S ADJUVANT, TUMORIGENESIS,
 POTENTIATION, HAMSTER (0058)
 FURFURAL, RESPIRATORY TRACT TUMOR,
 HAMSTER (1574)
 GASTRIC CANCER, ICELANDERS, INCIDENCE,
 NANITOBA (3265)
 HEPATIC TOXICATION-DETOXICATION
 SYSTEMS, DRUG METABOLISM, ENZYME
 INDUCTION, REVIEW (5720)*
 HEPATOTOXICITY, CARBON TETRACHLORIDE,
 RAT (4451)*
 -HYDROXY DERIVATIVE, SKIN FIBRO-
 SARCOMA, MOUSE (5141)
 HYDROXYLASE
 LUNG, OZONE, NITROGEN DIOXIDE,
 RABBIT (5803)
 SPIRONOLACTONE, ETHYLSTRENIOL,
 LIVER MICROSOME, RAT (1138)*
 INDUCED VIRUS PRODUCTION, TRANSFORMED
 CELL LINE, HAMSTER (5271)
 LIVER, MICROSOMAL MIXED-FUNCTION
 OXIDASE, RAT, MOUSE (1650)*
 LUNG, LIVER, METAL DISTRIBUTION,
 MICROSOMAL ENZYMES, RAT (4403)
 LUNG CARCINOMA, DUST, RAT (3617)
 LUNG TUMOR, DOSE RESPONSE, RAT (1576)
 MEDULLARY TUMORS, HISTOPATHOLOGY, BONE
 MARROW, RAT (5815)*
 METABOLISM
 CYTOTOXICITY, MAMMALIAN CELL
 (2311)
 VITAMIN A-INDUCED MODIFICATION,
 CELL CULTURES, HAMSTER (4362)
 METABOLITE FORMATION, FIBROBLASTOID
 CELLS, HAMSTER (5177)
 -METHYLCHOLANTHRENE
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 TERATOGENESIS, TOAD (0067)
 TRANSPLACENTAL ACTION, MOUSE (0649)*
 -METHYLCYTOSINE, PHOTOCHEMICAL
 COUPLING, PHOTOENHANCEMENT OF
 CARCINOGENICITY (3025)*
 FOPLASTIC GROWTH, NUCLEAR VOLUME, DNA
 CONTENT, MOUSE (5779)
 OVERHEATED COOKING OILS, CARCINO-
 GENICITY, RAT (5159)
 PETROLEUM EXPLOITATION, OCCUPATIONAL
 HAZARDS (0368)*
 PLAGUE INDUCTION, STREPTOCOCCUS
 PYOGENES (2390)*
 PHOTODYNAMIC TOXICITY, ANTIOXIDANT,

PROTECTION, RAT (0352)
 PHOTOINDUCED PHENOXY RADICAL (2434)*
 RADIATION, E. COLI, SURVIVAL (1289)*
 RESPIRATORY TRACT CARCINOGENESIS,
 HAMSTER (5176)
 SMOG RESIDUE, RAT, HAMSTER (0059)
 SMOKED FOOD PRODUCTS, PENETRATION
 THROUGH BODY, RAT, DOG, HUMAN (5095)
 SOOT, CARCINOGENICITY, MOUSE (1602)
 SQUAMOUS METAPLASIA, TRACHEA, HAMSTER
 (3685)
 STEROID HORMONES, MITOCHONDRIA, LIVER,
 RAT (2314)
 TOXICITY, EPIDERMAL CELL, HUMAN
 (0964)
 TRACHEOBRONCHIAL EPITHELIUM, ULTRA-
 STRUCTURAL CHANGES, HAMSTER (4437)
 TRANSFORMATION ENHANCEMENT, X-RAY,
 HAMSTER (1661)
 TRANSPLACENTAL SENSITIZATION,
 THYMECTOMY, RAT (5831)*
 TUMOR INCIDENCE, ANTIBODY PRODUCTION,
 MOUSE (1573)
 TUMOR PROGRESSION, MOUSE (5764)
 TUMORIGENESIS, TIME AND DOSE, MOUSE
 (2935)
 TUMORIGENESIS INHIBITION, 7,8-BENZO-
 FLAVONE, MOUSE (2928)
 1,2-BENZOPYRENE
 CARCINOGENIC ACTION, ELECTRONIC STRUC-
 TURE, MOLECULAR ORBIT (5140)
 ELECTRONIC STRUCTURE, CARCINOGENIC
 ACTIVITY, RESONANCE ANALYSIS (5099)
 3,4-BENZOPYRENE
 CARCINOGENIC ACTION, ELECTRONIC STRUC-
 TURE, MOLECULAR ORBIT (5140)
 ELECTRONIC STRUCTURE, CARCINOGENIC
 ACTIVITY, RESONANCE ANALYSIS (5099)
 BERYLLIUM
 TUMOR INDUCTION, BONE, RAT (2425)*
 BESNOITIA JELISONI
 INFECTION, IMMUNITY TRANSFER,
 RADIATION, HAMSTER (3729)
 2-BETA-AMINOETHYLISOTHIOURONIUM
 X-RAY, CANCER, RAT (1674)*
 BETA-DIETHYLAMINOETHYL DIPHENYLPROPYL-
 ACETATE
 LIVER MICROSOMAL AZOREDUCTASE,
 PHENOBARBITAL, 3-METHYLCHOLANTHRENE,
 RAT (1627)*
 BILE
 FLOW RATE, SODIUM PHENOBARBITOL,
 DIMETHYLNITROSAMINE, RAT (1614)*
 BILE DUCT
 EXTRAHEPATIC, CARCINOMA, NOMENCLATURE
 (4152)*
 MALIGNANT TUMORS, HUMAN (3361)*
 BILIRUBIN
 GLUCURONIDATION, LIVER,
 3-METHYLCHOLANTHRENE (1279)*
 BIOPSY
 TUMOR SPREAD, HUMAN (2080)*
 BIOTIN
 SYNTHESIS, HELA CELLS (3501)*
 BISDIOXOPIPERAZINE
 IMMUNOSUPPRESSION, MOUSE (3901)
 BIS(CHLOROMETHYL)ETHER
 ANALOGS, CARCINOGENESIS, STRUCTURE
 ACTIVITY RELATIONSHIP, MOUSE (3002)
 1,3-BIS(2-CHLOROETHYL)-1-NITROSOUREA
 CYTOSINE ARABINOSIDE, HEMATOPOIETIC
 PRECURSOR, MOUSE (1298)*
 BITUMENS
 CARCINOGENESIS, OCCUPATIONAL HAZARD,

- HUMAN, REVIEW (5027)
- BLADDER
- ADENOCARCINOMA, CYSTITIS GLANDULARIS, ASSOCIATION, HUMAN (0505)*
- ORTHOYCID SARCOMA, URINE, CYTOLOGY, DOG (6348)*
- CANCER
- AROMATIC AMINE, TRYPTOPHAN METABOLISM, HUMAN (5124)
- CIGARETTE SMOKING, POPULATION TRENDS, UNITED STATES, ENGLAND, DENMARK (3266)
- COFFEE, RAT (5795)
- ETIOLOGY, HUMAN (6160)*
- ETIOLOGY, HUMAN, REVIEW (3614)
- HISTOPATHOLOGY, HUMAN (6227)*
- HUMAN, REVIEW (6328)*
- IMMUNOLOGICAL CHARACTERISTICS, HUMAN, REVIEW (5055)*
- MORTALITY, NEWSPAPER WORKERS, LONDON (2773)*
- PARA-AMINOBIIPHENYL, OCCUPATIONAL HAZARD, HUMAN (0982)*
- SMOKING, REVIEW (5725)*
- CARCINOMA
- AROMATIC AMINE, N-OXIDATION PRODUCT, DOG (1247)
- ARTIFICIAL SWEETENER, HUMAN (0032)*
- BILHARZIAL, PREGNANCY, LABOR, HUMAN (1979)
- CHROMOSOMES, HUMAN (3326)*
- CIRCULATING CELLS, HUMAN (6231)*
- COFFEE DRINKING, HUMAN (0078)
- CYCLAMATE, DIABETES MELLITUS (1636)*
- FIBRINOLYTIC ACTIVITY, HUMAN (1492)*
- HUMAN, REVIEW (4323)*
- INCIDENCE, KENYA (2752)
- RECURRENCE, TRYPTOPHAN METABOLISM, HUMAN, REVIEW (0305)
- EPITHELIAL NEOPLASMS, SCHISTOSOMA HEMATOBIUM INFECTION, MONKEY (3944)
- EPITHELIUM
- N-DIBUTYLNITROSAMINE, ALKALINE PHOSPHATASE DEFICIENCY, RAT (1085)
- MITOTIC ACTIVITY, INGESTED FORMAMIDE, RAT (2360)
- TUMOR
- RADIATION THERAPY, CERVICAL CARCINOMA, HUMAN (0393)
- TISSUE TYPE SPECIFIC ANTIGENS, 3-METHYLCHOLANTHRENE, MOUSE, RAT (3162)
- TUMOR MORPHOLOGY, HISTOCHEMISTRY, HUMAN (6245)*
- TUMORIGENESIS, TRYPTOPHAN, N-NITROSODIBUTYLAMINE, RAT (0947)
- URINARY
- N-BUTYL-N-(4-HYDROXYBUTYL)-NITROSAMINE, TUMOR INDUCTION, RAT (2402)*
- EPITHELIAL TUMOR, OXIDOREDUCTASE ENZYME (1465)*
- TUMOR, 3,2'-DIMETHYL-4-AMINO-BIPHENYL, HAMSTER (2958)
- VESICAL CARCINOMA, 3-HYDROXYANTHRANILIC ACID, RAT (0979)*
- BLADDER CANCER
- INDUCTION, N-METHYL-N-NITROSOUREA, HISTOLOGY, RAT (4431)
- BLAST CELLS
- MATURATION, AUTORADIOGRAPHY, PHAGOCYTOSIS, HUMAN (2123)*
- BLASTOGENIC EFFECT
- MURINE LYMPHOCYTES, PHYCOPHAGGLUTININ MOUSE (2098)*
- BLASTOGENIC RESPONSE
- LYMPHOCYTES, ARABINOSYL-6-MERCAPTO-PURINE, HUMAN (2397)*
- BLASTOMOGENESIS
- LYMPHOCYTE, LEUKEMIA CELLS, IMMUNOCOMPETENCE, SERUM, HUMAN (5360)
- THYROID, 6-METHYLTHIOURACIL, RAT (5296)
- TRANSPLACENTAL
- DIMETHYLNITROSAMINE, NITROSOMETHYLUREA, MOUSE (1607)*
- NITROSO COMPOUNDS, RAT (3618)
- URETHANE, NITROSOMETHYLUREA, DIMETHYLNITROSAMINE, MOUSE (1603)*
- URETHANE, DNA NUCLEOTIDE COMPOSITION, LUNG TISSUE, MOUSE (5813)*
- BLOCKING ACTIVITY
- CELLULAR IMMUNITY, MAMMARY TUMOR, MOUSE (3879)
- BLOCKING FACTOR
- TRANSPLANTATION IMMUNITY, REVIEW (1509)
- BLOOD
- ABO GROUP, CANCER, INDIA (4297)*
- ALTERATIONS, GRAFFI VIRUS LEUKEMIA, CELL-FREE FILTRATES, MOUSE (0137)*
- ANEMIA, MYELOGENOUS LEUKEMIA, MOUSE (5443)
- ANTICOAGULATION SYSTEM, LEUKEMIA, HUMAN (3343)*
- ATYPICAL MICROBIAL AGENTS, SEROLOGICAL CHARACTERISTICS, LEUKEMIA PATIENTS (4180)*
- CELLS
- CHRONIC MYELOID LEUKEMIA, CASE REPORTS (4130)*
- HEMOLYSIS, CARCINOMA PATIENTS (4195)*
- CHANGES
- 7,12-DIMETHYLBENZ(A)ANTHRACENE, SPIRONOLACTONE, PROADIFEN, RAT (1571)
- RADIO IODINE THERAPY, HUMAN (1666)
- CHRONIC MYELOID LEUKEMIA, SERUM, VITAMIN B12 BINDING, HUMAN (1960)
- CLOTTING SYSTEM
- UTERINE MYOMA, ANEMIA, HUMAN (3539)*
- YOSHIDA SARCOMA, E-AMINOCAPROIC ACID, SINTROM, RAT (3438)*
- COAGULATION FACTORS, SYNTHESIS, ACTINOMYCIN D INHIBITION, HEPATOMA, RAT (3296)
- CONSTITUENTS, BINDING, 4-DIMETHYL-AMINOSTILRENE, RAT (5798)
- DIMETHYLAMINOSTILRENE, KINETICS, RAT (4427)
- DISEASES
- ONCOGENESIS, MYCOTOXIN (1539)*
- PATHOLOGY, NON-HEMOLYTIC CHEMICAL AGENTS, CRYPTOGENETIC LEUKEMIA, REVIEW (5733)*
- DISORDER, BENZENE POISONING, HUMAN (0974)*
- ERYTHROID DIFFERENTIATION, TRANSFORMATION, POLYCYTHEMIA-INDUCING, FRIEND VIRUS, MOUSE (2507)
- FIBRINOLYSIS, CANCER PATIENT (0566)*

FIBRINOLYTIC ENZYME SYSTEM, HEPATIC
CIRRHOSIS, MALIGNANT METASTASES,
HUMAN (3452)*

FLOW DETERMINATION, IRRADIATED SARCOMA
CLEARANCE OF XENON-133, MOUSE
(3464)*

GROUP

ANTIGENICITY DETERMINATION,
GROWTH, MOUSE (1173)*

DISTRIBUTION, CANCER INCIDENCE,
HUMAN, REVIEW (3616)*

MAMMARY CARCINOMA, HUMAN (0763)

HAPTOGLOBIN, LEUKEMIA, HUMAN (0558)*

HEMOGLOBIN, BENZENE, HUMAN (0661)*

HYALURONIDASE, HYDATID MOLE, CHORIO-
EPITHELIOMA, HUMAN (4262)*

HYPERGLYCEMIA, ETHYLURETHAN, RAT
(1275)*

ISOANTIGEN, LEUKEMIA, NEURAMINIDASE,
HUMAN (0477)

LEUKEMIC, LIFE SPAN, CELLULAR CULTURES
HUMAN (6129)

LEUKOCYTE

ADENOSINE DEAMINASE, LEUKEMIA,
HUMAN (3302)

ESTABLISHMENT OF CELL LINES, HUMAN
(0852)

LYMPHOCYTE, CHRONIC LYMPHOCYTIC
LEUKEMIA, SURFACE IMMUNOGLOBULIN,
HUMAN (1829)

LYMPHOCYTE COUNT, X-RAY, RAT (1672)*

MALIGNANCY, ANTINUCLEAR ANTIBODY,
LEUKOCYTE REACTIVITY, HUMAN (1405)*

MALIGNANT DISEASE, HL-A ANTIGEN
HUMAN (1807), (3173)

MALIGNOLIPIN, UTERINE CANCER, AMINO
ACID, HUMAN (1143)*

MICROBIAL AGENTS, ISOLATION AND
IDENTIFICATION, ACUTE LEUKEMIA,
HUMAN (3538)*

MONOCYTES, GRANULOCYTE STIMULATORS,
MONONUCLEAR COLONY FORMATION,
HUMAN (5507)*

NEOPLASTIC DISEASE, LYMPHOBLASTOID
CELL, LEUCOGENOL, HUMAN (1180)*

PERIPHERAL CELLS, COLONY GROWTH,
LEUKEMIA PATIENTS (5493)*

PLASMA, HISTAMINE CONTENT,
MYELOGENOUS LEUKEMIA, HUMAN
(0582)*

PLASMA-CORTISOL, PLASMA-ANDROGEN
SULPHATES, IMMUNE RESPONSE, BREAST
CANCER, HUMAN (2636)

PLATELET FUNCTION ABNORMALITIES,
MYELOPROLIFERATIVE DISORDERS,
CLINICAL STUDY (6299)*

PLATELETS, MYELO-MONOCYTIC LEUKEMIA,
RESISTANT ANEMIA, CLINICAL STUDY
(6164)*

SERUM ALPHA₂-FETOGLOBULIN, GASTRIC AND
PROSTATIC, CARCINOMA, CASE REPORT
(2635)

SERUM COPPER MEASUREMENT, LYMPHOMAS,
HUMAN (3408)*

SERUM PROTEIN FRACTIONS, PROPERDIN
TITER, GASTRO-INTESTINAL CANCER,
HUMAN (3553)*

SOTAL PROTEASE ACTIVITY, LEUKEMIA,
PURULENT DISEASES, HUMAN (6257)*

TRANSFUSION, HEPATOMA, INDUCTION
RESISTANCE, 4-DIMETHYLAMINOAZOBEN-
ZENE, RAT (2931)

TUMOR CELLS, RECTAL CANCER PATIENTS
(1161)*, (6148)*

BLOOD GROUP

GASTRIC CANCER, AGE, SEX, INCIDENCE,
LONDON (1924)

GRAVITZ TUMOR, KIDNEY, HUMAN (4848)

BLOOD VESSEL

TUMORIGENESIS, 1,2-DIMETHYLHYDRAZINE,
MOUSE (0940)

BONE

ADAMANTINOMA, ULTRASTRUCTURE, CASE
REPORTS (5649)*

ANGIOFIBROMA, HUMAN (3486)*

AVASCULAR NECROSIS, CUSHING'S SYNDROME
CARCINOID-ISLET CELL TUMOR, PANCREAS
CASE REPORT (4893)*

CANCER, ETIOLOGY, SPREAD, IMMUNOLOGY
(0321)*

CHONDROBLASTOMA

CLINICOPATHOLOGIC STUDY, ULTRA-
STRUCTURE, HUMAN (3385)*

PATHOLOGY, HUMAN (4093)*

DETERIORATION, TUMOR GROWTH, MOUSE
(4103)*

EOSINOPHILIC GRANULOMA, CUTANEOUS
LESIONS, INFILTRATED CELLS, ULTRA-
STRUCTURE, CASE REPORT (6154)*

EWING'S SARCOMA, ULTRASTRUCTURE, CASE
REPORTS (4299)*

EWING'S TUMOR, PATHOLOGY, CHILDREN
(4230)*

GIANT CELL TUMOR, SOFT TISSUE,
RECURRENCE, HUMAN (0276)*

GRANULOMA, MALIGNANT RETICULOENDO-
THELIOSIS, CASE REPORT (3484)*

IMPLANT CARCINOGENICITY, RAT (6271)*

LYMPHOGRANULOMATOSIS, CLINICAL STUDY
(6149)*

MALIGNANT OSTEOBLASTOCLASTOMA,
RADIATION THERAPY, CASE REPORT
(5870)*

MANDIBLE, METASTATIC NEUROBLASTOMA,
CASE REPORT (3419)*

MARROW, TOLERANCE INDUCTION,
SENSITIZATION, PREINCUBATION WITH
ALLOGENIC ERYTHROCYTES, MOUSE
(2652)*

METASTASES

MAMMARY CANCER, HUMAN (3489)*

UTERINE CERVIX CANCER,
ASSOCIATION (3594)*

MYELOFIBROSIS, ACUTE LEUKEMIA, HUMAN
(4079)*

NEOPLASM

METASTASES, SCAN, HUMAN (2071)*

URINARY HYDROXYPROLINE SERUM,
ALKALINE PHOSPHATASE, PHOSPHORUS
CALCIUM, (4251)*

OSTEOGENIC SARCOMA

HEAD AND NECK, RADIATION THERAPY-
INDUCED, CASE REPORTS (3736)*

IMMUNOFLUORESCENCE REACTIVITY,
HUMAN (0158)

OSSIFICATION, HUMAN, REVIEW
(5043)*

TALUS ULTRASTRUCTURE, HUMAN
(0260)*

OSTEOSARCOMA

GROWTH RATE, RADIO NUCLIDE,
BEAGLE (1104)

INDUCTION, MOUSE (3765)

PU239, RAT (5865)*

VIRAL ETIOLOGY, IMMUNOLOGICAL
EVIDENCE, HUMAN (4515)

OSTEOSARCOMA INDUCTION, MURINE SARCOMA
VIRUS, RAT (2575)*

- OSTEOSARCOMA VIRUS, EVIDENCE, HUMAN (2484)
 PLUTONIUM RADIATION, RAT (5198)
 SARCOMA
 EWING'S ULTRASTRUCTURE (2179)*
 RADIATION, HUMAN (1303)
 ULTRASTRUCTURE, HUMAN (2116)*
 SPONTANEOUS OSTEOGENIC SARCOMA, MONKEY (4169)*
 STRONTIUM 90, HUMAN (0105)*
 TUMOR
 ANGIOFIBROMA, HUMAN (3486)*
 ATOMIC BOMB RADIATION, JAPAN, REVIEW (3633)*
 CALCIUM METABOLISM, HUMAN (6400)*
 COLLAGEN METABOLISM, HUMAN (1467)*
 FIBROUS DYSPLASIA, HUMAN (4300)*
 HISTOPATHOLOGY, HUMAN (6378)*
 MORTALITY, INCIDENCE, HUMAN (0215)*
 SIALIC ACID, HUMAN (3530)*
 TUMOR INDUCTION, BERYLLIUM, RAT (2425)*
 BONE MARROW
 ABNORMAL NUCLEAR DIVISION, CARCINOMA, FEULGEN STAINING METHOD, HUMAN (0274)*
 ANTIBODY FORMATION, RADIATION, MOUSE (0750)
 AREGENERATIVE ANEMIA, LEUKEMIA, HUMAN (4783)
 BLAST, LEUKEMIA, SERUM COPPER, HUMAN (5432)
 CELL STIMULATION, COLONY FORMATION, CELL FACTOR CHARACTERIZATION, MOUSE (4668)
 CHANGES
 LEUKEMIA, 7,8,12-TRIMETHYL-BENZ(A)ANTHRACENE-INDUCED, RAT (3691)
 RADIO IODINE THERAPY, HUMAN (1666)
 CHROMOSOME, ABNORMALITY, RADIATION, HUMAN (0103)
 CYCLOPHOSPHAMIDE, PHENYLBUTAZONE, HAMSTER (1654)*
 CYTOGENETICS, PROLIFERATION, SIDERO-BLASTIC ANEMIA, CASE REPORT (4241)*
 CYTOPLASMIC BUDS, HEMATOLOGIC NEOPLASMS, HUMAN (4917)*
 ERYTHROPOIETIN, LEUKEMIA, POLYCYTHEMIA VERA, HUMAN (4039)
 FIBROBLAST, CHIMERA, DISK IMPLANT, MOUSE (1167)*
 GAMMA-RAY
 GUINEA PIGS (1671)*
 ULTRASTRUCTURE, DOG (1000)*
 HEMATOPOIETIC CELLS, INHIBITION, NEOPLASM, MOUSE (2077)*
 KARYOTYPE, LYMPHOSARCOMA, COW (3937)
 LEUKEMIA
 DNA, STAINING, HUMAN (0652)*
 ELECTRON MICROSCOPE, RAT (1969)
 LIPID GRANULOMAS, CLINICAL STUDY (4961)*
 LYMPHOCYTE COUNT, X-RAY, RAT (1672)*
 MACROPHAGE PRODUCTION, TUMOR-BEARING MICE (6280)*
 MEDULLARY TUMORS, HISTOPATHOLOGY, ONCOGENIC HYDROCARBON ADMINISTRATION RAT (5815)*
 MICROBIAL AGENTS, ISOLATION AND IDENTIFICATION, ACUTE LEUKEMIA, HUMAN (3538)*
 MULTIPLE MYELOMA, CYTOLOGY, IMMUNOLOGY HUMAN (5390)*
 NEUROBLASTOMA, HISTOLOGIC STUDY, CHILDREN (5598)*
 PRELUKEMIA, CHROMOSOME ABERRATION, HUMAN (0182)
 REPOPULATION, EHRICH ASCITES TUMOR, MOUSE (1075)*
 SEGMENTED NEUTROPHILS, MORPHOLOGIC ABNORMALITIES, TUMOR BEARING ANIMALS (4870)*
 SERUM COPPER, HUMAN (2115)*
 STEM CELL RESPONSE, TUMOR GRAFTS, MOUSE (3225)*
 STEM CELLS, RADIATION EFFECT, CELL CYCLES, MOUSE (3734)*
 TELOCENTRIC CHROMOSOME, ABERRATION VULNERABILITY, 7,12-DIMETHYLBENZ(A)-ANTHRACENE, RAT (3010)
 THYMOCYTE, CYTOTOXICITY, ALLOGRAFT IMMUNITY, LYMPHOMA, MOUSE (3873)
 TRANSPLANTATION, GRAFT VS HOST REACTION, RESPONSIVENESS TO ALLO-ANTIGENS, MOUSE (3228)*
 TUMOR, BURKITT'S LYMPHOMA, HUMAN (4786)
 BOVEL
 CARCINOMA, FECAL STEROID, DIET, AFRICA, UNITED KINGDOM (1101)
 HEMANGIOMATOSIS, HISTOLOGY, CASE REPORT (4906)*
 INFLAMMATORY DISEASE, CARCINOEMBRYONIC ANTIGEN, CASE REPORTS (5370)*
 LARGE, CANCER, INCIDENCE, INTERNATIONAL (6082)
 BOWEN'S DISEASE
 HODGKIN'S DISEASE-ASSOCIATED, PALM, CASE REPORT (4926)*
 BRACKEN FERN
 ENVIRONMENTAL HAZARD, HUMAN (0938)
 LYMPHATIC LEUKEMIA, LUNG TUMOR, MOUSE (4387)
 MUTAGEN, T4-BACTERIOPHAGE (0937)
 BRAIN
 ASTROCYTE, POLYPHOSPHOINOSITIDES, RODENT (1194)*
 ASTROCYTOMA, MOUSE (1186)*
 BOVINE PAPILLOMA VIRUS, HAMSTER (5237)
 CELL CULTURE, SPONTANEOUS TRANSFORMATION, C-TYPE VIRUS, HUMAN (3750)
 CEREBELLUM, PRECANCEROUS CHANGE, 9,10-DIMETHYL-1,2-BENZANTHRACENE (1606)*
 CEREBRAL LEPTOMENINGES, PRIMARY MELANOBLASTOMA, REVIEW (2911)*
 CEREBRAL TUMOR
 ACID PHOSPHATASE, HUMAN (1154)*
 IMMUNOLOGICAL STUDY, CELLS, HUMAN (4640)
 CHOROID PAPILLOMA, PAPOVA VIRUS, HUMAN (0398)
 COMPLEMENT FIXING ANTIBODY, SARCOMA 180, MOUSE (3163)
 CRANIAL TUMOR, ADENOVIRUS 12, N,N'-DIMETHYLNITROSOUREA, MOUSE (5252)
 EPENDYMOMA, ULTRASTRUCTURE, HUMAN (3457)*
 FIBROSARCOMA, FIBROMA, HISTOLOGY, ULTRASTRUCTURE, HUMAN (1491)*
 GLIOMASTOMA MULTIFORME, TRANSFER RNA, CHEMICAL COMPOSITION, HUMAN (0264)*
 GLIOMA
 CHROMOSOME, HUMAN (0554)
 METASTASIS, YOUNG HUMAN (1195)*

ULTRASTRUCTURE, SCHMIDT-RUPPIN
ROUS SARCOMA VIRUS, DOG (0735)*
GLIOSARCOMA, HISTOLOGY, 3-METHYL-
CHOLANTHRENE, MOUSE (0065)
ALIGNANT TUMORS, IMMUNITY, ANTIGENIC
STIMULATION, HUMAN (5962)
MEDULLOBLASTOMA
CELL NUCLEUS, ULTRASTRUCTURE,
HUMAN (4852)
RNA-DEPENDENT DNA POLYMERASE,
HUMAN (1984)
ELANOTIC MENINGIOMA, ULTRASTRUCTURE,
CASE REPORT (6068)*
ENINGEAL MELANOCYTOMA, ULTRASTRUCTURE
CASE REPORT (6068)*
ETASTATIC CARCINOMA, SCINTIGRAMS,
HUMAN (5609)*
RIMARY TUMOR, INCIDENCE, MEXICO
(2804)*
ROTEIN, LYMPHOCYTE SENSITIZATION,
CARCINOMA, HUMAN (1187)*
ARCOMA, MORPHOLOGY, CASE REPORTS
(4250)*
PECIFIC PROTEINS, TUMOR, N-METHYL-
NITROSOUREA, RAT (4258)*
V40-LIKE VIRUS, HUMAN (4517)
TRANSPLANTABLE TUMOR, RNA POLYMERASE,
MOUSE (6345)*
UBERCULOMAS, INCIDENCE, INDIA (4872)*
UMOR INDUCTION, N-NITROSOBUTYLUREA,
RAT (4422)
UMOR TRANSPLANTATION, ANTILYMPHOCYTIC
SERUM, RAT (2623)
UMORS
ALDOLASE ISOZYME, HUMAN (1152)*
ATYPICAL MITOSIS, HUMAN (5452)
CELL MEDIATED IMMUNITY, HUMAN
(3841)
CEREBROSPINAL FLUID PROTEINS,
HUMAN (4118)*
CYTOLOGICAL AND CYTOGENETICAL
STUDY, CHROMOSOME IDENTIFICATION
HUMAN (2876)
EPIDEMIOLOGY, AGE FACTOR (0518)*
EXPERIMENTAL INDUCTION, HISTO-
GENESIS, RAT (1888)
FIBROSARCOMA, PROTON RADIATION,
MONKEY (0390)
GEOGRAPHIC DISTRIBUTION, KENTUCKY
(5422)
GLUTAMATE DEHYDROGENASE, ASPARTATE
AMINOTRANSFERASE ACTIVITY, HUMAN
(5657)*
GLUTAMIC ACID, GAMMA-AMINOBUTYRIC
ACID, METABOLISM (6170)*
LACTATE DEHYDROGENASE ISOENZYME
HUMAN (3443)*, (6220)*
LIPID AND FATTY ACID COMPOSITION,
HUMAN (3429)*
MENINGOENCEPHALITIS, SERUM,
CEREBROSPINAL FLUID ANALYSIS
(6340)*
20-METHYLCHOLANTHRENE, MOUSE
(5849)*
METHYLNITROSOUREA, HISTOGENESIS
RAT (1409)
N-METHYL-N-NITROSOUREA, RAT (1592)
MORPHOLOGY, IN VITRO, MOUSE
(4055)*
NITROSOUREA-INDUCED, GLIOMAS,
PATHOGENESIS, RAT (3014)*
PATHOGENESIS, ANIMALS, REVIEW
(5719)*
RADIOACTIVE TRACER, INCORPORATION,

EXTRACELLULAR SPACE, 3-METHYL-
CHOLANTHRENE, MOUSE (0061)
ROUS SARCOMA VIRUS, RAT (5277)
TRITON X-100 IRRADIATION, ACID
PHOSPHATASE, RAT (3376)*
ULTRASTRUCTURE, RAT (6064)*
X-RAY EXPOSURE, MONKEY (4498)*
ULTRASTRUCTURE, N-METHYL-N-NITROSOUREA
RAT (1638)*
BREAST
ABDOMEN, CANCER, WOMEN (6396)*
ADENOCARCINOMA, WOMEN UNDER 30,
CLINICAL STUDY (6195)*
BILATERAL CARCINOMA, INCIDENCE,
PATHOLOGY, HUMAN (6275)*
CANCER
AGE AT MENARCHE, CASE-CONTROL
STUDY, POLAND (3319)
RITTNER VIRUS, MALE CARRIERS,
HUMAN (5941)*
BLOOD ESTROGENS, HUMAN (4277)*
CERVIX, AGE OF PATIENT'S MOTHER
(1160)*
CYTOLOGY, HUMAN (6201)*
DISSEMINATION, DERMAL LYMPHATICS,
HUMAN (4805)*
ELASTOSIS, CLINICAL STUDY (4929)*
ESTROGEN EXCRETION, ANDROGEN-
TREATED PATIENTS (5501)*
ESTROGEN RECEPTORS, HUMAN (2159)*
GENETIC, SOCIOECONOMIC, VIRAL
ASSOCIATIONS, IDENTIFICATION OF
HIGH RISK GROUPS (3273)
HORMONE DISTURBANCES, WOMEN
(3236)
HUMAN, MOUSE, REVIEW (5025)
INCIDENCE
INDIA (6086)
MALE, GERMANY (6103)*
MORTALITY, NORTH AMERICA
(1920)
MAMMARY TUMOR VIRUS, MOUSE (5211)
MINIMAL, HUMAN, REVIEW (4307)
MULTICENTRIC ORIGIN, CASE REPORT
(5616)*
SOFT TISSUE METASTASES, GROWTH
RAT (3980)*
TRYPTOPHAN METABOLISM, HUMAN
(4920)*
TUMOR ANTIGENS, HUMAN (6045)*
UTERINE CERVIX CANCER, REVIEW
(5732)*
VIRAL ETIOLOGY, MOUSE, REVIEW
(2909)
CANCER RISK
BENIGN LESION, ATYPICAL
CHARACTERISTICS, HUMAN (1881)
MENOPAUSE, UNITED STATES (3971)
CARCINOMA
AGE FACTOR, SEX CHROMATIN, HUMAN
(4281)*
BENIGN DISEASE, ESTRADIOL RECEPTOR
MENOPAUSE, HUMAN (2948)
CELLULARITY, MORPHOMETRIC ANALYSIS
HUMAN (3965)
CHILDHOOD, RECURRENCE (4097)*
EPIDEMIOLOGICAL STUDY, GERMANY
(5419)
EPIDEMIOLOGY, HUMAN, REVIEW
(5038)*
EPITHELIOID CELL LINE ISOLATION,
HUMAN (5683)*
ESTROGEN REPLACEMENT THERAPY,
WOMEN (4450)*

- ESTROGEN-BINDING CAPACITY, CYTOPLASMIC RECEPTOR, TISSUE, HUMAN (5513)*
- GROWTH PATTERNS, HUMAN (4217)*
- HETEROTRANSPLANTATION, CELL LINE, HUMAN (4769)*
- INTRA-EPITHELIAL, ULTRASTRUCTURE, HUMAN (2099)*
- MALE, ZAMBIA (6302)*
- MENSTRUAL STATUS, RISK FACTORS, CLINICAL STUDY (6355)*
- METASTASES TO SKIN, TIBIA, LIVER, CASE REPORT (6278)*
- MORTALITY
- DETECTION (6377)*
- UNITED STATES (1944)*
- YUGOSLAVIA (1926)
- PRECANCEROUS CONDITIONS, DETECTION HUMAN, REVIEW (5067)*
- SIMULTANEOUS BILATERAL, MALE, CASE REPORT (4982)*
- THERMOGRAPHY
- BLOOD IRRIGATION, HUMAN (6399)*
- HUMAN (6398)*
- TUMOR-ASSOCIATED ANTIGEN HUMAN (4675)
- LEVELS, HUMAN (4775)*
- VIRUSES, HUMAN, REVIEW (5040)*
- WOMEN (AGE 35 TO 45), AUSTRALIA (6342)*
- CARCINOMA LOBULARE IN SITU, HISTOPATHOLOGY, HUMAN (6241)*
- CHONDROCARCINOMA, HISTOPATHOLOGY, CASE REPORT (6268)*
- EPITHELIOMA, INVOLUTION, DOG (4116)*
- LOBULAR CARCINOMA
- CLINICAL STUDY (5624)*
- ULTRASTRUCTURE, CASE REPORTS (5467)*
- LYMPHOMA, HISTOLOGY, PATHOLOGY, HUMAN (4235)*
- MALIGNANCY, METASTATIC BONE DISEASE, HUMAN (4236)*
- MALIGNANT TUMORS, ESTRADIOL BINDING, THIOLS, HUMAN (6339)*
- ORAL CONTRACEPTIVE, PATHOLOGY, REVIEW (0922)*
- PAGET'S DISEASE, MALE, CASE REPORT (4979)*
- PATHOLOGY, EXOGENOUS FACTORS, HUMAN (6217)*
- PRIMARY OPERABLE CANCER, MAXIMUM DIAMETER, METASTATIC AXILLARY LYMPH NODES, STATISTICAL STUDY (4855)
- TUBULAR CARCINOMA, ULTRASTRUCTURE CASE REPORTS (3354)*
- HUMAN (4054)*
- TUMOR
- ATOMIC BOMB RADIATION, INCIDENCE, HUMAN, REVIEW (3027)
- CALCIFICATIONS, ULTRASTRUCTURE, HUMAN (6262)*
- BRENNER TUMOR
- OVARY, LEYDIG CELL HYPERPLASIA, CASE REPORT (5611)*
- PROLIFERATIVE
- CASE REPORT (5587)*
- MALIGNANT, OVARY, CLINICAL STUDY (5569)*
- BROMODEOXYURIDINE
- C-TYPE VIRUS INDUCTION, CLONAL CELL LINES, MOUSE (4523)
- 5-BROMODEOXYURIDINE
- EPSTEIN-BARR VIRUS, ACTIVATION, HUMAN (2512)
- EPSTEIN-BARR VIRUS-ASSOCIATED ANTIGENS HUMAN CELLS (5387)*
- FOCUS FORMING VIRUS, GENOME RESCUE, NON-PRODUCTIVE CELL, RAT (1731)
- MURINE LEUKEMIA VIRUS, ACTIVATION, 5-IODODEOXYURIDINE, MOUSE (1031)
- RADIOSENSITIZATION, α -IRRADIATION, CELL CYCLE, HAMSTER (1309)*
- 5-FORMO-2-DEOXYURIDINE
- SV40 T ANTIGEN SUPPRESSION, TRANSFORMED HAMSTER CELLS (4750)*
- BROMOETHYLBENZ(A)ANTHRACENE
- DNA CROSS-LINKING, T7 BACTERIOPHAGE (5181)
- 7-BROMOMETHYLBENZ(A)ANTHRACENE
- CARCINOGENESIS, STRUCTURE AND ACTIVITY (2414)*
- DERIVATIVES, CARCINOGENICITY, MOUSE (3671)
- DNA, DOUBLE HELICER, CROSS-LINKING (3659)
- POLYGUANYLIC ACID, CARCINOGEN ACTION (0382)*
- BRONCHI
- CARCINOMA
- GROWTH, HUMAN (0803)*
- HUMAN, REVIEW (0623)*
- INCIDENCE, SWITZERLAND (1418)
- ISONIACIDE, TUBERCULOSIS, HUMAN (0985)*
- MITOTIC INDEX, HUMAN (1109)*
- BRONCHIAL
- CANCER, HUMAN (2112)*
- BRONCHITIS
- MORTALITY, NEWSPAPER WORKERS, ENGLAND (2754)
- BRONCHIUM
- CARCINOID ADENOMA, CUSHING'S SYNDROME, ACTH, HUMAN (4292)*
- BROWN-PIERCE CARCINOMA
- METASTASIS INHIBITION, INTERFERON, RABBIT (1164)*
- METASTASIZATION, INTERFERON INFLUENCE, RABBIT (3342)*
- RURKITT'S LYMPHOMA
- ANTIBODIES TO EPSTEIN-BARR VIRUS, AMERICAN PATIENTS (4630)
- ANTIGENICITY, COMPLEMENT FIXATION, EPSTEIN-BARR VIRUS, HUMAN (0467)
- BONE MARROW INVOLVEMENT, HUMAN (4786)
- CELL AGGREGATION, STATIONARY CULTURE, EXPERIMENTAL ANALYSIS, THEORETICAL ANALYSIS (5584)*
- CELL CHARACTERIZATION, ACIDIC NUCLEAR PROTEIN PROFILE, HUMAN (3999)
- CELL CULTURE, EPSTEIN-BARR VIRUS, MEMBRANE ANTIGEN, EARLY ANTIGEN (0448)
- CELL DENSITY, EPSTEIN-BARR VIRUS, SYNTHESIS (1322)
- CELL LINE ESTABLISHMENT, EPSTEIN-BARR VIRUS (4032)
- CELLS
- OCULAR HERPES SIMPLEX VIRUS, INFECTION INHIBITION, HUMAN (1725)
- VERO CELLS, COCULTIVATION, EPSTEIN-BARR VIRUS (0693)
- CELLULAR RESPIRATION, MICRO-CARTESIAN DIVER TECHNIQUE (4133)*
- CHROMOSOME, FLUORESCENT PATTERN, HUMAN (0275)*

CHROMOSOME 14; MARKER BAND (3795)
CLINICAL FEATURES

IMMUNOLOGY, ETIOLOGY, REVIEW
(0907)

THERAPY, REVIEW (2906)

COLONY INHIBITION, EFFECTOR CELL,
HUMAN (4685)

COMPLEMENT-FIXING ANTIBODY, SERUM,
HUMAN (4663)

CYTOTOXIC ANTIBODY, INFECTIOUS
MONONUCLEOSIS, LEUKEMIA, HUMAN
(0752)

EPSTEIN-BARR VIRUS

CASE REPORT, INDIA (0736)*

DNA SYNTHESIS, ARGININE
DEPRIVATION (0402)

HERPESVIRUS SAIMIRI, H. SAIMIRI
LYMPHOMA, REVIEW (4320)

HOST CELL GROWTH (1010)

HUMAN, REVIEW (5041)*

IGM (5977)

PRODUCTION, LYMPHOCYTE, MONKEY
(1011)

ETIOLOGY

EPSTEIN-BARR VIRUS, REVIEW (0903)

REVIEW (5736)*

HERPESVIRUS, ANTIGENIC RELATIONSHIPS,
MAREK'S DISEASE, INFECTIOUS BOVINE
RHINOTRACHEITIS (4611)

HODGKIN'S DISEASE, MULTIPLE MYELOMA,
AFRICA, REVIEW (0005)

IGM IMMUNOGLOBULIN, KAPPA CHAIN,
ISOLATION, HUMAN (1380)

IMMUNOGLOBULIN, IGM-KAPPA, CELL
SURFACE (1058)

IMMUNOGLOBULIN SYNTHESIS, HUMAN (4690)

INCIDENCE, ETIOLOGY, CONGO (0202)

INDUCTION OF ACUTE LEUKEMIA, CASE
REPORT (3384)*

INFECTIOUS MONONUCLEOSIS, SOLUBLE
ANTIGEN, SERUM, MAN (0166)

KARYOTYPE, CHROMOSOME (0399)

LEUKEMIA, DIMETHYLSULFOXIDE KINETICS,
IN VITRO (4254)*

LEUKOCYTE, EFFECTOR CELL ACTIVITY,
HUMAN (4623)

LYMPHOBLASTOID CELLS, HYBRIDIZATION,
INACTIVATED SENDAI VIRUS, CHROMOSOME
ANALYSIS, MOUSE AND HUMAN CELL LINES
(3053)

MEASLES, REGRESSION, HUMAN (0781)*

NASOPHARYNGEAL CARCINOMA,

IMMUNOGLOBULIN (1052)

NASOPHARYNX, HUMAN, REVIEW (4332)*

NIGERIA, EPIDEMIOLOGY (0201)

RELAPSE PATTERNS, UGANDA (4789)

SOMATIC CELL HYBRID, EPSTEIN-BARR
VIRUS, RESCUE, 5-IODODEOXYURIDINE
(4536)

SURVIVAL, GHANA (3257)

TIME-SPACE CLUSTER, INCIDENCE,
UGANDA (1094)

TROPICAL SPLENOMEGALY SYNDROME,
HUMAN (0400)

TUMOR CELL, AUTOCHTHONOUS LEUKOCYTE
REACTION, CELL STIMULATION, HUMAN
(3888)

TUMORS, FLUORESCENT CHROMOSOME STAIN-
ING, HUMAN (2852)

ULTRASTRUCTURE, CYTOLOGY, CASE REPORT
(4207)*

RN

NUCLEIC ACID SYNTHESIS, REVERSIBLE
ALTERATION, HUMAN (1683)*

BURSECTOMY

ROUS SARCOMA VIRUS, TUMOR GROWTH,
HYPOGAMMAGLOBULINEMIA, CHICKEN
(5239)

BUTYL(3-CARBOXYPROPYL)NITROSOAMINE
URINARY BLADDER TUMOR INDUCTION,
RAT (4470)*

BUTYL(4-HYDROXYBUTYL)NITROSOAMINE
METABOLISM, RAT (4458)*

N-BUTYL-N-(4-HYDROXYBUTYL)NITROSAMINE
BLADDER TUMOR INDUCTION, RAT
(2402)*

KIDNEY TUMOR, RAT (5183)

B-BUTYL-NITROSOUREA

NEUROGENIC TUMORS, RAT (5144)

CACHEXIA

CANCER SYNDROME, CELL TURNOVER, MOUSE
(5437)

CADMIUM

CARCINOGENESIS, HUMAN, RAT (5014)

LEYDIG CELL TUMOR, ENZYME, RAT (0952)

SOLUBILITY, SERUM, MUSCLE (4448)

TESTES, CARCINOGENESIS, RAT (4423)

CADMIUM CHLORIDE

INTERSTITIAL CELL TUMORS, TESTES, RAT
(5132)

CAFFEINE

COFFEE DRINKING, BLADDER CANCER, HUMAN
(0078)

NUCLEIC ACID SYNTHESIS, LIVER, MOUSE
(1639)*

CALCIUM

MAGNESIUM, PHOSPHOROUS, TUMOR,
HUMAN, ANIMAL (0538)

METABOLISM

BONE TUMOR, HUMAN (6400)*

TUMORS, MOUSE, PHOSPHORUS (0537)

METABOLISM IN TUMORS, CHROMIUM

ACCUMULATION, 51CR-ALLOXANTIN,

CALCIUM PHOSPHOROUS (2396)*

PHOSPHOLIPID-CALCIUM COMPLEXES,

EXPERIMENTAL TUMORS (5536)*

PRECIPITATION, TUMOR, ANIONS (0846)

PROTEIN SYNTHESIS, NORMAL CELLS,

TUMOR CELLS, RAT (5583)*

UPTAKE, EHRlich ASCITES TUMOR, MOUSE
(1487)*

CALCIUM CHROMATE

LUNG TUMOR INCIDENCE, MOUSE (4413)

CAMPTOTHECIN

ADENOVIRUS TYPE 2, INHIBITION, HELA
CELLS (5936)*

ADENOVIRUS TYPE 2 FORMATION, INHIBI-
TION (3739)

CELLULAR DEGRADATION, ADENOVIRUS
TYPE 2, HELA, RAT (2419)*

CANCER

ADENOVIRUS, ETIOLOGY, HUMAN, REVIEW
(3602)

AGE DISTRIBUTION, MATHEMATICAL MODEL,
CIGARETTE SMOKING, REVIEW (0610)

ANTIGEN, HUMAN, REVIEW (3628)*

BACILLUS CALMETTE-GUÉRIN, LEUKEMIA,
HUMAN, REVIEW (2213)

BASAL CELL, SCAR TISSUE, HUMAN (2196)*

BENIGN DISEASE, ETIOLOGICAL FACTORS,
REVIEW (1208)

BLOOD GROUP RELATIONSHIP, INDIA
(4297)*

BONE, ETIOLOGY, SPREAD, IMMUNOLOGY
(0321)*

BREAST, STROMA, ULTRASTRUCTURE, HUMAN
(2033)*

BREAST-FEEDING (0893)*

- BRONCHIAL, HUMAN (2112)*
CELL DIFFUSION
CHICKEN EGG, (3241)*
EMBRYONATED EGG, CHICKEN (4139)*
CHILD, REVIEW (0924)*
COLON, IMMUNOLOGY, HUMAN (3933)*
CONGENITAL MALFORMATION, PINEAL TUMORS
EPIDEMIOLOGICAL STUDY, JAPAN (3975)
CYTOLOGY, EXUDATES, HUMAN (6244)*
DISTRIBUTION, INCIDENCE, ENDOGAMOUS
GROUPS, INDIA (3290)*
ENZYMES, MOLECULAR FORMS (5538)
EPIDEMIOLOGY
AFRICA (0323)*
ESOPHAGEAL, GASTRIC, COLONIC,
BRONCHIAL, BREAST, REVIEW (2209)
INCIDENCE, INTERNATIONAL,
REVIEW (3636)*
PROBLEMS, SMALL POPULATION,
GERMANY (3286)*
ETIOLOGY
PATHOGENIC FACTORS (3281)*
SPREAD (0328)*
EXPERIMENTATION, REVIEW (2252)*
FAMILIAL OCCURRENCE, HUMAN (1498)*
FEMALE, HIGH INCIDENCE GROUPS, REVIEW
(2269)*
GASTRIC
HISTOLOGY, PROGNOSIS, HUMAN
(2105)*
SEROLOGICAL REACTION, HUMAN
(2104)*
GASTRIC STUMP, ULCER, HUMAN (6213)*
GASTROINTESTINAL TRACT, EPIDEMIOLOGY,
DAKAR (0521)*
HERPESVIRUS HUMANIS, INFECTIOUS
MONONUCLEOSIS (0315)*
HUMAN, REVIEW (2913)*
IMMUNITY, HUMAN, REVIEW (3634)*
IMMUNOGENICITY, TUMOR (0007)*
IMMUNOLOGY, MOUSE, REVIEW (2914)*
INCIDENCE
CONNECTICUT (1947)*
INDIA (1226)*
MAMMARY GLAND, STRUCTURE, MOUSE
(0575)*
1969, CONNECTICUT (5429)*
THAILAND (1931)
YUGOSLAVIA (3289)
INCIDENCE TRENDS, 1935-1965,
CONNECTICUT (4809)
JUVENILE, TISSUE AGING (5559)*
LEUKEMIA, MORTALITY, FRANCE (3249)
LIVER, ALPHA-FETOPROTEIN IMMUNO-
FLUORESCENCE, HUMAN (4713)*
LUNG, GI TRACT, MINERAL OIL, INCIDENCE
HUMAN (5426)
MAMMARY GLAND, CORPUS UTERI, ANTI-
GONADOTROPIC FACTOR, HUMAN (6175)*
METASTASES, VERTEBRAL BODY, POSTMORTEM
EXAMINATION, X-RAY STUDY (3585)*
METASTASES TO THE BREAST, HISTOLOGY,
HUMAN (4224)*
MICROSCOPICALLY DIAGNOSED, INCIDENCE,
SINGAPORE (2748)
MORTALITY
AIR POLLUTION, SWITZERLAND (6098)*
ETHNIC GROUPS, INCIDENCE, HAWAII
(3263)
INDIA (1930)
JEWISH POPULATIONS, UNITED STATES
(6075)
NEW YORK CITY (3262)
1950-1967, AMERICAN INDIANS (5421)
POLISH MIGRANTS TO AUSTRALIA
(3274)
YUGOSLAVIA (6076)
NEOPLASTIC TRANSFORMATION, GENETIC
CHANGE, REVIEW (0607)
OCCUPATIONAL HAZARD, ENVIRONMENT,
HUMAN, REVIEW (2279)*
ONCOGENIC VIRUSES, HUMAN, REVIEW
(3643)*
PANCREAS, STOMACH, HUMAN, REVIEW
(2273)*
PATIENT
ALLERGY, ASSOCIATION, HUMAN
(0261)*
CARBOHYDRATE METABOLISM (1171)*
LYMPHOCYTE ACTIVATION, PHYTO-
HEMAGGLUTININ (0481)
SERUM SULFHYDRYL GROUPS,
ALKALINE PHOSPHATASE, HUMAN
(0870)*
PREINVASIVE, ULTRASTRUCTURE, CORNEAL
EPITHELIUM (1866)
PREVENTION, REVIEW (2266)*
PRIMARY, LIVER, HEPATITIS, CIRRHOSIS,
EPIDEMIOLOGY, DAKAR (4018)
PRONENESS, AGE, MONTH OF BIRTH,
STATISTICAL STUDY (4807)
RADIATION-INDUCED, HUMAN, REVIEW
(4329)*
RECTUM
REVIEW (2229)*
TNM-CLASSIFICATION, CLINIC,
THERAPY (3583)*
SCAR, CHRONIC ULCERATION, HUMAN
(3953)*
SMOKING & HUMAN, REVIEW (2277)*
SPONTANEOUS REGRESSION, FACTORS,
AUTOPSY STUDY (6024)*
STILBESTEROL, REVIEW (0927)*
STOMACH, SURGERY, BENIGN, HUMAN
(2188)*
SURFACE-CHEMICAL THEORY, REVIEW
(5734)*
SURVIVAL, LUNG, SMOKING, HUMAN (3693)
THEORY, CELL SURFACE POLYMERS,
INTRACELLULAR IONIC HIERARCHY,
MITOTIC REGULATION (0224)
TISSUE PROTEOLYSIS, ENZYMES, REVIEW
(3623)*
TISSUE TRANSPLANTATION, XENOPUS LAEVIS
(3934)*
TOBACCO, PROCESSING FACTOR,
EPIDEMIOLOGY (0333)*
TYPICAL SITES, WOMEN (6396)*
VIROLOGY, BREAST CANCER VIRUS,
MORPHOLOGIC DEVELOPMENT, TRANS-
MISSION MECHANISMS, REVIEW (3632)*
VIRUS (0327)*
EPIDEMIOLOGY, AFRICA (0316)*
HUMAN, REVIEW (5071)*
LEUKEMIA, MAMMARY GLAND (0330)*
VIRUS THEORIES, RESEARCH (4610)*
VULVAR PRURITUS, TRICHOMONAS,
CANDIDIASIS, HUMAN (6224)*
CANCER FAMILY
CHROMOSOME (0247)
CANCER REGISTRY
BIAS, UGANDA (4814)
CANCEROGENESIS
CYTODIFFERENTIATION, EPIGENETIC
MECHANISM, REVIEW (2910)
DIMETHYLBENZ(A)ANTHRACENE, PROGESTER-
ONE, DNA SYNTHESIS, MAMMARY GLAND,
RAT (4364)

INVERTEBRATES, EXPERIMENTAL ANIMAL,
 SNAIL (1956)
 MOLECULAR ASPECTS, REVIEW (2915)*
 ANDIDIASIS
 CHRONIC MUCOCUTANEOUS, MYOSITIS,
 THYMOMA, CASE REPORT (6283)*
 ANNABINOLIDS
 ONCOGENIC POTENTIAL, MURINE LEUKEMIA
 VIRUS, FISCHER RAT EMBRYO CELLS,
 TRANSFORMATION (3080)
 ANTHARIDIN
 ASIATICOSIDE, 3-METHYLCHOLANTHRENE,
 SKIN, RETICULOSIS, MOUSE (4391)
 ARBAMATE
 1-(4-CHLOROPHENYL)-1-PHENYL-2-PROPYL,
 TUMORIGENICITY, RAT (5077)
 ARBOHYDRATE
 METABOLISM
 CANCER PATIENT (1171)*
 CHRONIC LEUKOSIS, HUMAN (3485)*
 EHRLICH ASCITES TUMOR, NUCLEOTIDE,
 IN VITRO (6240)*
 ENZYME ACTIVITY, GENETIC EXPRESS-
 ION REGULATION, CANCER CELL
 DETECTION (6141)*
 HEPATOMAS, ENZYME ACTIVITY, MOUSE,
 HAMSTER (5840)*
 MALIGNANT LYMPHOMA, HUMAN (6226)*
 NEOPLASTIC PROCESS, HUMAN (3313)
 PROTEIN, DIET, DIMETHYLNITROSAMINE
 METABOLISM, RAT (0965)
 TRANSPLANTATION ANTIGENS, SPLEEN
 CELLS, TUMOR CELLS, MOUSE (0159)
 TUMOR CELL, ELECTRON MICROSCOPY,
 CONCAVALIN A, MOUSE (4080)*
 TA-CARBOLINES
 CARCINOGENICITY, NITROGEN COMPOUNDS
 (2433)*
 CARBON TETRACHLORIDE
 HEPATOTOXICITY, BENZO(A)PYRENE
 PRETREATMENT, RAT (4451)*
 LIVER, 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 ADRENAL GLAND, RAT (4414)
 LUNG, LIVER, METAL DISTRIBUTION,
 MICROSOMAL ENZYMES, RAT (4403)
 3-METHYLCHOLANTHRENE, LIVER,
 CIRRHOSIS, RAT (0064)
 CARCINOEMBRYONIC ANTIGEN
 COLON, STOMACH, TUMOR, HUMAN (4664)
 COLON ADENOCARCINOMA, HUMAN (5327)
 COLONIC TUMOR, DIFFERENTIATION, HUMAN
 (4684)
 DETERMINANTS, COLONIC CARCINOMA, HUMAN
 (5320)
 DIGESTIVE SYSTEM, HUMAN, REVIEW (5710)
 ISOLATION, DIGESTIVE TRACT CANCER,
 HUMAN (4689)
 RADIOIMMUNE ASSAY (4648)
 SERUM, PLASMA, LYMPHOCYTE INHIBITION,
 COLON CANCER, HUMAN (3181)
 SKIN REACTIVE ANTIGEN, INTESTINE,
 CANCER, HUMAN (4697)
 CARCINOGENESIS
 AFLATOXIN, RAT, DUCK (3673)
 AROMATIC HYDROCARBONS, K AND L REGION
 THEORY, MOUSE (2427)*
 BIOCHEMICAL ASPECTS, AFLATOXIN,
 NITROSAMINES, REVIEW (2285)*
 BIOCHEMICAL PATHOGENESIS, MOLECULAR
 BIOLOGY, REVIEW (5744)*
 7-BROMOMETHYLBENZ(A)ANTHRACENE,
 STRUCTURE AND ACTIVITY (2414)*
 CADMIUM, HUMAN, RAT (5014)
 CHEMICAL
 AFLATOXIN, PESTICIDES, ALKYLATING
 AGENTS, REVIEW (2265)*
 TUMOR CELL BIOLOGY (0311)*
 CONTROL, ACTIVATED MACROPHAGES, MOUSE
 (4984)*
 DIAZODIBENZOPYRENE, MOUSE (3699)
 7H-DIBENZO(C,G)CARBAZOLE, RESPIRATORY
 TRACT, EPITHELIUM, HAMSTER (2940)
 DIETHYLNITROSAMINE, RAT (3670)
 DIMETHYLAMINOAZOBENZENE, POLYADENYLIC
 ACID HYDROLASE, LIVER, RAT (3654)
 DIMETHYLBENZANTHRACENE, RAT (4365)
 DIMETHYLCARBAMYL CHLORIDE, MOUSE
 (3647)
 DRUG-INDUCED CANCER, HUMAN (2998)
 DYNAMICS, RADIOLOGY, RAT (0517)*
 ENVIRONMENTAL HAZARD, HUMAN, REVIEW
 (2281)*
 EPIDEMIOLOGY, MULTI-STAGE MODEL
 (0513)
 ETHYLNITROSOUREA, NEURINOMA, TISSUE
 CULTURE, RAT (3700)
 FETAL, EXPERIMENTAL, REVIEW (2234)*
 GENETICS, HUMAN, REVIEW (5023)
 GROWTH, METASTASIS, REVIEW (2231)*
 HISTOLOGY, ETIOLOGY, REVIEW (2221)*
 HORMONAL, GENETIC, VIRAL, CHEMICAL,
 RADIATION, REVIEW (2270)*
 HORMONE-INDUCED, HUMAN (0314)*
 IMMUNODEPRESSION, REVIEW (2272)*
 INFORMATION THEORETICAL MODEL,
 TRANSFORMATION, CELL (4441)
 INHIBITION, DIMETHYLBENZANTHRACENE,
 DIETARY ZINC, HAMSTER (1259)
 MAMMARY ADENOCARCINOMA, ESTROGEN,
 MONKEY (3669)
 MECHANISM, RNA TUMOR VIRUS,
 DNA POLYMERASE, FELINE SARCOMA VIRUS
 (0697)
 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE,
 LIVER, RAT (0347)
 NICKEL, CHROMIUM, HUMAN, REVIEW (5009)
 NITROSO COMPOUNDS, STOMACH, RAT
 (2426)*
 PARASITOSIS, HUMAN (0313)*
 PSYCHOLOGICAL FACTOR, REVIEW (4204)*
 RADIATION, HUMAN (0031)*
 SOLUBLE FACTOR, LYMPHOCYTE, MAN (0835)
 SQUAMOUS CELL CARCINOMA, 3-METHYL-
 CHOLANTHRENE, LUNG, RAT (4404)
 THEORY, METABOLIC PATHWAYS, REVIEW
 (4326)*
 TOPICAL ASPECTS, REVIEW (5758)*
 TRANSPLACENTAL, STILBESTROL, HUMAN
 (0093)*
 TUMOR ANTIGENS, MOUSE (6049)*
 TUMOR GROWTH, MAMMALIAN CELL SYSTEMS,
 PROLIFERATIVE PROPERTIES, REVIEW
 (5756)*
 TUMOR VIRUSES, REVIEW (5753)*
 URETHANE, MOUSE (4412)
 VIRAL, REVIEW (4339)*
 VIRAL GENOME, REVIEW (5757)*
 VIRUS, EXPERIMENTAL, REVIEW (2241)*
 CARCINOGENIC HYDROCARBONS
 MITOCHONDRIA, CHEMILUMINESCENCE (5790)
 CARCINOGENICITY
 N-ACETYL-2-AMINOFLUORENE, MUTAGENIC
 PROPERTIES, MOLECULAR MECHANISM,
 DROSOPHILA (2340)
 AFLATOXIN B1, LASIOCARPINE, LIVER,
 RAT (2351)
 AGROBACTERIUM TUMEFACIENS, BACTERIAL
 ATTENUATION, CROWN GALL TUMOR

- (6242)*
 ANTINEOPLASTIC THERAPEUTIC AGENTS,
 POTENTIAL EFFECTS (2382)*
 ANTITUMOR AGENTS, IMMUNOSUPPRESSION,
 EXPERIMENTAL STUDIES (2440)*
 ASBESTOS, GUINEA PIG (2333)
 BENZO(A)PYRENE
 FERRIC OXIDE, LUNG, HAMSTER (2312)
 MITOCHONDRIA, LIVER, RAT (2313)
 CIGARETTE TAR, LUNG CELLS, TRANS-
 FORMATION, HAMSTER (2332)
 CYTOSTATIC SUBSTANCE, REVIEW (1513)
 DAUNOMYCIN, ADRIAMYCIN, BREAST
 CARCINOMA, FIBROADENOMA, RAT (2343)
 DIETARY EFFECT, 3-MMA8 ACTIVITY, RATS
 (2302)
 DIMETHYLAMINOAZOBENZENE, 3'-METHYL-DAR
 MICROSOMES, LIVER, RAT (2301)
 ENHANCEMENT, N-NITROSODIETHYLAMINE,
 TRANSPLACENTAL AND MATURE AGE
 EXPOSURE, MOUSE (0357)
 ESTROGEN
 CERVICAL, MOUSE (2346)
 UROGENITAL TRACT, HUMAN (2345)
 ETHYLNITROSOBIURET, TRANSPLACENTAL
 EFFECT, NEONATAL TREATMENT, RAT
 (0345)
 HERPES VIRUS, REVIEW (0613)
 HETEROLOGOUS BONE FRAGMENTS, RAT
 (6271)*
 4-HYDROXYAMINOQUINOLINE-1-OXIDE,
 PANCREAS, RAT (2350)
 INHIBITION, METASTASIS, TRITON WR 1339
 MOUSE (2361)
 LASIOCARPINE, RAT (2352)
 NITROGEN COMPOUNDS
 BETA-CARBOLINES (2433)*
 POLYCYCLIC AMINES, ANTI-MARCHWALD
 ORIENTATION, SKRAUP REACTIONS
 (2373)*
 4-NITROQUINOLINE 1-OXIDE, MICROBIAL
 ASSAY, SALMONELLA TYPHIMURIUM (4419)
 NITROSAMINE-INDUCED, ALKYLATION OF
 N-7 GUANINE, DIETHYLNITROSAMINE,
 N-ETHYL-N-NITROSOUREA, ETHYL
 METHANESULPHONATE, RAT (2320)
 NITROSAMINES, FOOD, FISH (2319)
 OVERHEATED COOKING OILS, BENZO(A)-
 PYRENE, RAT (5159)
 5-OXO-5H-BENZO(E)ISOCHROMENO(4,3-B)
 INDOLE, STRUCTURE ACTIVITY
 RELATIONSHIPS, MOUSE (0338)
 PARTICULATE POLLUTANTS, NEW YORK CITY,
 MOUSE (4366)
 PENICILLIN, MECHANISM, ALKYLATION
 PROCESS (0076)
 POLYPROPYLENE PRODUCTS, MOUSE (0037)
 POTENTIAL, SODIUM HYPOCHLORITE, MOUSE
 (2334)
 SOIL FACTORS, REVIEW (2249)*
 SOOT, BENZO(A)PYRENE, MOUSE (1602)
 TRANSPLACENTAL, HEXAMETHYLENE-
 TETRAAMINE, RAT (0040)
 TUMOR, CHEMOTHERAPEUTIC AGENTS, REVIEW
 (0004)
 TUMOR CELL NUCLEIC ACIDS, HUMAN, MOUSE
 (3829)*
 ULTRASTRUCTURE, NUCLEOLAR SEGREGATION,
 4-NITROQUINOLINE-1-OXIDES (0644)
 URETHANE, HEPATOCYTES, ULTRASTRUCTURE,
 MOUSE (2327)
 CARCINOGENS
 DYES, MEAT MARKING COLORS,
 NEW ZEALAND (2986)
 ENVIRONMENT, REVIEW (2250)*
 ENVIRONMENTAL HAZARD, MAXIMUM
 CONCENTRATIONS, REVIEW (2251)*
 CARCINOIDS
 CASE REPORTS, REVIEW (2291)*
 ORGAN DISTRIBUTION, STATISTICS, WIENNA
 (4150)*
 CARCINOMA
 ADENOID CYSTIC, PAROTID GLAND,
 ULTRASTRUCTURE (0228)
 ADENOMA, LUNG, CHROMOSOME, HUMAN
 (0245)
 ADRENOCORTEX, CYCLIC NUCLEOTIDE
 PHOSPHODIESTERASE, RAT (4071)*
 ADRENOCORTICAL, ESTROGEN-DEPENDENT
 TUMOR, GROWTH, RAT (0229)
 ALVEOLAR CELL, HUMAN (2139)*
 AUTOIMMUNOLOGICAL CHANGES, SKIN
 (1856)*
 BASAL CELL
 CAPILLARY STRUCTURE, HUMAN (6246)*
 ELECTRON MICROSCOPY, HUMAN (2079)*
 TRAUMA INDUCED, HUMAN (2100)*
 ULTRASTRUCTURE, DIFFERENTIATION
 (0192)*
 BENIGNITY, REPRESSION, CHILDREN
 (0019)*
 BILATERAL, BREAST, INCIDENCE,
 PATHOLOGY, HUMAN (6275)*
 BLADDER
 BILHARZIAL, PREGNANCY, LABOR,
 HUMAN (1979)
 CIRCULATING TUMOR CELLS, HUMAN
 (6231)*
 BREAST
 BLOOD IRRIGATION, HUMAN (6399)*
 CHILDHOOD, RECURRENCE (4097)*
 INTRA-EPITHELIAL, ULTRASTRUCTURE,
 HUMAN (2099)*
 METASTASES, ESOPHAGUS, HUMAN
 (2133)*
 MORTALITY, DETECTION (6377)*
 THERMOGRAPHY, HUMAN (6398)*
 BRONCHIAL
 EPIDEMIOLOGY, ETIOLOGY, REVIEW
 (2298)*
 ETIOLOGY, PATHOGENESIS, REVIEW
 (2283)*
 RISK POPULATIONS (6397)*
 BRONCHIOLO-ALVEOLAR, NODULAR DIS-
 SEMINATED TYPE, NODULAR PNEUMONIC
 MIXED TYPE, ALVEOLAR CELL CARCINOMA
 (3584)*
 BRONCHUS, NECROPSY FINDINGS, HUMAN,
 REVIEW (2902)
 CELL TUMORIGENICITY, ANTILYMPHOCYTE
 GLOBULIN, MONKEY, HUMAN (3872)
 CERVIX, INCIDENCE, ISRAEL,
 EPIDEMIOLOGICAL STUDY (3973)
 CLOACOGENIC, ANAL CANAL, ULTRASTRUC-
 TURE, CLINICAL-HISTOLOGICAL STUDY
 (4171)*
 COLON
 IMMUNE REACTIVITY, HUMAN (1868)*
 IMMUNOLOGY (0009)*
 RECTUM, HUMAN, REVIEW (2276)*
 COMPLICATION, ILEOCYSTOPLASTY, HUMAN
 (2057)*
 DIGESTIVE TRACT, CARCINOEMBRYONIC
 ANTIGEN, HUMAN (1869)*
 DUODENUM, POLYPOSIS, CASE REPORT
 (4294)*
 EHRLICH, TRANSPLANT, MICE (2051)*
 EHRLICH ASCITES, LIVER, LIPIDS, MOUSE

(2088)*
 DOMETRIAL, ULTRASTRUCTURE, HUMAN
 (0886)*
 IDEMIOLOGY, ANTHROPOMETRY, WOMAN
 (0529)*
 IDERMAL, MITOTIC INHIBITION, MICE
 (2073)*
 XTRAHEPATIC BILE DUCT SYSTEM,
 NOMENCLATURE (4152)*
 STRIC
 HISTOLOGIC APPEARANCE, HIGH
 AND LOW MORTALITY COUNTRIES
 (0879)*
 HUMAN (2026)*
 IMMUNOLOGIC DISORDERS, HUMAN
 (2024)*
 STROINTESTINAL TRACT, EARLY DETEC-
 TION, MORTALITY (6376)*
 EATER OMENTUM, HISTOPATHOLOGY, CASE
 REPORT (6260)*
 MLYTIC PROCESSES, HUMAN (4195)*
 PATOCELLULAR, BENZIDINE, MOUSE
 (0052)
 POPHARYNGEAL, HUMAN CELL LINE
 (2117)*
 MUNODEFICIENCY, INCIDENCE, HUMAN
 (0024)*
 CIDENCE
 EAST AFRICA, INDIAN POPULATION
 (0814)
 EFFECT OF AGING (0621)*
 GEOGRAPHIC VARIATION, HUMAN
 (0309)*
 LET CELLS, STAINING TECHNIQUES,
 HUMAN (2199)*
 UKEMIC REACTIONS (3587)*
 UKOSIS, COINCIDENCE, HUMAN (0923)*
 GHT INDUCED, EPIDERMIS, HUMAN,
 REVIEW (2271)*
 VER, PATHOLOGY (4257)*
 CALIZATION, PROSTATIC (1526)*
 NG
 ASBESTOS, INCIDENCE, HUMAN (5782)
 BRONCHIA, MORPHOLOGY, HUMAN
 (4285)*
 CALCIFIED BODIES, CYTOPATHOLOGY,
 CASE REPORTS (4273)*
 CCUPATIONAL HAZARD, INCIDENCE,
 SWEDEN (1928)
 MMARY
 ESTRADIOL RECEPTORS (2007)
 METASTASES, AXILLARY NODES, HUMAN
 (2114)*
 MMARY GLAND, SPREAD, LYMPH NODE,
 HUMAN (0285)*
 OULLARY, THYROID, HISTOLOGY, CASE
 REPORT (4142)*
 CROINVASIVE SQUAMOUS CELL, UTERINE
 CERVIX, HUMAN (1887)
 ARY
 CHROMATIN BODIES, HUMAN (2065)*
 ENDOMETRIOD, METASTASES (1967)
 ENDOMETRIOSIS, HUMAN (4226)*
 EPIDEMIOLOGY, BULGARIA (5423)
 LATE, INDIA, SMOKING, INCIDENCE
 (0820)*
 ROTID GLAND
 ACINIC CELL
 ULTRASTRUCTURE
 HUMAN (2106)*, (2135)*
 MORPHOLOGY, INCIDENCE, ALASKA
 (4232)*
 NOEPITHELIAL, LARYNGEAL SCLEROMA,
 HUMAN (2742)*

PRIMARY
 BARTHOLIN GLAND, HISTOPATHOLOGY,
 CASE REPORT (6253)*
 LIVER, GLUTAMIC DEHYDROGENASE
 (2102)*
 PROGNOSIS, CYTOLOGICAL, HUMAN (2740)*
 PROSTATE
 ARGENTAFFIN CELLS, DIFFERENTIATION
 LIPO FUSCIN, MELANIN, PROSTATIC
 EPITHELIUM (1883)
 CYTOLOGY, HUMAN (6394)*
 RENAL, FAMILIAL, HUMAN (2166)*
 RENAL PARENCHYMA, MORPHOLOGY, HUMAN
 (4143)*
 RUMEN, CATTLE, KENYA (0072)
 SALIVARY DUCT, ULTRASTRUCTURE, HUMAN
 (4129)*
 SCAR TISSUE, ESOPHAGUS, HUMAN (0507)*
 SKIN, IMMUNE RESPONSE, HUMAN (1867)*
 SQUAMOUS CELL, DISCOID LUPUS
 ERYTHEMATOSUS, CASE REPORT (6167)*
 SQUAMOUS CERVIX, HOST RESPONSE,
 CELLULAR IMMUNITY, HUMAN (1820)
 STOMACH, PATHOLOGY, HUMAN (4065)*
 THYROID
 DIAGNOSIS, THERAPY, HUMAN (2050)*
 HUMAN (2084)*, (2145)*
 URINARY BLADDER, BILHARZIASIS, HUMAN
 (4057)*
 UTERINE CERVIX
 GRANULOCYTE, ZINC, HUMAN (0571)*
 PREGNANCY, HUMAN (6382)*
 STROMAL INVASION, PATHOLOGY
 (4249)*
 VAGINAL-CERVIX-INNervation, RELATION-
 SHIP, HUMAN (3347)*
 VULVA, CHROMOSOME, HUMAN (3940)
 WALKER 256, GROWTH, SEROMUCOID
 FRACTION, OXYPHENBUTAZONE, RAT
 (1626)*
 WALKER'S, CHROMATIN TRANSCRIPTION,
 DNA REPRESSION, TRANSFORMATION
 PROCESS (4090)*
 CARCINOSARCOMA
 BLADDER, HUMAN (2180)*
 GALL BLADDER, CASE REPORT (1181)*
 GASTRIC, CASE REPORT (5496)*
 TRANSPLANTABLE, GROWTH PROMOTION,
 CREATININE, MOUSE (1629)*
 WALKER, GROWTH, ANTIBODY, MACROPHAGE,
 RAT (1406)*
 WALKER 256, TUMOR GROWTH, LIVER
 REGENERATION, RATS (3589)*
 CAROTID BODY
 TUMOR, SEX CHROMATIN, CASE REPORT
 (4280)*
 CARTILAGE
 CARTILAGINOUS TUMOR, FINGER, CASE
 REPORT (6135)*
 CASTRATION
 CARCINOGENESIS, DIMETHYLBENZANTHRACENE
 SKIN, RAT (2952)
 CATABOLISM
 GAMMA G IMMUNOGLOBULIN, MYELOMA
 PROTEIN, HUMAN, MONKEY (4699)
 CATECHOLAMINE
 CELLS, CULTURE (2171)*
 GLIAL CELLS, CULTURE, RAT (2164)*
 NEUROBLASTOMA, GANGLIONEUROMA,
 CLINICAL STUDY (6035)*
 SEX ORGAN, MICROSOMAL ENZYME INDUCER,
 GUINEA PIG (1281)*
 CECUM
 CARCINOMA, REVIEW (6313)*

LEIOMYOSARCOMA, HISTOPATHOLOGY, CASE
 REPORT (6261)*
 CELIAC DISEASE
 LYMPHOCYTE REACTIVITY, IMPAIRMENT,
 HUMAN (1835)
 CELL
 ABNORMAL, GRANULOCYTIC LEUKEMIA,
 HUMAN (2847)
 ACUTE LEUKEMIC, RNA SYNTHESIS, BLOOD
 AND BONE MARROW, HUMAN (2841)
 ADRENOCORTICAL CARCINOMA, METABOLIC
 REGULATION, ULTRASTRUCTURE, RAT
 (3531)*
 AGGREGATION, LIVER CELL CULTURE,
 DIETHYLAMINOAZOBENZENE, RAT (5793)
 ALVEOLAR CARCINOMA, LUNG, ULTRASTRUCTURE,
 HUMAN (3497)*
 ANTIBODY-PRODUCING, PLAQUE-FORMING
 CELL, IDENTIFICATION (1851)*
 ARGENTAFFIN
 ADENOMA OF STOMACH, HUMAN (4936)*
 PROSTATE CARCINOMA, DIFFERENTIATION,
 LIPO FUSCIN, MELANIN,
 PROSTATIC EPITHELIUM (1883)
 ASCITES, SUSPENSION, ION PERMEABILITY,
 MICE (2058)*
 BALB/3T3, SENSITIVITY TO VIRAL
 INFECTION, POLYCATION EFFECT (3770)
 BEHAVIOR MODULATION, SUBSTRATUM,
 FIBROBLASTIC AND LEUKEMIC CELL
 LINES, MOUSE (4895)*
 BIOLOGY
 CANCER, REVIEW (2288)*
 TUMOR (0311)*
 BLOOD MONOCYTES, GRANULOCYTE STIMULATORS,
 MONONUCLEAR COLONY FORMATION,
 HUMAN (5507)*
 BRONCHOPULMONARY CANCER, BLOOD STREAM,
 HUMAN (3363)*
 CANCER
 BINUCLEATE, IN VITRO (1460)*
 DIFFUSION, EMBRYONATED EGG,
 CHICKEN (4139)*
 EVOLUTIONARY PROPERTIES, REVIEW
 (5722)*
 NUCLEIC ACID KINETICS, HUMAN
 (3305)
 CHEMICAL CARCINOGEN TREATMENT,
 INCREASE IN LIFE SPAN, HAMSTER
 EMBRYO (5175)
 CLONES, CHRONIC MYELOID LEUKEMIA,
 CYTOCHEMISTRY, HUMAN (6144)*
 CULTURE
 CATECHOLAMINES (2171)*
 CHEMICAL CARCINOGEN, VIRUS,
 RADIATION (0022)*
 CHEMICAL RESPONSE, GLUCAGON,
 EPINEPHRINE, PROSTOGLANDINS
 (2103)*
 CHORIOCARCINOMA, HUMAN (0295)*
 HEPATOMA, LIVER TISSUE BREAKDOWN
 TECHNIQUES (4206)*
 CV-1, SV40 RESISTANT (3752)
 CYCLE, RADIATION (2463)*
 DEATH, HISTOCHEMISTRY, TRANSPLANTED
 TUMORS, MOUSE (2845)
 DEGRADATION, CAMPTOTHECIN, ADENOVIRUS
 TYPE 2, HELA, RAT (2419)*
 DENSITY, BURKITT LYMPHOMA, EPSTEIN-
 BARR VIRUS, SYNTHESIS (1322)
 DIFFERENTIATION, RAUSCHER LEUKEMIA
 VIRUS, HEMOCYANIN, MOUSE (4680)
 DIFFUSION, CANCER, CHICKEN EGG (3241)*
 DIVISION, CHEMICAL REGULATION,

CHALONES, REVIEW (5721)*
 EARLY PROLIFERATION, HEMOPOIESIS,
 ULTRASTRUCTURE, MOUSE (1903)*
 EHRlich ASCITES TUMOR, ADENOSINE
 TRIPHOSPHATASE ACTIVITY, NACE
 CONTENT OF CULTURE MEDIUM (4901)*
 EHRlich CARCINOMA
 ACCUMULATION OF EXOGENOUS ENZYMES,
 MOUSE (4147)*
 ANTIGENICITY, LIVER, MOUSE (6026)*
 ELECTRIC CHARGE, INTERACTION, MAMMARY
 GLAND TUMOR, LIVER, RAT (6389)*
 ELECTRICAL POTENTIAL DIFFERENCE, ION
 DISTRIBUTION, SHAY CHLOROLEUKEMIC
 TUMOR (4186)*
 ELECTROLYTE ALTERATIONS, LANTHANUM,
 EHRlich ASCITES TUMOR CELLS, MOUSE
 (6300)*
 FUNCTION, CHEMICAL CARCINOGENESIS,
 MOUSE (3656)
 GAUCHER
 CHRONIC MYELOGENOUS LEUKEMIA
 (3545)*
 MYELOID LEUKEMIA, ULTRASTRUCTURE,
 CYTOCHEMISTRY (6139)*
 GLIA-LIKE, PROLIFERATION, HUMAN
 (3420)*
 GROWTH, TUMOR, CONCAVALIN A
 AGGLUTINABILITY (4721)*
 GUERIN CARCINOMA, ULTRASTRUCTURE
 (6147)*
 HAIRY, RETICULOENDOTHELIOSIS, ULTRA-
 STRUCTURE, HUMAN (4950)*
 HELA
 RIOTIN SYNTHESIS, CULTURE (3501)*
 LYSOSOME, ADENOVIRUS TYPR 7
 (3828)*
 HEPATOMA, BIOCHEMISTRY, CYTOGENETICS,
 RAT (5456)
 HYBRIDS, RAT HEPATOMA-MOUSE FIBROBLAST
 ALBUMIN SYNTHESIS (4259)*
 IMMATURE, MONOCYTIC LEUKEMIA, HUMAN
 (0574)*
 INDUCED CHANGES, REVIEW (2227)*
 INTERCELLULAR JUNCTIONS, NORMAL AND
 MALIGNANT CELLS, REVIEW (4310)
 INVASIVE PROPERTIES, HISTONE TRANS-
 FORMED, MOUSE (2348)
 CELL - CONTINUED
 KINETICS
 MELANOMA, HUMAN (1105)
 RETICULUM CELL SARCOMA, SCALP,
 CASE REPORT (4234)*
 LEUKEMIA, COLONY GROWTH, CHROMOSOMES
 (2815)
 LEUKEMIC
 HEMOSTATIC ACTIVITIES, HUMAN
 (2849)
 SURFACE ANTIGEN, MURINE LEUKEMIA
 VIRUS, MOUSE (1814)
 LEYDIG TUMORS, EXPERIMENTALLY PRODUCED
 RAT, REVIEW (2919)*
 LINE, MURINE PLASMOCYTOMA, CULTIVATION
 IN SERUM-DEPRIVED MEDIA (6372)*
 L-M, IRRADIATION, LOW-LEVEL GAMMA,
 GROWTH ALTERATIONS, VIRUS
 SENSITIVITY (2476)*
 LUNG, DIFFERENTIATION, GROWTH IN VITRO
 NEOPLASIA, ULTRASTRUCTURE, HUMAN
 EMBRYO (4009)
 LYMPH NODE, GAMMAGLOBULIN, SYNTHESIS,
 SECRETION (2048)*
 LYMPHOBLASTOID
 CULTURE METHODS, EPSTEIN-BARR

VIRUS, HUMAN (2593)*
 MOTILITY, SHAPE, HUMAN (4974)*
 LYMPHOID
 CYTOTOXICITY, CANCER-BEARING MICE
 (6603)*
 IMMUNOBIOLOGY, IMMUNOGLOBULIN
 BIOSYNTHESIS, HUMAN (2695)*
 MALIGNANT
 AMINO ACID NAPHTHYLAMIDASE, HUMAN
 (0567)*
 CHARACTERIZATION, BIOCHEMICAL,
 MOUSE, HUMAN (3474)*
 MALIGNANT GLIAL, ADENYL CYCLASE,
 PHOSPHODIESTERASE, CYCLIC AMP
 DEPENDENT PROTEIN KINASE (1904)*
 MALIGNANT TRANSFORMATION, POLYCYCLIC
 HYDROCARBONS, EPOXIDES, PROSTATE,
 MOUSE (2304)
 MAMMALIAN
 TRANSFORMED, AMINO ACID AND
 CARBOHYDRATE TRANSPORT SITES
 (2735)*
 VIRAL DNA GENOMES, CARCINOGENESIS
 MECHANISM, ORGANIZATION, REVIEW
 (3611)
 MEMBRANE
 ALLOANTIGENS, LYMPHOID LOCI,
 REVIEW (1516)
 BIOCHEMICAL CHANGE, TRANSFORMATION
 DNA, MOUSE (1315)
 IMMUNOLOGIC SPECIFICITY,
 MODIFICATION, HERPESVIRUS,
 REVIEW (1206)
 NEUROBLASTOMA, ELECTROGENESIS,
 MOUSE (0552)
 MEMBRANE CHANGE, MALIGNANCY, HAMSTER
 (2644)
 MESOTHELIAL
 ENDOTOXIN INDUCED PROLIFERATION,
 RAT (2387)*
 INCREASED PROLIFERATION, INTRA-
 PERITONEAL ENDOTOXIN INJECTION,
 RAT (3535)*
 METABOLISM
 EHRLICH ASCITES TUMOR, ASCITES
 SERUM ADDITION, IN VITRO (4246)*
 INTRACRANIAL TUMORS, HISTOENZYMOL-
 OGY, HUMAN (4264)*
 MORPHOLOGY, PLANT CELLS RESEMBLING,
 TUMOR CELLS (4240)*
 MULTIPLICATION, SERUM, CANCER PATIENTS
 (5981)*
 URINE TUMOR, SYNTHESIS, L-ASPARAGINE
 (2047)*
 NEOPLASTIC
 METABOLISM, REVIEW (5047)*
 NUCLEOLINI, HUMAN (0555)
 PROLIFERATION, DEVELOPMENT,
 ACTINOMYCIN D, FLAVONOID
 COMPOUNDS (3366)*
 SELECTIVE GROWTH, CULTURE (2867)
 SURFACE, ATPASE, HUMAN (1442)
 NEOPLASTIC MAST CELL, GLYCOSPHINGO-
 LIPIDS, AMINES, MOUSE (3424)*
 NEUROBLASTOMA
 MORPHOLOGIC CHANGE, PROSTAGLANDIN
 INDUCED, MOUSE (2362)
 SURFACE GLYCOPROTEIN (2868)
 NONPRODUCTIVE
 EPSTEIN-BARR VIRUS, GENOME
 DETECTION (1703)
 FOCUS FORMING VIRUS, GENOME
 RESCUE, 5'-BROMODEOXYURIDINE,
 RAT (1731)
 MURINE SARCOMA VIRUS, GENOME
 RESCUE KINETICS, MOUSE (1735)
 NORMAL, MALIGNANT, SENSITIVITY,
 8-AZAHYPOXANTHINE, HUMAN (1473)*
 NUCLEI ISOLATION, ASCITES HEPATOMA,
 RAT (4174)*
 OPSONIC ADHERENCE, VENERAL TUMOR, DOG
 (1878)*
 PANCREATIC EXOCRINE, LIPID CONTENT,
 WALKER TUMOR, RAT (5635)*
 PATHOLOGY, UTERINE DYSPLASIA,
 CARCINOMA, HUMAN (2723)*
 PLASMA, TUMORS, ANTIBODIES, MOUSE
 (6022)*
 POLYNUCLEAR ENDOTHELIUM, VEIN,
 MALIGNANT TUMORS (4279)*
 POPULATION
 IMMUNOLOGICAL UNRESPONSIVENESS,
 MOUSE (2653)*
 VAGINA, HORMONAL CONDITION, HUMAN
 (6203)*
 POPULATION KINETICS
 MAMMARY FIBROADENOMA, SERIAL
 TRANSPLANTATION, RAT (3303)
 NEUROBLASTOMA, NEPHROBLASTOMA,
 HUMAN (4221)*
 TRANSMISSIBLE VENEREAL TUMOR,
 THYMIDINE LABELLING TECHNIQUE,
 DOG (6104)*
 PROLIFERATION
 COLONIC CRYPT, EPITHELIUM,
 GUINEA PIG (0591)*
 GENE ACTIVATION, PROTEIN SYNTHESIS
 REQUIREMENT, HUMAN FIBROBLAST
 (1884)
 GLOBULIN SYNTHESIS, RABBIT (5985)*
 NORMAL TISSUE, MALIGNANT TISSUE,
 REVIEW (1503)
 PANCREATIC ACINAR EPITHELIA,
 AUTORADIOGRAPHIC STUDIES,
 3H-THYMIDINE, RAT (3242)*
 SEBACEOUS GLAND, LABELLING INDEX,
 REGIONAL VARIATIONS, HUMAN
 (1880)
 TUMOR, GLUCOSE, IN VITRO (0570)*
 PROTOPLASMIC INCLUSIONS, TUMOR, MAN
 (0547)
 PULMONARY, STUDY METHOD, RAT, HAMSTER
 (3405)*
 PYROLYSIS-GAS-LIQUID CHROMATOGRAPHY,
 NORMAL CELLS, LEUKEMIC CELLS,
 MAMMALS (5537)*
 RECOMBINATION OF CELL LINES,
 ROTATION CULTURE, HUMAN (4886)*
 CELL - CONTINUED
 RESPIRATION
 BURKITT LYMPHOMA, MICRO-CARTESIAN
 DIVER TECHNIQUE (4133)*
 MAMMARY GLAND CARCINOMA, MOUSE
 (4188)*
 RETICULOENDOTHELIAL, IMMUNOGENIC
 ACTIVITY, TUMOR ANTIGENS, MOUSE
 (2616)
 SINGLE-CELL SUSPENSIONS, PREPARATION,
 NORMAL LIVER, REGENERATING LIVER,
 HEPATOMAS, MOUSE, RAT (6179)*
 SKIN, SENSITIVITY, SHOPE PAPILLOMA
 VIRUS, HERPES SIMPLEX VIRUS, RABBIT,
 IN VITRO (0397)
 SPINDLE CELL CARCINOMA, BURN SCAR,
 UPPER LIMB, CASE REPORT (5564)*
 SQUAMOUS CELL CARCINOMA, HISTOPATHOL-
 OGY, ULTRASTRUCTURE, HUMAN (3533)*
 SURFACE

- ANTIGEN, TOPOGRAPHY (1378)
 HEPATOMA, ANTIBODY TREATMENT,
 ELECTROPHORESIS, RAT (4711)*
 HL-A ANTIGEN, LOCALIZATION (1403)*
 ULTRASTRUCTURE, CONTACT
 MECHANISMS (0549)
 SURFACE INTERACTION, AGGLUTININ,
 RICINUS COMMUNIS (2651)*
 SURFACE MARKERS, BACTERIA, MALIGNANT,
 MAMMALIAN (2837)
 SYNCYTIUM FORMATION, XC SARCOMA CELLS,
 MURINE ENDOCRINE CARCINOMA CELLS,
 MECHANISM (4598)*
 THECA-GRANULOSA TUMORS, PROLIFERATIVE
 ENDOMETRIAL RESPONSE, HUMAN (3681)
 TRANSFORMED
 CONCAVALIN A BINDING, IMMUNO-
 FLUORESCENCE, MOUSE (1830)
 CYCLIC ADENOSINE 3',5'-MONOPHOS-
 PHATE LEVELS (2843)
 MURINE SARCOMA VIRUS PRODUCTION,
 CLONAL ISOLATION, RAT (1729)
 RNA TUMOR VIRUS, GLYCOSIDASE,
 PROTEOLYTIC ENZYME, MOUSE (1741)
 TUMOR
 ASCITES, 67 GALLIUM, MICE (2082)*
 BLOOD, RECTAL CANCER PATIENTS
 (6148)*
 CYTOPLASMIC GRANULES, ULTRAVIOLET
 INDUCIBLE FLUORESCENCE, THIAZINE
 DYE (6341)*
 LYMPHORETICULAR SYSTEM, GROWTH,
 IN VITRO (4020)
 MEMBRANES, TOPOLOGY (2009)
 MICROWAVE ABSORPTION, HAMSTER
 (1169)*
 PRESERVATION OF ANTIGENICITY,
 FORMALIN FIXATION, RABBIT
 (2654)*
 TUMORIGENESIS, PITUITARY TUMORS,
 ESTROGEN INDUCED, RAT (2416)*
 TYPING, BREAST CANCER, HUMAN (6201)*
 URINE CYTOLOGY, UROGENITAL TRACT
 TUMORS, HUMAN (6258)*
 VOLUME, CIGARETTE SMOKING, HUMAN
 (1637)*
 B-CELL
 FUNCTIONAL ONTOGENY, THYMUS, MOUSE
 (3188)
 LEUKEMIA, LYMPHOMA, MOUSE (3179)
 L-CELL
 MACROPHAGE HYBRID, IMMUNOLOGIC
 PROPERTIES (1850)*
 T-CELL
 FUNCTIONAL ONTOGENY, THYMUS, MOUSE
 (3188)
 LEUKEMIA, LYMPHOMA, MOUSE (3179)
 CELL CYCLE
 ACUTE LYMPHOBLASTIC LEUKEMIA,
 L-ASPARAGINASE, HUMAN (4026)
 CARCINOGENESIS, REVIEW (1514)
 DEPRESSION, DNA SYNTHESIS, METHYL-
 NITROSUREA, MOUSE EMBRYO (2934)
 GROWTH, TUMORS, HUMAN, REVIEW (5048)*
 KINETICS, LEUKEMIA, MOUSE (5410)
 LYMPHOCYTES, CHRONIC LYMPHOCYTIC
 LEUKEMIA, PROLIFERATION, RAT (5958)
 MOVEMENT AND DIFFERENTIATION OF CELLS,
 BASAL LAYER, CORNEAL EPITHELIUM
 (5601)*
 NONCYCLING CELLS, AGING, MODEL (4919)*
 NONHISTONE CHROMOSOMAL PROTEINS, HELA
 CELL (6124)
 NUCLEIC ACID METABOLISM, CELLULAR
 PROLIFERATION, NORMAL TISSUES,
 MALIGNANT TISSUES, HUMAN (6077)
 PHASE PROGRESSION, LEUKEMIC CELL,
 ACTINOMYCIN D, PUROMYCIN, MOUSE
 (1630)*
 RADIOSENSITIZATION, X-IRRADIATION,
 5-BROMODEOXYURIDINE, HAMSTER (1309)*
 RNA SYNTHESIS, 3H URIDINE AND 3H
 ADENINE INCORPORATION, HAMSTER CELLS
 (5606)*
 ROUS SARCOMA VIRUS, ACTIVATION,
 CHICKEN (4511)
 SYNCHRONIZATION, CYTOSINE ARABINOSIDE,
 MELANOMA, MOUSE (5632)*
 CELL DELETION
 APOPTOSIS, NEOPLASIA, REVIEW (5020)
 CELL MEMBRANE
 GROWTH NUTRIENT, MALIGNANT GROWTH,
 REVIEW (5016)
 MELANOMA, IMMUNOGLOBULIN, IMMUNO-
 FLUORESCENCE, HUMAN (6036)*
 TUMOR, PROTEOLYTIC PRODUCTS, N-ACETYL-
 NEURAMINIC ACID (3509)*
 TUMORIGENESIS, CONCAVALIN A, HUMAN
 (2093)*
 CELL MIGRATION
 INHIBITION, LYMPHOMA, ANTISERA, MOUSE
 (3897)
 CELL PROLIFERATION
 THYMUS, STIMULATION, RAT (2001)
 CELL SURFACE ANTIGEN
 MALIGNANT DISEASE, REVIEW (1510)
 CELLOPHANE
 INDUCED-TUMORS, SEMINAL GLAND, RAT
 (5199)
 CENTRAL NERVOUS SYSTEM
 EPENDYMOMA, SURVIVAL, HISTOLOGY,
 GERMANY (6180)*
 GIANT CELL TUMORS, METHYLNITROSUREA,
 DOG, RAT (5109)
 LEUKEMIA, CYTOCENTRIFUGATION, CASE
 REPORTS (4947)*
 MALIGNANT TUMOR, NUCLEASE, HUMAN
 (0236)
 NEOPLASMS
 EPIDEMIOLOGY, MINNESOTA (4820)
 FAMILIAL OCCURRENCE, POLAND (4815)
 SARCOMA, MORPHOLOGY, RAT (4856)
 TUMORS
 INCIDENCE, AFRICA (4953)*
 NERVOUS TISSUE-SPECIFIC PROTEIN
 RAT (5363)
 CEREBELLUM
 CHEMICAL CARCINOGENESIS,
 HISTOPATHOLOGY, ENZYMOPATHOLOGY,
 RAT (1416)
 GLIOMASTOMA, EXPERIMENTAL HYPER-
 THYREOSIS, ADRENAL CORTEX FUNCTION,
 RAT (6251)*
 HEMANGIOBLASTOMA, OCCURRENCE IN TWO
 CONSECUTIVE GENERATIONS, CASE REPORT
 (6255)*
 CEREBRAL
 GLIOMAS, ULTRASTRUCTURE, HUMAN (2070)*
 CEREBROSPINAL FLUID
 ALVEOLAR CARCINOMA, MALIGNANT CELL,
 ULTRASTRUCTURE, HUMAN (1182)*
 CERUMINOUS GLAND
 ADENOCARCINOMA, ULTRASTRUCTURE, CASE
 REPORT, HUMAN (3409)*
 CERVICAL ESOPHAGUS
 CANCER, TREATMENT, CASE REPORTS
 (5494)*
 CERVIX

ADENOCARCINOMA, MESONEPHRIC, HUMAN (2111)*
 OPSIED CERVICAL TUMOR CELLS, HSU-2 ANTIGENS, LATENCY, HUMAN (3895)
 ANGER
 BSP HALF-TIME, HUMAN (3415)*
 CASE REPORTS (2840)
 CAUSATION, PREVENTION, REVIEW (2218)
 EPIDEMIOLOGICAL STUDIES, SPECIFIC SOCIAL FACTORS, ANALYSIS (3268)
 EPIDEMIOLOGY OF SURVIVAL, NEW YORK (4837)*
 HERPESVIRUS HOMINIS, TYPE 2, HUMAN, REVIEW (5715)
 MORTALITY, UNITED STATES, ENGLAND (3246)
 SOCIOECONOMIC STATUS, RELATIONSHIP CONNECTICUT (3272)
 SOLUBLE MEMBRANE ANTIGEN, HERPES-VIRUS TYPE 2 ANTISERUM, IMMUNOLOGY (5372)*
 NCER PATIENT, SERUM ANTIBODY, HERPESVIRUS (2535)
 RCINOGENICITY, ESTROGEN, MOUSE (2346)
 RCINOMA
 ANTIBODY, HERPESVIRUS HOMINIS, ADENOVIRUS, HUMAN (3864)
 BIRTH CONTROL PILL, INCIDENCE, HUMAN (5794)
 BREAST, AGE OF PATIENT'S MOTHER (1160)*
 CELL-MEDIATED IMMUNITY, HUMAN (1401)
 CHROMOSOME, HUMAN (0790)*
 CHROMOSOME PATTERN, HUMAN (3546)*
 GLYCOLYSIS, HISTOGENESIS, HUMAN (4030)
 HERPES GENITALIS VIRUS, REVIEW (1223)*
 HERPES SIMPLEX VIRUS, GENITAL ORGANS, EPIDEMIOLOGY (0216)*
 HERPES SIMPLEX VIRUS TYPE 2, ANTIBODY, HUMAN (0712)
 HERPESVIRUS TYPE 2, SERO-EPIDEMIOLOGIC STUDY (1718)
 HYALINOSIS, PELVIC LYMPH NODES, CLINICAL STUDY (6171)*
 IMMUNOGLOBULINS, HUMAN (3932)*
 INCIDENCE (1417)
 AMERICAN INDIAN (2765)
 ISRAEL, EPIDEMIOLOGICAL STUDY (3973)
 METHYLCHOLANTHRENE, ESTRADIOL BENZOATE, PROGESTERONE, MONKEY (0095)*
 ORAL CONTRACEPTIVE, REVIEW (1225)*
 RADIATION THERAPY
 BLADDER TUMOR, HUMAN (0393)
 SURVIVAL, LEUKEMIA, HUMAN (1304)
 SERUM PROTEIN-BOUND FUCOSE LEVELS, PATIENTS (5484)*
 SEXUAL INTERCOURSE (0186)
 TRYPTOPHAN METABOLISM, HUMAN (4920)*
 RCINOMA IN SITU
 HERPESVIRUS, VIRAL ANTIBODY, HUMAN (0462)
 INCIDENCE, IRAQ (0525)*
 TOCERVICAL CANCER, INDIRECT METAPLASIA, BASAL PLATE, ULTRASTRUCTURE, HUMAN (6059)*
 DOMETRIOSIS, VAGINAL ADENOCARCINOMA, CASE REPORT (0794)*
 EPIDERMAL CARCINOMA, ENDOMETRIUM CARCINOMA OF UTERUS, CASE REPORTS (3244)*
 EPITHELIAL ATYPIA, PREGNANCY, INCIDENCE, CASE REPORTS (3939)
 GLUCOSE-6-PHOSPHATE DEHYDROGENASE, CARCINOMA (0249)
 HERPESVIRUS HOMINIS, INFECTED CELL, ULTRASTRUCTURE, HUMAN (3815)
 INFECTION, HERPESVIRUS TYPE 2, HUMAN (2533)
 LESIONS, NEOPLASTIC AND NON-NEOPLASTIC HYALURONIDASE VALUES, HUMAN (2726)*
 3-METHYLCHOLANTHRENE
 ESTROGEN, MOUSE (4370)
 ORIGIN, SQUAMOUS CARCINOMA, MOUSE (0060)
 MICROINVASIVE CARCINOMA, HUMAN, REVIEW (4331)*
 NEOPLASIA, EPIDEMIOLOGY, HUMAN (2772)*
 ORAL CONTRACEPTIVE, CYTOLOGY, HISTOLOGY, HUMAN (0971)*
 PERITONEAL, METASTASIS, REVIEW (1524)*
 PROTEIN SYNTHESIS, SUBCELLULAR FRACTIONS, NORMAL AND MALIGNANT TISSUE, HUMAN (4229)*
 SQUAMOUS CARCINOMA, HOST RESPONSE, CELLULAR IMMUNITY, HUMAN (1820)
 TUMOR, HERPESVIRUS TYPE 2, ISOLATION, HUMAN (1723)
 UTERI, INTRAEPITHELIAL CARCINOMA, INCIDENCE, ENGLAND (2747)
 UTERINE CARCINOMA, BACILLUS VAGINALIS, CYTOLYSIS IN DYSPLASIA, HUMAN (2720)
 UTERINE CORPUS, MORTALITY (0206)
 VAGINAL CARCINOMA, ATYPICAL EPITHELIUM STAGES, HUMAN (2741)*
 VAGINAL-CERVIX-INNervation, CARCINOMA, RELATIONSHIP, HUMAN (3347)*
 VERRUCOUS CARCINOMA, CASE REPORT (4914)*
 CERVIX UTERI
 CARCINOMA, MORTALITY, INTERNATIONAL (1921)
 EPITHELIAL LESIONS, CYTOLOGY, HISTOLOGY, REVIEW (2918)*
 MALIGNANCY, HISTOLOGY, DNA, HUMAN (2089)*
 PRIMARY MALIGNANT LYMPHOMA, CASE REPORT (4879)*
 CHALONE
 CELL REPLACEMENT, SKIN, TUMOR, REVIEW (5707)
 CHEMICAL REGULATION, CELL DIVISION, REVIEW (5721)*
 9,10-DIMETHYL-1,2-BENZANTHRACENE, SKIN CARCINOGENESIS, MOUSE (0053)
 CHEBIK-HIGASHI'S SYNDROME
 PLASMA CELL, PROLIFERATION, ALEUTIAN DISEASE, MINK (1433)
 CHEMICAL CARCINOGEN
 ACYLATION, CARBAMOYL PHOSPHATE (0944)
 ADENOMA, LUNG, MOUSE (2375)*
 AFLATOXIN, PESTICIDES, ALKYLATING AGENTS, REVIEW (2265)*
 ALKYLATING AGENT, LYMPHOCYTE, DNA REPAIR, HUMAN (0935)
 AMINO-AZO-DYE, BINDING PROTEIN, LIVER, RAT (0972)*
 AROMATIC AMINES, NITRO COMPOUNDS, AZO DYES, ALKYLATING AGENTS, REVIEW (2207)
 AROMATIC HYDROCARBONS

BENZENE, TOLUENE, MOLECULAR INTERACTION (2423)*
 DNA, COVALENT BINDING, FREE RADICAL (0354)
 AVIAN TUMOR VIRUS INDUCTION, NORMAL CHICK CELL (1707)
 BENZENOID HYDROCARBON, PI-ELECTRON RING CURRENTS (0632)
 3,4-BENZO(A)PYRENE, THYMIN, PHOTO PRODUCT, STRUCTURE (2364)*
 BLADDER, ARTIFICIAL SWEETENER, HUMAN (0032)*
 7-BROMOMETHYLBENZ(A)ANTHRACENE, POLYGUANYLIC ACID, CARCINOGEN ACTION (0382)*
 CELL TRANSFORMATION, MAMMAL, REVIEW (1210)
 CEREBELLUM, HISTOPATHOLOGY, ENZYMOPATHOLOGY (1416)
 CIGARETTE SMOKING, INSECTICIDE, MICROSOMAL ENZYMES, ENVIRONMENTAL HAZARD, HUMAN (REVIEW (0306)
 CYCLAMATES, CANCER, HUMAN, REVIEW (2278)*
 CYTOTOXICITY, TRANSFORMATION, CHROMOSOME BREAKAGE, ARYL HYDROCARBON HYDROXYLASE (4433)
 DELAYED HYPERSENSITIVITY, CELL-FREE TRANSFER, GUINEA PIG (1393)
 N,N'-DIMETHYLNITROSOUREA, LYMPHOMA, INDUCTION, MICE, REVIEW (2215)
 DOSE LIMITS DETERMINATION, REVIEW (5045)*
 HYDROCARBON
 ENZYME REPRESSION, MOLECULAR SIZE REQUIREMENT, RAT (0642)
 HETEROCYCLIC ANALOGUES (2400)*
 TRANSFORMATION IN VITRO, HAMSTER (0640)
 LASIOCARPINE, MALIGNANT TUMOR, RAT (2352)
 LUNG ADENOMA, NEWBORN MOUSE (0033)
 MECHANISM, REVIEW (0911)
 METABOLISM, BACTERIA, COLON, HUMAN, REVIEW (0304)
 3-METHYLBENZOANTHRENE, SCHMIDT-RUPPIN ROUS SARCOMA VIRUS, HUMAN CELL, TRANSFORMATION (0691)
 MURINE LEUKEMIA VIRUS, CELL SURFACE ANTIGENS, THYMIC LYMPHOMA, MOUSE, RAT (1062)
 MUTAGEN, DETECTION, BACTERIA, DNA POLYMERASE DEFICIENCY (0590)*
 MUTAGENICITY
 NEUROSPORA CRASSA (4468)*
 RNA-FORMING GENES, DROSOPHILA (5780)
 NEOPLASTIC ALTERATIONS, TOXICITY, CELLS, REVIEW (5005)
 NITROSAMINES
 ENVIRONMENT, REVIEW (2222)*
 ENVIRONMENTAL HAZARD, ANIMAL, HUMAN, REVIEW (0303)
 FOCUS, FISH (2319)
 N-NITROSAMINES, FOOD, REVIEW (2230)*
 NUCLEAR PROTEIN, BINDING, LIVER, RAT (4375)
 OCCUPATIONAL HAZARD
 ANIMAL STUDIES, REVIEW (5021)
 HUMAN, REVIEW (0617)*
 PHENYTOIN, MOUSE (2376)*
 POLYCYCLIC COMPOUNDS, PHOTODYNAMIC ACTIVITY, ZOXAZOLAMINE HYDROXYLASE INDUCTION (0635)

POLYCYCLIC HYDROCARBON, ARYL HYDROXYLASE, INDUCTION, TUMORIGENESIS, RODENT (0348)
 RADIATION, GASTRIC ADENOCARCINOMA, REVIEW (1201)
 REVIEW (0918)*
 SKIN, TOPICAL APPLICATION, MOUSE (0641)
 SOOT, LIGHT RADIATION (0097)*
 STRUCTURAL ANALOGUES, COMPARATIVE CARCINOGENICITY, RAT (0634)
 SUBCUTANEOUS TISSUE REACTION, MAMMALS (2374)*
 THIMEROSAL, VACCINE PREPARATION, CARCINOGENICITY, TOXICITY, RAT (1271)
 TISSUE CULTURE, EPOXIDES, DIOLS, PHENOLS (0062)
 TRANSFORMATION IN VITRO, HAMSTER EMBRYO CELL (1591)
 TRANSPLACENTAL, HUMAN, REVIEW (1505)
 TUMOR INDUCTION
 AXOLOTL (2403)*
 EPIDERMIS, MOUSE (2424)*
 TUMOR PROMOTION, SKIN (0088)*
 TUMOR TRANSPLANT, LIVER CELL, AGGREGATION, RAT (1269)
 TUMORIGENESIS DETERMINATION, GENETICS, HAMSTER (2925)
 UMBILICAL CORD LEUKOCYTE, CULTURE, VIRUS, RADIATION, HUMAN (0719)
 URETHANE, NITROSOMETHYLUREA, DIMETHYLNITROSAMINE, TRANSPLACENTAL BLASTOMYOGENESIS, MOUSE (1603)*
 VIRUS, RADIATION, CELL CULTURE (0022)*
 CHEMICAL CARCINOGENESIS
 3,4-BENZOPYRENE, 1,2-BENZOPYRENE, ELECTRONIC STRUCTURE, MOLECULAR ORBIT (5140)
 CELL FUNCTION, MOUSE (3656)
 CELL-FREE EXTRACTS, MOUSE (5860)*
 CHROMOSOMAL CONTROL, HAMSTER (2337)
 EPIDERMIS CELL CULTURES, MOUSE EMBRYO (5859)*
 INHIBITION, VIRAL VACCINES, MOUSE (2964)
 MECHANISMS, REVIEW (5024)
 POLYCYCLIC HYDROCARBONS, MOLECULAR MECHANISMS, K AND L REGIONS (5147)
 STATISTICAL ANALYSIS, CONTINUOUS APPLICATION, MOUSE SKIN (3698)
 TRANSPLACENTAL, HUMAN, REVIEW (3630)*
 CHEMICAL RESPONSE
 CELLS, CULTURE, GLUCAGON, EPINEPHRINE, PROSTAGLANDINS (2103)*
 CHEMILUMINESCENCE
 MITOCHONDRIA, CARCINOGENIC HYDROCARBONS (5790)
 CHEMOECTOMA
 GLOMUS JUGULARE, MIDDLE EAR, HUMAN (4933)*
 LARYNX, CASE REPORTS (5481)*
 LUNG, PATHOLOGY, HUMAN (0897)*
 CHEMOTHERAPY
 IMMUNITY, MUTATION, NEOPLASM, REVIEW (1522)*
 LEUKEMIA
 ACUTE, HUMAN (2129)*
 DNA METABOLISM, LEUKEMIC CELLS, LEUKOCYTE METABOLISM, REVIEW (0609)
 LEUKOCYTE, CHROMOSOME, ABNORMALITY, HUMAN (5454)
 CHILDREN

CANCER
OBSTETRIC RADIOGRAPHY (2471)*
REVIEW (0924)*

CARCINOMA
BENIGNITY, REPRESSION (0019)*
INCIDENCE, SENEGAL (0823)*
CLINICAL STUDY (4960)*
LEUKEMIA MORTALITY, BIRTH WEIGHT
(1097)
LIVER TUMOR (0012)*
NEONATAL ONCOLOGY, CLINICAL STUDY
(6162)*
NEOPLASIA, INCIDENCE, INDIA (6200)*
POLYP, RECTUM, COLON, PATHOLOGY
(0802)*

CHLORAMPHENICOL
MITOCHONDRIAL FUNCTION INHIBITOR, ROUS
SARCOMA VIRUS REPLICATION,
MALIGNANT TRANSFORMATION, CHICK
EMBRYO CULTURE (3771)
TUMOR TISSUE, PTERIDINE, RIBOFLAVIN,
RAT (3991)

CHLORIDE
EXCHANGE, EHRlich ASCITES TUMOR,
MOUSE (1176)*

CHLORMADINONE
MESTRANOL, MAMMARY TUMORIGENESIS, RAT
(0375)*

CHLOROLEUKEMIA
CYTOLOGY, LEUKOCYTES, HUMAN (0561)*
HISTONE ISOLATION, PRIMARY STRUCTURE,
RAT (3348)*

CHLOROMA
7,12-DIMETHYLBENZ(A)ANTHRACENE,
MYELOPEROXIDASE, RAT (1567)
TUMOR, GLYCOGEN SYNTHETASE, RAT
(1446)*

CHLOROPRENE
KARYOTYPE, TRANSPLANTATION, RAT
(6215)*
LUNG CANCER, OCCUPATIONAL HAZARD
(5768)

CHOLESTEROL
HEPATOMA, FEEDBACK, RAT (1968)
HYDROXYMETHYLGLUTARYL COENZYME,
FEEDBACK CONTROL, HEPATOMA, RAT
(0536)
LIPID ANOMALY, LIVER, AFLATOXIN,
DUCKLING (1622)*
LIVER, MORRIS HEPATOMA, ENZYME
REGULATION, RAT (4851)
SYNTHESIS, N-2-FLUORENYLACETAMIDE,
LIVER, RAT (4782)
SYNTHESIS, METABOLIC CONTROLS,
PREGANEROUS LIVER, N-2-FLUORENYL-
ACETAMIDE, RAT (2963)
UNSATURATED FAT DIET, CANCER RISK
(0077)

CHOLINE
TRANSPORT, HEPATOMA, RAT (1357)*

CHONDROITINSULFATE
GROWTH, SOLID EHRlich ASCITES TUMOR,
MOUSE (4899)*

CHONDROSARCOMA
MUCOPOLYSACCHARIDE, PROTEIN POLY-
SACCHARIDE, ISOLATION, RAT (0293)*

CHORIOCARCINOMA
BETA-GLUCURONIDASE, HEXOSAMINIDASE,
CULTURED HUMAN CELLS (6309)*
CELL, CULTURE, HUMAN (0295)*
GESTATIONAL
HL-A ANTIGENS, HUMAN (3892)
IMMUNOLOGICAL ASPECTS, REVIEW
(5759)*

INVASIVE HYDATID MOLE, INCIDENCE,
DENMARK (3250)
GYNECOMASTASIA, ESTROGENS, CASE
REPORT (1185)*
HL-A ANTIGEN SYSTEM, HUMAN (2413)*
HL-A ANTIGENS, HUMAN (3172)
MALIGNANT TROPHOBLASTIC NEOPLASIA,
INCIDENCE, SINGAPORE (0809)
SERUM HYALURONIDASE, HYDATID MOLE,
HUMAN (4262)*
TESTICLE, LSD, HUMAN (0986)*
TROPHOBLAST, ENZYME, HUMAN (0259)*
TROPHOBLASTIC NEOPLASIA, HISTO-
COMPATIBILITY, REVIEW (1228)*
TROPHOBLASTIC TUMOR, HL-A ANTIGEN,
HUMAN (1061)
UTERUS, HYDATIDIFORM MOLE, CASE REPORT
(6221)*

CHORIOEPITHELIOMA
METASTASES, BRAIN, HUMAN (1200)*

CHORION
CARCINOMA, HL-A ANTIGEN, HUMAN (0776)*
MALIGNANCY (1987)
MALIGNANT MELANOMA, CONGENITAL
GANGLIONEUROMATOSIS, HUMAN (0865)*

CHOROID
METASTASIS, PRIMARY CANCER OF THE
BREAST, HUMAN (4137)*

CHROMATIN
ALGERIAN WOMEN, INCIDENCE (1421)*
CARCINOGENESIS, DIETHYLNITROSAMINE,
LIVER, RAT (5800)
SARCOMA, LIVER PYRUVATE KINASE
ISOENZYMES, RAT (4223)*

SEX
MAMMARY CARCINOMA, HUMAN (0863)*
TROPHOBLASTIC TUMOR, HUMAN (2681)*
TRANSCRIPTION, TRANSFORMATION,
WALKER'S CARCINOMA (4090)*
WALKER TUMOR, TRANSCRIPTIONAL TRANS-
FORMATION, NONHISTONE PROTEINS,
LIVER, RAT (4841)

CHROMATOGRAPHY
PYROLYSIS-GAS-LIQUID, NORMAL CELLS,
LEUKEMIC CELLS, MAMMALS (5537)*

CHROMIUM
ACCUMULATION IN TUMORS, CALCIUM
METABOLISM, 51CR-ALLOXANTIN,
CALCIUM-PHOSPHOROUS (2396)*
CARCINOGENESIS, OCCUPATIONAL HAZARD,
HUMAN, REVIEW (5009)

CHROMOSOME
ABERRANT, THERAPY (2072)*
ABERRATIONS
ADENOVIRUS, HUMAN (0446)*
BLOOD CELL, GAMMA IRRADIATION,
OCCUPATIONAL HAZARD, HUMAN
(0389)
CARCINOGENESIS, REVIEW (4317)
FANCONI'S ANEMIA, ADENOVIRUS
(0143)*
LEUKEMIA
CANCER, COINCIDENCE (0798)*
LYMPHOPROLIFERATIVE DISEASE,
MULTIPLE MYELOMA REVIEW
(3627)*
LEUKEMIC RETICULOENDOTHELIOSIS,
HUMAN (0593)*
LYMPHOBLASTOID CELL, HUMAN (1488)
LYMPHOBLASTOID CELL CULTURE,
LEUKEMIA, HUMAN (2831)
LYMPHOBLASTOID CELL LINE, BAROON
(5951)*
LYMPHOSARCOMATOUS TUMOR, CASE

REPORT (6110)
 MALIGNANT TUMORS
 HUMAN (3417)*
 VIRAL ETIOLOGY, HUMAN, REVIEW
 (5042)*
 N-METHYL-N'-NITRO-N-NITROSOGUANI-
 DINE, TRANSFORMATION, HAMSTER,
 CELL (3677)
 MULTIPLE MYELOMA, CASE REPORT
 (0919)*
 PRELEUKEMIA, BONE MARROW, HUMAN
 (0182)
 PRIMARY POLYCYTHEMIA, BONE MARROW
 CELL, HUMAN (1122)
 SPERMATOGONIA, CHEMICAL MUTAGENS,
 MOUSE (1644)*
 SV40 INFECTION, HELA CELL (1029)
 X-IRRADIATION, LEUKOCYTES, HUMAN,
 MARMOSET (2477)*
 X-RAY
 EMBRYO, RAT (1678)*
 RAT (0391)

ABNORMALITIES
 LEUKOCYTE, THERAPEUTIC DRUG,
 RADIATION, HUMAN (5454)
 MULTIPLE MYELOMA, HUMAN (2730)*
 ROUS SARCOMA VIRUS, TUMOR ULTRA-
 STRUCTURE, RAT (6081)
 X-IRRADIATION, LEUKEMIC CELLS,
 MOUSE (6123)
 ACUTE LEUKEMIA, DNA, CLINICAL STUDY
 (6108)
 ACUTE MYELOGENOUS LEUKEMIA, HUMAN
 (1410)
 ALTERATIONS
 CARCINOGENESIS, HUMAN, REVIEW
 (5023)
 MALIGNANT MELANOMA, HUMAN (0565)*

ANALYSIS
 FALLOPIAN TUBE CARCINOMA, CASE
 REPORT (6197)*
 HUMAN TUMORS, HETEROTRANSPLANTA-
 TION TO MOUSE (5617)*
 KARYOTYPE, QUINACRINE FLUORESCENT
 AND GIESSA BANDING, TRANSFORMED
 AND MALIGNANT CELL LINES,
 LIVER, RAT (5599)*
 ANEUPLOIDY, ACUTE LYMPHATIC LEUKEMIA,
 TRISOMY 21, CASE REPORT (3315)

ANOMALIES
 AMYLOSE, AGED MICE (5672)*
 ENDOMETRIAL ADENOCARCINOMA, HUMAN
 (4253)*
 NEOPLASIA, HUMAN (6380)*
 ASCITES TUMOR CELLS, RESISTANCE,
 DAUNORUBICINE (1995)
 BONE MARROW, RADIATION, ABNORMALITY,
 HUMAN (0103)
 BONE MARROW C, MYELOPROLIFERATIVE
 DISEASE, PRE-LEUKEMIA STATE,
 CHILDREN (3232)
 BREAKAGE
 ADENOVIRUS, CELL SUSCEPTIBILITY,
 HUMAN (0142)*
 1-METHYL-2-BENZYLHYDRAZINE, CANCER
 CELLS, MOUSE (5824)*
 TRANSFORMATION, CYTOTOXICITY
 CHEMICAL CARCINOGEN, ARYL
 HYDROCARBON HYDROXYLASE (4433)
 C- AND G- BANDING PATTERNS, RAT
 (4884)*
 CANCER FAMILY (0247)
 CERVICAL CARCINOMA, HUMAN (0790)*
 CHANGES

BENZENE, HUMAN (1288)*
 HERPES-TYPE VIRUS INFECTION,
 HUMAN CELL (1025)
 CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN
 (5448)
 CONTROL OF CHEMICAL CARCINOGENESIS,
 HAMSTER (2337)
 D, DELETION, RETINOBLASTOMA, HUMAN
 (6130)
 CHROMOSOME - CONTINUED
 DAMAGE, PHENYLBUTAZONE, LEUKEMIA,
 CASE REPORT (1292)*
 DNA, LEUKEMIA, HUMAN (0885)*
 DOUBLE-MINUTES, ORIGIN, ROUS SARCOMA,
 RAT (4601)*
 DOWN'S SYNDROME, CHRONIC MYELOID
 LEUKEMIA, HUMAN (0836)
 E16, MALIGNANCY, DATA PROCESSING
 METHOD, HUMAN (4019)
 EFFECTS OF EQUINE HERPES 3 VIRUS,
 HERPES SIMPLEX, COMPARATIVE STUDY,
 KIDNEY CELLS, RABBIT (3079)
 FAMILIAL LEUKEMIA, PELGER-HUET ANOMALY
 ICELAND (6117)
 N-2-FLUORENYLACETAMIDE, LIVER NODULE,
 HEPATOCELLULAR CARCINOMA, RAT
 (0046)
 FLUORESCENT MARKER, MALIGNANT
 LYMPHOMA (2558)
 FLUORESCENT PATTERN
 BURKITT'S LYMPHOMA, HUMAN (0275)*
 HEPATOCELLULAR CARCINOMA, RAT
 (3469)*
 MALIGNANT LYMPHOMAS, HUMAN
 (3309)
 FLUORESCENT STAINING, BURKITT'S
 LYMPHOMA, HUMAN (2852)
 45,XO, TURNER'S SYNDROME, WILM'S
 TUMOR, IMPERFORATE ANUS, CASE
 REPORT (1139)*
 GLIOMAS, METHYLCHOLANTHRENE INDUCED,
 KARYOLOGICAL STUDY, MOUSE (3304)
 HARDING-PASSEY MELANOMA, KIDNEY TUMOR
 (2030)*
 HEMOCYTOBLASTIC LEUKEMIA, CASE REPORT
 (0577)*
 HERPES SIMPLEX VIRUS, HEMATOPOIETIC
 CELL, HUMAN (3812)
 HETEROIDITY, ORIGIN, TUMOR, HUMAN,
 HAMSTER (1440)
 HYBRID, SV40-TRANSFORMED CELL, ANTIGEN
 MOUSE, RAT (4510)
 HYBRID CELL, MORPHOLOGIC DIFFERENTIA-
 TION, TUMOR (4027)
 HYBRIDIZATION, ADENOVIRUS RNA AND DNA,
 HUMAN (3108)
 INDUCED REPLICATION, MITOSIS,
 T-ANTIGEN, AUTORADIOGRAPHY (0434)
 INVASIVE CERVICAL CARCINOMA,
 PREINVASIVE (1950)
 ISOCHROMOSOME 17, IDENTIFICATION,
 MYELOID LEUKEMIA, HUMAN (4980)*
 KARYOLOGY, RHABDOMYOSARCOMA, 3-METHYL-
 CHOLANTHRENE-INDUCED, RAT (5112)
 KARYOTYPE
 ACUTE LEUKEMIA, HUMAN (4125)*
 BONE MARROW, LYMPHOSARCOMA, COW
 (3937)
 BURKITT'S LYMPHOMA (0399)
 LUNG, CARCINOMA, HUMAN (0245)
 KLINEFELTER'S SYNDROME, BREAST
 CARCINOMA, HUMAN (2834)
 LEUKEMIA, (1525)*
 MYELOID FIBROSIS, POLYCYTHEMIA,

HUMAN (0562)*
 LEUKEMOGENIC RESPONSE, RADIATION,
 MOUSE (1665)
 LYMPHOBLASTOID, MONONUCLEOSIS,
 BURKITT'S LYMPHOMA (1973)
 LYMPHOSARCOMA, BURKITT LYMPHOMA, HUMAN
 (1116)
 MALIGNANT CELL, HYBRID, MOUSE (0848)
 MALIGNANT LYMPHOMA, CASE REPORTS
 (3317)
 MARKER
 LEUKEMIA, MOUSE (0994)
 SPONTANEOUS MELANOMA, HAMSTER
 (0246)
 YOSHIDA SARCOMA, RAT (5525)*
 MARKER BAND, BURKITT'S LYMPHOMA (3795)
 NASOPHARYNGEAL CANCER, HUMAN (2021)
 NEURINOMA, NEUROSARCOMA, HUMAN (4214)*
 NUMBER, TRANSFORMED CELL PROPERTY,
 REVERTANT VARIANT, HAMSTER CELL
 (3683)
 OSTEOSARCOMA-DERIVED CELL LINE, HUMAN
 (4151)*
 OXYGEN SUPPLY, STABILITY, EMBRYO CELLS
 MOUSE (2724)*
 PATTERN
 CERVICAL CARCINOMA, ATYPICAL
 HYPERPLASIA, HUMAN (3546)*
 7,12-DIMETHYLBENZ(A)ANTHRACENE-
 INDUCED TUMOR, ROUS SARCOMA
 VIRUS TUMOR, HAMSTER (4191)*
 CHROMOSOME - CONTINUED
 PHILADELPHIA
 ACUTE LEUKEMIA, RADIATION, CASE
 REPORT (5867)*
 CHRONIC MYELOGENOUS LEUKEMIA,
 BLASTIC CRISIS, CASE REPORT
 (5473)*
 CLONAL ORIGIN, CHRONIC MYELOID
 LEUKEMIA, HUMAN (1441)
 PLOIDY FLUCTUATIONS, PLASMA CELL
 TUMOR, TRANSPLANTATION, MOUSE (2015)
 POIKILOTHERMIC CELLS, SV40 VIRUS,
 TEMPERATURE RESPONSE (2584)*
 POLYPLOIDY INDUCTION, THYMIDINE, SKIN
 FIBROBLAST, HUMAN (1296)*
 PRIMARY NEOPLASM, HAMSTER (1913)*
 PRIMARY ROUS SARCOMA, RAT (5462)*
 PULVERIZATION
 MITOSIS, SENDAI VIRUS, HAMSTER
 (0541)
 RNA SYNTHESIS (1475)*
 QUINACRINE FLUORESCENT KARYOTYPES,
 DIPLOID, HETEROPOID, HUMAN (3473)*
 RADIATION EFFECT, HUMAN (1658)
 RAUSCHER'S MURINE LEUKEMIA, V-CELL,
 MOUSE (3779)
 REPLICATION, MYELOCYTIC LEUKEMIA,
 HUMAN (0564)*
 REVERSION, TRANSFORMED CELLS, VIRUS
 (2002)
 RHABDOMYOSARCOMA, C-TYPE VIRUS, HUMAN
 (3076)
 SEQUENTIAL CHANGE, SARCOMA, ROUS
 SARCOMA VIRUS, RAT (5221)
 SMALL ACROCENTRIC, ANOMALIES, TUMOR
 CELLS, HUMAN (6354)*
 SPLEEN CELL, SEQUENTIAL CHANGES,
 FRIEND VIRUS LEUKEMIA, MOUSE (3791)
 STEMLINE KARYOTYPE, CENTRIC FUSION,
 MOUSE SARCOMA (5695)*
 SV40, PARA ADENOVIRUS, TRANSFORMED
 CELL, HAMSTER (0431)
 TELOCENTRIC, ABERRATION VULNERABILITY,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 BONE MARROW, RAT (3010)
 TRANSFORMED CELL, REVERSION, HAMSTER
 CELL (4038)
 21 TRISOMY, LEUKEMIA, INFANT (1199)*
 VULVAR NEOPLASM, CONDYLOMA ACUMINATUM,
 PAGET'S DISEASE, CARCINOMA,
 MALIGNANT MELANOMA, HUMAN (3940)
 XY-GONADAL DYSGENESIS, SV40 INFECTION,
 SUSCEPTIBILITY, HUMAN (4514)
 Y-CHROMATIN, INTERPHASE CANCER CELLS,
 HUMAN (6362)*
 CICATRIZATION
 WOUND, CANCER, RAT (4149)*
 CIGARETTE TAR
 CHEMICAL CARCINOGEN, LUNG CELLS,
 TRANSFORMATION, HAMSTER (2332)
 CIGNOLIN
 9,10-DIMETHYL-1,2-BENZANTHRACENE,
 SKIN TUMORS, MOUSE (5777)
 CIRCULAR DICHROISM
 NUCLEIC ACID, SMALL MOLECULES,
 INTERACTION (1549)
 CIRCULATION
 BLOOD SUPPLY, ACUTE LIGATION, HEPATIC
 ARTERY, PORTAL VEIN, LIVER
 METASTASES, RAT (5554)*
 GLOMUS TUMOR, KIDNEY, HISTOLOGY
 (1912)*
 CIRRHOSIS
 DIMETHYLNITROSAMINE-INDUCED, LIVER
 REGENERATION, HEPATIC COLLAGEN
 DEPOSITION, RAT (4479)*
 HEPATOCARCINOMA, COINCIDENCE, CHILD
 (1084)
 HEPATOMA, INCIDENCE, HUMAN (2195)*
 INHIBITION, LATHYROGENIC COMPOUND,
 LIVER, RAT (5189)*
 CLONE
 HEAD AND NECK, TUMOR ORIGIN, HUMAN
 (3942)
 3-METHYLCHOLANTHRENE, TRANSFORMED CELL
 ANTIGENICITY, MOUSE (4401)
 MYELOMA CELLS, RARE VARIANT DETECTION,
 MOUSE (4705)*
 COCARCINOGEN
 CAPER SPURGE SEED OIL, DITERPENE ESTER
 (1651)*
 DNA, REPAIR INHIBITION (1536)
 DNA REPAIR SYNTHESIS, INHIBITION,
 LYMPHOCYTE, HUMAN (5139)
 METABOLISM, BONE TUMOR, HUMAN (1467)*
 PHOROLESTER
 CROTON OIL (0619)*
 SKIN, MOUSE (0633)
 COCARCINOGENESIS
 IRRADIATION,
 N,N'-2,7-FLUORENYLFNEBISACETAMIDE,
 RAT (0941)
 COFFEE
 BLADDER CANCER, RAT (5795)
 COLCEMID
 DNA SYNTHESIS, CELL CULTURE, MOUSE,
 MITOTIC INHIBITORS (0281)*
 COLLAGEN
 SYNTHESIS, PEPTIDYLPROLINE HYDROXYLASE
 ACTIVITY, MAMMARY CANCERS, MOUSE
 (6331)*
 COLON
 ADENOCARCINOMA
 CARCINOEMBRYONIC ANTIGEN, HUMAN
 (5327)
 FAMILIAL POLYPOSIS, CANCER FAMILY
 (0288)*

MULTIPLE PRIMARY CANCER, FAMILIAL STUDY (4902)*
 CANCER, IMMUNOLOGY, HUMAN (3933)*
 CANCER PLASMA, LYMPHOCYTE INHIBITION, CARCINOEMBRYONIC ANTIGEN, SERUM ALPHA-GLOBULIN, HUMAN (3181)
 CANCER SURVIVAL RATE, SOCIOECONOMIC FACTOR, RACIAL FACTOR (6080)
 CARCINOMA
 ADENOMATOUS POLYPS, BIOPSY, ORGAN TISSUE CULTURE, HUMAN (5470)*
 ANTIGEN, HUMANS (3910)*
 AUTOIMMUNE SYSTEM, ULCERATIVE COLITIS (0015)*
 CARCINOEMBRYONIC ANTIGEN
 DIFFERENTIATION, HUMAN (4684)
 RADIOIMMUNOASSAY, SERUM, HUMAN (5371)*
 STRUCTURE, DETERMINANTS, HUMAN (5320)
 COLITIS, ASSOCIATION, HUMAN (0583)*
 ETIOLOGY, REVIEW (0921)*
 IMMUNOLOGICAL REACTIVITY, HUMAN (1868)*
 IMMUNOLOGY (0009)*
 LYMPHOCYTE CYTOTOXICITY, HUMAN (4698)
 MEMBRANE ANTIGEN, HUMAN (0475)
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE, RAT (0949)
 NASAL ADENOCARCINOMA, COMPARATIVE PATHOLOGY, HUMAN (0880)*
 NEGRO, INCIDENCE, AMERICA, NIGERIA (1095)
 NON-TUMORAL MUCOSA, MEMBRANE ANTIGENS, NEW ISOLATION METHOD, HUMAN (4743)*
 PATHOGENESIS, OCCUPATIONAL HAZARD (0317)*
 RECTUM, HUMAN, REVIEW (2276)*
 TUMOR-ASSOCIATED ANTIGEN LEVELS, HUMAN (4775)*
 CELL PROLIFERATION, PATHOGENESIS, MAN (0499)*
 CHEMICAL CARCINOGEN, METABOLISM, BACTERIA, HUMAN, REVIEW (0304)
 COLONIC MUCOSA, CARCINOSARCOMA IMPLANTATION, RAT (5487)*
 EPITHELIUM, GOBLET CELL, PROLIFERATION GUINEA PIG (0591)*
 FAMILIAL POLYPOSIS, CASE REPORT, HUMAN (0791)*
 LYMPHOMA, ULCERATIVE COLITIS, CASE REPORTS (6306)*
 MALIGNANT TUMOR, LONG-TERM ORGANOTYPIC CULTURE, HUMAN (2822)
 METASTASIS, CARCINOMA, BLOOD, STREPTOKINASE, HUMAN (0292)*
 MULTIPLE PRIMARY MALIGNANT TUMORS, PATHOLOGY, CASE REPORT (4192)*
 NEOPLASIA, HIGH-RISK GROUP, REVIEW (1233)*
 PLASMACYTOMA, MORPHOLOGY, CASE REPORT (4059)*
 POLYP MALIGNANT TRANSFORMATION, HUMAN, REVIEW (0629)*
 POLYPOID LESION, CARCINOMA, 3-2'-DIMETHYL-4-AMINOBIIPHENYL, RAT (0336)
 POLYPOSIS
 CARCINOMA, MALIGNANT CHANGE, HUMAN (0495)*
 HEREDITY, CLINICAL COURSE,

HUMAN (1147)*
 POLYPS
 EPITHELIAL GROWTH, CARCINOMA, PATHOGENESIS, HUMAN (0504)*
 IMMUNOFLUORESCENCE, HUMAN (4624)
 MUCOSAL DIFFERENTIATION, HUMAN (0197)*
 NOSOLOGY (0195)*
 PRIMARY MULTIPLE CANCERS, CLINICAL STUDY (5602)*
 RECTUM
 ADENOMATOUS POLYPS, CARCINOMA, EPIDEMIOLOGY (0023)*
 CARCINOMA
 EPIDEMIOLOGY (0509)
 INCIDENCE, DIET, HUMAN (0533)*
 INCIDENCE, GERMANY (3282)*
 FAMILIAL POLYPOSIS, HUMAN (1192)*
 POLYP
 HUMAN, REVIEW (0628)*
 OCCURRENCE, ADULT (0801)*
 PATHOLOGY, CHILDREN (0802)*
 POLYPOSIS, REVIEW (0604)*
 SIMULATED CARCINOMA, IMMUNOLOGICAL ROLE OF REGIONAL LYMPH NODES, RABBIT (4742)*
 TUMOR
 CARCINOEMBRYONIC ANTIGEN, HUMAN (4664)
 SPECIFIC ANTIGEN, HUMAN (1827)
 tRNA METHYLATION, 1,2-DIMETHYL-HYDRAZINE, MOUSE (5093)
 URETERO-SIGMOIDOSCOPY, CASE REPORT (1450)*
 TUMOR TISSUES, CARCINOEMBRYONIC ANTISERA PREPARATION (3218)*
 COMMUNICABLE
 ETIOLOGY, MELANOMA (1519)*
 COMPLEMENT
 LYMPHOMA GRAFT REJECTION, ANTIBODY, MOUSE (3182)
 COMPLEMENT FIXATION
 SACCCHAROMYCES CEREVISIAE RNA, IMMUNO-ONCOLOGY, INFANTS (5998)*
 VIROLOGY, AGGLUTINATION, CELLS (1948)
 CONCAVALIN A
 AGGLUTINABILITY, GROWTH, CULTURED TUMOR CELLS (4721)*
 AGGLUTINATION, ROUS SARCOMA VIRUS, TRANSFORMED CELLS (5914)
 ASCITES TUMOR DEVELOPMENT, INHIBITION (2879)
 BINDING
 AGGLUTININ, LIVER, ASCITES HEPATOMA-NUCLEI, RAT (4968)*
 RNA VIRUS, MOUSE (3767)
 TRANSFORMED CELL, IMMUNO-FLUORESCENCE, MOUSE (1830)
 BINDING TO SURFACE MEMBRANE, NORMAL AND TRANSFORMED CELLS (4613)
 CARBOHYDRATE VISUALIZATION, TUMOR CELL, ELECTRON MICROSCOPY, MOUSE (4080)*
 IMMUNOGENICITY, LEUKEMIA, MOUSE (0162)
 LYMPHOCYTE STIMULATION, CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN (5811)
 LYMPHOMA, DNA SYNTHESIS, AGGLUTINATION MOUSE (4646)
 MEMBRANE BINDING SITE, TUMOR CELL (4864)
 RECEPTOR SITES
 LYMPHOCYTES, LYMPHOBLASTS, HUMAN (5605)*
 SV40, TRANSFORMATION, HAMSTER

(4568)
TUMORIGENICITY, AGGLOUTINABILITY,
HAMSTER CELL (3694)
ONDYLOMA ACUMINATUM
VULVA, CHROMOSOME, HUMAN (3940)
ONNECTIVE TISSUE
DISEASES, VIRUS, HUMAN, ANIMAL (1778)*
MAMMARY GLAND CARCINOMA, HISTOCHEMICAL
STUDY, HUMAN (6137)*
PROLIFERATION, RATS (2151)*
SPONTANEOUS EQUINE SARCOID, CELL LINE
CHARACTERISTICS, HORSE (6307)*
ONNECTIVE TISSUE DISEASE
EPSTEIN-BARR VIRUS, ANTIBODY, HUMAN
(5969)
ONTRACEPTIVE
CHROMOSOME ABNORMALITY, LYMPHOCYTE
(0282)*
INTRAUTERINE DEVICE, ADENOCARCINOMA OF
UTERINE BODY, CASE REPORT (4495)*
MAMMARY CARCINOGENESIS, GESTAGENS,
MALE AND FEMALE MICE (4390)
ONTRAST MEDIA
LYMPOGRAPHY, TUMOR SPREAD, RAT
(0254)
OPPER
SERUM LEVEL, BONE MARROW BLAST,
LEUKEMIA, HUMAN (5432)
ORONARY HEART DISEASE
MALIGNANT DISEASE, RELATIONSHIP (1915)
ORTICOSTERONE
LIVER, ENZYMIC RESPONSE, RESPIRATORY
RESPONSE, DIETHYLNITROSAMINE, RAT
(1648)*
RANIOPHARYNGIOMA
ALKALINE PHOSPHATASE, DENTAL CYST,
HUMAN (1175)*
CHEMICAL STATISTICAL ANALYSIS (3600)*
INTRACRANIAL TUMORS, INCIDENCE, UGANDA
(4839)*
RATHKE-POUCH TUMORS, CHILDREN, KRAKOW
(4810)
REATINE
NITROSO COMPOUNDS FORMATION, NITRITE
REACTION (1544)
REATININE
GROWTH PROMOTION, TRANSPLANTABLE
CARCINOSARCOMA, MOUSE (1629)*
NITROSO COMPOUNDS FORMATION, NITRITE
REACTION (1544)
REUTZFELDT-JAKOB DISEASE
BRAIN CELL, SPONTANEOUS TRANSFORMATION
C-TYPE VIRUS, HUMAN (3750)
ROTON OIL
7,12-DIMETHYLBENZ(A)ANTHRACENE, TUMOR,
PEROXIDATION, MOUSE (3245)*
EPIDERMIS, DNA CONCENTRATION, MOUSE
(2969)
INDUCED SKIN TUMORIGENESIS, INHIBITION
BY STEROID HORMONES, MOUSE (4368)
PHORBOLESTER, SKIN, MOUSE (0633)
TUMOR PROMOTION, EPITHELIUM, DNA
SYNTHESIS, MOUSE (3644)
ROWN GALL TUMOR
AGROBACTERIUM TUMEFACIENS ATTENUATION,
CARCINOGENICITY (6242)*
ULTURE
MURINE LEUKOSIS VIRUS, HELA CELL,
L CELL (3807)
USHING'S SYNDROME
ACTH-PRODUCING THYMIC TUMOR, CASE
REPORT (4912)*
AVASCULAR NECROSIS OF BONE, CARCINOID
ISLET CELL TUMOR, PANCREAS, CASE
REPORT (4893)*
CYCASIN
CARCINOGENESIS, RESEARCH BIBLIOGRAPHY
(4330)*
LIVER TUMORIGENESIS, RAT (5119)
MAMMARY GLAND, TARGET ORGAN SHIFT,
INTESTINE, RAT (5781)
TUMOR INDUCTION
R-GLUCOSIDASE MODULATION, PRE-
WEANLING RATS (4416)
LIVER, RAT (5783)
RAT, MOUSE, HAMSTER, RABBIT,
GUINEA PIG (5091)
TUMORIGENESIS, LIVER, KIDNEY, MOUSE,
RAT (0036)
CYCLAMATE
CANCER, HUMAN, REVIEW (2278)*
CYCLOHEXYLAMINE (1605)*
MUTAGENESIS, MOUSE (0344)
DIABETES MELLITUS, BLADDER CARCINOMA
(1636)*
DIET, TOXIC RESPONSE, RAT (4379)
ENVIRONMENTAL HAZARD, REVIEW (0920)*
TISSUE DISTRIBUTION, PREGNANT RAT,
FETAL RAT (0951)
CYCLIC NITROSAMINES
TUMORIGENICITY, RAT (5080)
CYCLOHEXIMIDE
ARYL HYDROCARBON HYDROXYLASE,
POLYCYCLIC HYDROCARBON, RAT LIVER
(1241)
CYCLOHEXYLAMINE
CYCLAMATE (1605)*
MUTAGENESIS, MOUSE (0344)
DOMINANT LETHAL EFFECT, MOUSE (1531)
CYCLOPHOSPHAMIDE
ENZYME METABOLISM, TOXIC METABOLITE,
LIVER, MOUSE (3660)
IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY,
MOUSE (5968)
IMMUNOSUPPRESSION
ANTIBODY PLAQUE-ANTIBODIES, MOUSE
(6019)*
ONCOGENICITY, MOUSE (2367)*
CYCLOPHOSPHATE
BONE MARROW, HAMSTER (1654)*
CYLINDROMA
UPPER RESPIRATORY TRACT, HISTOPATHOL-
OGY, HUMAN (6211)*
CYST
LIVER, TRANSFORMATION, AFLATOXIN,
HUMAN (1555)
LUNG, TUMOR DEVELOPMENT, CASE REPORT
(6374)*
MAMMARY CYSTIC DISEASE, HYPERPLASTIC
LESION, DNA DISTRIBUTION, CARCINOMA,
HUMAN (0785)
PRODUCTION, BOVINE PAPILLOMA VIRUS,
CALF (1312)
CYSTEINE
DECOMPOSITION, NITROSOUREA,
1-METHYL-3-NITRO-1-NITROSOGUANIDINE
(2368)*
CYSTOSARCOMA PHYLLODES
CASE REPORTS (5680)*
MAMMARY GLAND, ULTRASTRUCTURE, HUMAN
(0579)*
CYTIDINE-3H
INCORPORATION, SKIN, MOUSE (2342)
CYTOCHEMISTRY
ACUTE LEUKEMIAS, REVIEW (3624)*
LEUKEMIA, ESTERASE, REVIEW (0912)*
MELANOMA, KARYOMETRICS, HUMAN (2062)*
ULTRASTRUCTURE, PHAGOCYTOSIS,

- MESOTHELIAL CELLS, TUMOR CELLS, HUMAN (2083)*
- CYTOGENETICS
- GUERIN TB ASCITES TUMOR, EXTENDED, PASSAGES IN VITRO (4164)*
- NEOPLASMS, CLINICAL STUDIES, HUMAN, REVIEW (5723)*
- OVARIAN CANCER, HUMAN (6219)*
- ROUS SARCOMA, MONKEY (0692)
- WALKER'S CARCINOMA, METASTASES, RAT (4110)*
- CYTOLIPIN R
- CERAMIDE TETRAHEXOSIDE HAPTEN, LYMPHOSARCOMA, RAT (4778)*
- CYTOLOGY
- DIRECT VISION BRUSHING, GASTRO-INTESTINAL TRACT CARCINOMA, DIAGNOSIS (1141)*
- LARYNX, PRECANCEROUS LESIONS, HUMAN, REVIEW (5061)*
- LEUKEMIA-LIKE VIRUS, HUMAN (5289)*
- MAMMARY CARCINOMA, DIFFERENTIATION, ULTRASTRUCTURE, HUMAN (1145)*
- METABOLISM, NEOPLASTIC CONVERSION, MOUSE CELL (1430)
- TUMOR, HAMSTER CHEEK POUCH (4141)*
- TUMOR CELL, MURINE SARCOMA VIRUS GENOME, HAMSTER (3785)
- URINE, BORTRYOID SARCOMA, BLADDER, DOG (6348)*
- CYTOLYSIS
- GLUCOCORTICOID, RECEPTOR, LYMPHOMA CELL, MOUSE (6127)
- IMMUNE, X-RAY, HAMSTER CELL (5864)
- IMMUNE LYMPHOCYTE, LIPOSARCOMA, OSTEOSARCOMA, GUINEA PIG (3898)
- CYTOPATHOLOGY
- SPONTANEOUS, C-TYPE VIRUS PARTICLE, RAT EMBRYO CELLS (3800)
- CYTOPLASM
- INCLUSION, NUCLEAR INCLUSION, LIVER CARCINOMA, HUMAN (1125)
- CYTOLINE ARABINOSIDE
- 1,3-BIS(2-CHLOROETHYL)-1-NITROSOUREA, HEMATOPOIETIC PRECURSOR, MOUSE (1298)*
- CELL CYCLE SYNCHRONIZATION, MELANOMA, MOUSE (5632)*
- HERPESVIRUS, INDUCTION OF LATENCY, HUMAN (3033)
- SKIN GRAFT REJECTION, MOUSE (4662)
- CYTOSTATIC DRUGS
- CARCINOGENICITY, REVIEW (5032)*
- CYTOSTATIC SUBSTANCE
- CARCINOGENICITY, REVIEW (1513)
- CYTOTOXIC FACTORS
- LYMPHOCYTE TRANSFORMATION, HUMAN, LYMPHORETICULAR MALIGNANCY (0765)
- CYTOTOXIC REACTION
- LYMPHOCYTE, IMMUNIZATION, RADIATION, MALIGNANT MELANOMA, HUMAN (0168)*
- SV40-TRANSFORMED CELLS, UNFERTILIZED MOUSE EGG (0165)
- CYTOTOXICITY
- ANTIBODY
- ACUTE LYMPHOCYTIC LEUKEMIA, HUMAN (5304)
- LEUKEMIA, BURKITT'S LYMPHOMA, INFECTIOUS MONONUCLEOSIS, HUMAN (0752)
- AUTOLOGOUS LYMPHOCYTE, TUMOR CELL, HUMAN (0460)
- CHEMICAL CARCINOGEN, CHROMOSOME BREAKAGE, TRANSFORMATION, ARYL HYDROCARBON HYDROXYLASE (4433)
- DEPLETION, SPLEEN CELL, ALLOGENEIC TUMOR CELL, MOUSE (4616)
- 7,12-DIMETHYLENE(1)ANTHRAcene, BENZO(A)PYRENE, METABOLISM, MAMMALIAN CELL (2311)
- ENHANCEMENT, PERITONEAL LYMPHOCYTE, YOSHIDA SARCOMA, ANTIGENIC CELL, RAT (2634)
- ETHYLNITROSOUREA, METHYLNITROSOUREA, NERVE CELL, RAT (5678)
- IMMUNE LYMPHOCYTE, ANTISERUM CONCENTRATION, MOLONEY SARCOMA VIRUS, MOUSE (3869)
- IMMUNE REACTION, LYMPHOID CELL, LYMPHOMA, GROSS VIRUS, RAT (4621)
- LEUKEMIA, FIBROBLASTS, CELL CULTURE (1996)
- LYMPHOCYTE
- LOCKING, TUMOR FLUATE, HUMAN (4671)
- HL-A COMPATIBILITY, HUMAN (3861)
- LYMPHOCYTE-MEDIATED, EFFECT OF ENHANCING ANTISERA (2646)
- LYMPHOID CELLS, CANCER-BEARING MICE (6003)*
- PHYTOAGGLUTININS, YOSHIDA SARCOMA CELLS (6006)*
- RNA SYNTHESIS INHIBITION, SERUM, MALIGNANT MELANOMA, HUMAN (3883)
- SHOPE FIBROMA VIRUS, ANTIBODY, IMMUNE SERUM, RABBIT (2604)
- SPECIFIC, MOLONEY SARCOMA VIRUS, LYMPHOID CELL, SERUM, IMMUNE MOUSE (2605)
- SPLEEN CELL, LYMPH NODE CELL, SUPPRESSION, ASCITES TUMOR, MOUSE (4752)*
- THYMOCYTE, BONE MARROW, ALLOGRAFT IMMUNITY, LYMPHOMA, MOUSE (3873)
- TUMOR CELLS, SPLEEN, MOUSE (4761)*
- TUMORIGENICITY, ENZYME, ARYL HYDRO-CARBON, MECHANISM (0348)
- DAEL'S TUMOR
- TRANSPLANTABLE, CULTIVATION, GUINEA PIG (4946)*
- DAUNOMYCIN
- ADRIAMYCIN, BREAST CARCINOMA, FIBRO-ADENOMA, RAT (2343)
- DNA POLYMERASE INHIBITION, RNA TUMOR VIRUS, MOUSE, CHICKEN (3787)
- KIDNEY TUMOR, RAT (1532)
- DDT
- ANTITUMORIGENIC EFFECT, MOUSE (0648)*
- CANCER, RESEARCH, REVIEW (5741)*
- CARCINOGENICITY, MOUSE (5766)
- EFFECT ON FETAL LUNG TISSUE, MOUSE (2995)
- LONG-TERM EXPOSURE, MOUSE (5791)
- METABOLITE STORAGE LEVELS, TISSUES, MOUSE (4456)*
- DEGRANOL
- IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY, MOUSE (5968)
- DELAYED HYPERSENSITIVITY
- MAMMARY TUMOR EXTRACT, SURVIVAL, HUMAN (1641)*
- DELTA 3,5-CHOLESTADIENNE-7-ONE
- ONCOGENESIS, MOUSE (1545)
- DELTA 4-CHOLESTENE-3,6-DIONE
- ONCOGENESIS, MOUSE (1545)
- 2-DEOXY-2-FLUORO-D-GLUCOSE
- ASCITES TUMOR CELLS, GLYCOLYSIS INHIBITION (5435)

2-DEOXYGLUCOSE
ENERGY METABOLISM, GRANULOMA TISSUE,
RAT (5495)*

2-DEOXY-D-GLUCOSE
AMINO ACID, TRANSPORT, NORMAL AND
MALIGNANT CELLS, REVIEW (3640)*
ASCITES TUMOR CELL, ULTRASTRUCTURE,
RAT (1534)
UPTAKE, POLYOMA-TRANSFORMED CELL,
HAMSTER (1757)

DEXTRAN SULFATE
PULMONARY METASTASIS INHIBITION, RAT
(5523)*

DIABETES
ALLOXAN
INSULIN DEPRIVATION, MAMMARY
CARCINOMA, GROWTH, RAT (2993)
LIVER CARCINOGENESIS,
2-DIACETAMIDOFLUORENE, RAT
(0939)

DIABETES MELLITUS
CYCLAMATE, BLADDER CARCINOMA (1636)*

2-DIACETAMIDOFLUORENE
LIVER CARCINOGENESIS, ALLOXAN DIABETES
RAT (0939)

4,15-DIACETOXY-8-(3-METHYLBUTYRYLOXY)-
12,13-EPOXY-DELTA 9-TRICOTHECEN-3-OI
LIVER, TROUT, RAT (0045)

2,7-DIACETYLAMINOFLUORENE
STOMACH, ULCER, TUMORIGENESIS, RAT
(0049)

DIAZO-ACETIC ESTER
SKIN TUMORS, MORPHOLOGY, RAT, MOUSE
(5763)

DIAZODIBENZOPYRENE
CARCINOGENESIS, MOUSE (3699)

DIBENZANTHRACENE
MACROMOLECULAR BINDING, METABOLISM,
MOUSE EMBRYO CELL (1565)
RHABDOMYOSARCOMA, TUMOR-SPECIFIC
TRANSPLANTATION ANTIGEN, IMMUNE
REACTION, MOUSE (5317)

DIBENZ(A,C)ANTHRACENE 10,11-OXIDE
SYNTHESIS, METABOLISM, LIVER
MICROSOMAL PREPARATIONS, RAT (5841)*

DIBENZ(A,H)ANTHRACENE
BENZ(A)ANTHRACENE, K-REGION DERIVATIVE
TRANSFORMATION, HAMSTER (0062)
EPOXIDES, FRAMESHIFT MUTAGEN,
SALMONELLA (2984)
MACROMOLECULAR BINDING
K-REGION EPOXIDE, HAMSTER CELL
(3709)
TRANSFORMED CELL (5774)

DIBENZ(A,H)ANTHRACENE METABOLITE
MITOCHONDRIAL VOLUME CHANGE, ATP,
LIVER, RAT (3697)

1,2,5,6-DIBENZANTHRACENE
OXIDATION, DIMETHYL SULFOXIDE (0090)*

7H-DIBENZO(C,G)CARBAZOLE
CARCINOGENICITY, RESPIRATORY TRACT,
EPITHELIUM, HAMSTER (2940)

DIBUCAINE
CELL LYSIS, CHICK EMBRYO, VIRUS
(0139)*

N,N'-DIBUTYL-ALPHA,ALPHA'-DI-(3-CHLORO-4-
METHOXYPHENYL)-ETHYLENEDIAMINE
INDUCED MAMMARY TUMOR, RAT (2431)*

N-DIBUTYLNITROSAMINE
URINARY BLADDER EPITHELIUM, ALKALINE
PHOSPHATASE DEFICIENCY, RAT (1085)

DIBUTYRYL ADENOSINE 3,5-CYCLIC
MONOPHOSPHATE
NEUROBLASTOMA, DIFFERENTIATION, MOUSE
(1246), (2924)

THEOPHYLLINE, POLYOMA VIRUS, WHEAT
GERM AGGLUTININ, 3T3 FIBROBLASTS
(0439)*

DIBUTYRYL CYCLIC ADENOSINE MONOPHOSPHATE
SULFATED ACID MUCOPOLYSACCHARIDE
SYNTHESIS, TRANSFORMED FIBROBLASTS
(4508)

TYROSINE AMINOTRANSFERASE ACTIVITY,
YOSHIDA SARCOMA, RAT (4986)*

DIBUTYRYL CYCLIC ADENOSINE PHOSPHATE
THEOPHYLLINE, MURINE, SARCOMA VIRUS,
TRANSFORMED CELLS, MOUSE (5952)*

3,3'-DICHLORO-4,4'-DIAMINODIPHENYLMETHANE
CARCINOGENIC EFFECT, DIET, RAT (2339)

2,4-DICHLORO-6-PHENOXYETHYLAMINE
LIVER MICROSOMAL AZOREDUCTASE, PHENO-
BARBITAL, 3-METHYLCHOLANTHRENE, RAT
(1627)*

DIET
AFLATOXIN B1, TOXICITY, RAT (1558)
AFLATOXINS, HUMAN LIVER CANCER,
INCIDENCE, THAILAND (4418)
ALCOHOLIC DRINKS, CANCER OF THE
ESOPHAGUS, EAST AFRICA (4454)*
CARCINOGEN, COLON CANCER, REVIEW
(0921)*
CHLORAMPHENICOL, LEUCINE INCORPORATION
RAT (1559)
COLON, RECTUM, CARCINOMA, INCIDENCE,
HUMAN (0533)*
CYCLAMATES, TOXIC RESPONSE, RAT (4379)
DEFICIENCY
N,N-DIMETHYL-P-(M-TOLYLAZO)ANILINE
LIVER TUMOR, RAT (0041)
TUMORIGENESIS, REVIEW (1502)
DIETHYLSTILBESTROL, CANCER, AMERICANS
(5826)*
FAT ENRICHED, INTRACRANIAL TUMORS,
MOUSE (2365)*
FECAL STEROIDS, BOWEL CARCINOMA,
AFRICA, UNITED KINGDOM (1101)
FOOD PREPARATION, CARCINOGENIC HYDRO-
CARBON FORMATION, GASTRIC CANCER,
HUMAN (5148)
GASTRIC CARCINOGENESIS, RAT (5820)*
MAMMARY CARCINOGENESIS, BACTERIA,
ESTROGEN, EPIDEMIOLOGY, HUMAN,
REVIEW (0611)
MODIFICATION, TUMOR GROWTH, MOUSE
(5540)*
N-NITROSODIMETHYLAMINE FORMATION,
AMMONIUM COMPOUNDS, TERTIARY AMINES,
FOOD (2321)
PHENYLALANINE, HYPERPLASTIC ALVEOLAR
NODULE, MAMMARY TUMOR, MOUSE (0185)
PHENYLALANINE DEFICIENCY, MAMMARY
TUMOR VIRUS ACTIVITY, MOUSE (4606)*
PROTEIN, CARBOHYDRATE,
DIMETHYLNITROSAMINE METABOLISM,
RAT (0965)
RICE, LUTEOSKYRIN, CYCLOCHLOROTINE,
LIVER TOXICITY, HEPATOMA, MOUSE
(2354)
SMOKED FOOD PRODUCTS, BENZO(A)PYRENE,
PENETRATION THROUGH BODY, RAT, DOG,
HUMAN (5095)
SMOKED MEAT PRODUCTS, CARCINOGENESIS,
REVIEW (5754)*
SPONTANEOUS CARCINOMA, DIGESTIVE TRACT
PRAOMYS (0272)*
ZINC DEFICIENCY, TUMOR INHIBITION,
MOUSE, RAT (3306)

DIETARY

- ALTERATION, 3-MMA3 ACTIVITY, RATS (2302)
- DIETHYL ESTERS
CIS- AND TRANS- EPOXYSUCCINIC ACID, CHROMATOGRAPHY (2437)*
- DIETHYL PYROCARBONATE
URETHANE, BEVERAGE, ENVIRONMENTAL HAZARD (4428)
- DIETHYLAMINOAZOBENZENE
LIVER CELL, AGGREGATE FORMATION, RAT (5793)
- DIETHYLAMINOETHYL(DEAE)DEXTRAN
ETHYLNITROSUREA, SARCOMA INDUCTION, MOUSE (3001)
- RESTRICTION OF MYXOMA VIRUS INFECTION, RABBIT (3143)
- 2-DIETHYLAMINOETHYL-2,2-DIPHENYL-VALERATE
LIVER POLYSOMAL DISAGGREGATION, DIMETHYLNITROSAMINE, LASIOCARPINE, MOUSE (1652)*
- DIETHYLNITROSAMINE
ALKYLATION, NUCLEIC ACIDS, LIVER, EMBRYO, RAT (5854)*
- ALTERED LIVER CELL FOCI, PARTIAL HEPATECTOMY, QUANTITATIVE STUDY, RAT (3715)*
- CARCINOGENESIS
CHROMATIN, LIVER, RAT (5800)
- MITOTIC ABNORMALITIES, HEPATOCYTE PROLIFERATION, RAT (2384)*
- RAT (3670)
- DIMETHYLNITROSAMINE, METHYLNITROSUREA, CARCINOGENESIS, HAMSTER (0070)
- HEPATECTOMY, PARTIAL
HEMANGIOENDOTHELIOMA, RAT (0374)*
- HEPATIC ACTIVITIES OF 1-CARBON ENZYMES, RAT (3022)*
- HEPATOCELLULAR CARCINOMA, GROWTH KINETICS, LIVER CELL POPULATIONS, RAT (5073)
- HEPATOMA, SERUM ANTIGENS, RAT (0488)*
- HEPATOMA INDUCTION, 4-HYDROXYPENTENAL, OXYGEN UPTAKE, SH CONTENT, LIVER, RAT (5190)*
- INDUCED PURPLE ADENINE MUTANTS, GENETIC CHARACTERIZATION, NEUROSPORA CRASSA (4483)*
- INFLUENZA VIRUSES, LUNG CARCINOMA INDUCTION, MOUSE (5079)
- LIVER
HEMANGIOENDOTHELIAL SARCOMA, HISTOLOGY, RAT (3711)
- RESPIRATORY RESPONSE, ENZYMIC RESPONSE, CORTICOSTERONE, RAT (1648)*
- LIVER CARCINOGENESIS, ENZYME DEFICIENT ISLAND, RAT (0356)
- LIVER CARCINOMA
HISTOLOGICAL CHANGES, HISTOCHEMICAL CHANGES, RAT (5401)
- INHIBITION, THYMUS TISSUES, RAT (5145)
- LIVER REGENERATION, HEPATECTOMY, RAT RAT (1633)*
- NEOPLASTIC GROWTH, NUCLEAR VOLUME, DNA CONTENT, RAT (5779)
- NEOPLASTIC TRANSFORMATION, CLONED CELL LINES, MOUSE (5770)
- POISONING, SERUM ALPHA-FETOPROTEIN LEVELS, BABOONS (5788)
- URINARY 7-METHYL GUANINE EXCRETION, RAT (5076)
- DITHYLSTILBESTROL
CANCER, DIET, AMERICANS (5826)*
- CARCINOGENESIS, CHILDREN, REVIEW (4342)*
- KIDNEY, TUMOR, HAMSTER (0942)
- POLYOVAR FOLLICLE INDUCTION, MONKEY (1620)*
- DIFFERENTIATION
ANTI BODY-FORMING CELL, LYMPH, SHEEP (1874)*
- COLON TUMOR, CARCINOEMBRYONIC ANTIGEN, HUMAN (4684)
- EPITHELIAL, RETINOL, RAT, HAMSTER (5846)*
- PROSTAGLANDIN-INDUCED, NEUROBLASTOMA CELLS, MOUSE (2362)
- DIGESTIVE TRACT
CANCER, CARCINOEMBRYONIC ANTIGEN, HUMAN (4689)
- CARCINOEMBRYONIC ANTIGEN
HUMAN, REVIEW (5710)
- RADIOIMMUNOASSAY, HUMAN (5384)*
- CARCINOMA
CARCINOEMBRYONIC ANTIGEN, HUMAN (1869)*, (5992)*
- CASE REPORTS (6160)*
- HIGH-RISK GROUP, REVIEW (1238)*
- LYMPH NODE, METASTASIS DISTRIBUTION, HUMAN (4029)
- PRECANCEROUS, HUMAN (2736)*
- PRECANCEROUS STAGES, HUMAN, REVIEW (5001)
- PRIMARY MALIGNANT LYMPHOMA, CASE REPORTS (5684)*
- SPONTANEOUS CARCINOMA, DIET, PRAOMYS (0272)*
- TUMOR, IMMUNOLOGY, CLINICAL STUDY (6042)*
- DIMETHYLAMINE
SODIUM NITRITE, LIVER TOXICITY, MOUSE (5778)
- DIMETHYLAMINOAZOBENZENE
CARCINOGENESIS, INHIBITION, LATHYROGENIC COMPOUND, LIVER, RAT (5189)*
- HEPATOCARCINOGENESIS, GLYCOLYSIS, RAT (5161)
- HUMORAL ANTIBODIES, RAT (0163)
- KIDNEY, EMBRYONIC TISSUE CULTURE, MOUSE (5818)*
- LIVER, HYPERBASOPHILIC FOCI, RAT (0956)
- METABOLISM, LIVER, RAT (1561)
- 4-DIMETHYLAMINOAZOBENZENE
ALPHA GLOBULIN, SERUM, RAT (0955)
- DERIVATIVES, LIVER, LUNG, MOUSE (0958)
- GLUCOSE-6-PHOSPHATASE, LIVER, RAT (0469)*
- HEPATOCARCINOGENESIS
ROUND DYE, GLUTATHIONE, RAT (0659)*
- LIVER LIPID METABOLISM, RAT (4440)
- HEPATOMA
CYTOSKELETON ALTERATIONS, LIVER CELLS, RAT (5131)
- SARCOMA, EMBRYONIC ANTIGEN, RAT (5332)
- SURFACE MEMBRANE ANTIGEN DELETION, RAT (4678)
- HEPATOMA INDUCTION, RESISTANCE, BLOOD TRANSFUSION, RAT (2931)
- KIDNEY, EMBRYONIC TISSUE CULTURE, MOUSE (5818)*
- LIVER
HEPATOMA, PRECANCEROUS CONDITION,

STAINING, RAT (0992)*
RNA, PROTEIN, STAINING, RAT
(0370)*
LIVER CELL, MORPHOLOGY, GROWTH, RAT
(1257)
RNA POLYMERASE SUPPRESSION, LIVER
CARCINOGENESIS, NITROFURAN, RAT
(2946)
N-DIMETHYLAMINOAZOBENZENE
LIVER, ADENOSINE TRIPHOSPHATASE, RAT
(4784)
METABOLISM, LIVER, RAT (3638)
N-DIMETHYL-4-AMINOAZOBENZENE
CARCINOGEN CONJUGATE, AZODYE-BINDING
PROTEIN, LIVER (0050)
HEPATIC ACTIVITIES OF 1-CARBON ENZYMES
RAT (3022)*
-DIMETHYLAMINOAZOBENZENE
LIVER CANCER
ALKALOID EFFECT, FUNTUMINE,
IREHDIAMINE, RAT (2957)
ESTROGEN EFFECT, RAT (2956)
PREGNANEDIOL, ALLOPREGNANEDIOL,
RAT (5769)
LIVER TUMORIGENESIS, PAPAIN, RAT
(4432)
,3-DIMETHYL-4-AMINOAZOBENZENE
LIVER MICROSOMES, ANTIGENICITY, MOUSE
(2930)
-3'-DIMETHYL-4-AMINORIPHENYL
POLYPOID LESION, CARCINOMA, COLON, RAT
(0336)
,2'-DIMETHYL-4-AMINORIPHENYL
INTESTINAL NEOPLASM, RAT, HUMAN (5074)
TUMOR INDUCTION, URINARY BLADDER,
HAMSTER (2958)
IMETHYLAMINOSTILBENE
KINETICS, BLOOD, RAT (4427)
-DIMETHYLAMINOSTILBENE
BLOOD CONSTITUENTS, BINDING, RAT
(5798)
N-DIMETHYL-P-(M-TOLYLazo)ANILINE
LIVER TUMOR, DIET DEFICIENCY, RAT
(0041)
IMETHYLBENZANTHRACENE
BENZO(A)PYRENE, 3-METHYLCHOLANTHRENE,
NUCLEIC ACIDS, MOLECULAR
CHARACTERISTICS, CARCINOGENIC
HYDROCARBON MECHANISM (0639)
CARCINOGENESIS
RAT (4365)
SKIN, CASTRATION, RAT (2952)
EAR LOBE TUMOR, RAT (3019)*
MAMMARY CARCINOMA, REGRESSION, NURSING
PERIOD, RAT (3655)
MEDULLARY TUMORS, HISTOPATHOLOGY,
BONE MARROW, RAT (5815)*
TRANSPLENTAL EFFECT, EMBRYONAL
KIDNEY CULTURE, MOUSE (5784)
TUMOR, FETAL ANTIGEN, MOUSE (3835)
TUMOR PROMOTER, EPITHELIUM, DNA
SYNTHESIS, MOUSE (3644)
IMETHYLBENZ(A)ANTHRACENE
CARCINOGENESIS, DNA SYNTHESIS, MAMMARY
GLAND, RAT (4364)
,12-DIMETHYLBENZANTHRACENE
INDUCED MAMMARY TUMORS, GROWTH
INHIBITION BY ERGOCORININE, RAT
(4455)*
METABOLITE FORMATION, FIBROBLASTOID
CELLS, HAMSTER (5177)
SARCOMA, SKIN TRANSPLANTS, MOUSE
(5270)
,12-DIMETHYLBENZ(A)ANTHRACENE
ACTINOMYCIN-D, SKIN, TUMOR INHIBITION,
PERSISTENCE, MOUSE (5072)
ADRENAL GLAND, CARBON TETRACHLORIDE,
LIVER, RAT (4414)
ADRENAL NECROSIS, SUPPRESSION,
STEROID, RAT (1566)
ADRENOCORTICAL NECROSIS, ESTRADIOL,
RAT (0976)*
BENZO(A)PYRENE
COMBINED EFFECT, SKIN, MOUSE
(5186)*
PROTEIN, NUCLEIC ACID, INTER-
ACTION, RAT (1261)
TOBACCO, TUMOR PROMOTER, MOUSE
(0075)
BINDING, PARENCHYMA DNA, PARENCHYMA
PROTEIN, MAMMARY GLAND, RAT (1564)
BLOOD CHANGES, SPIRONOLACTONE,
PROADIFEN, RAT (1571)
CARCINOGENESIS, GRENZ RADIATION, SKIN,
MOUSE (5862)
CARCINOGENESIS INHIBITION, DIETARY
ZINC, HAMSTER (1259)
CHLOROMA, MYELOPEROXIDASE, RAT (1567)
CONTACT SENSITIVITY INDUCTION,
TOLERANCE, GUINEA PIG (2937)
DEPRESSION ACTIVITY, GRAFT-VS-HOST
REACTION, HOMOGRAFT REJECTION, RAT
(2308)
DNA BINDING, DNA SYNTHESIS INHIBITION,
PREREPLICATIVE PHASE, REGENERATING
RAT LIVER (4400)
EMBRYO CELL, HUMAN (1575)
EMBRYONAL KIDNEY CULTURE, MOUSE
(5850)*
EPIDERMIS, DNA CONCENTRATION, MOUSE
(2969)
GROSS LEUKEMIA VIRUS, LEUKEMOGENESIS,
RAT (140)*
HERPES SIMPLEX VIRUS, INFECTED CELL,
DNA SYNTHESIS, RABBIT (4520)
HYPERTENSION, RAT (1645)*
INDUCED TUMORS, ACTINOMYCIN D, RAT
(2395)*
INFLAMMATORY RESPONSE, GENETIC LINKAGE
MOUSE (1262)
LEUKEMIA, THYMUS, MOUSE (5168)
LUNG TUMOR, DOSE RESPONSE, RAT (1576)
MALIGNANT TUMOR INDUCTION, OVARY, RAT
(5858)*
MAMMARY CARCINOGENESIS, BACILLUS
CALMETTE-GUERIN, CELLULAR IMMUNITY,
RAT (0637)
MAMMARY CARCINOMA
GROWTH, INSULIN, OOPHORECTOMY,
HYPOPHYSECTOMY, RAT (1563)
INSULIN DEPRIVATION EFFECT,
ALLOXAN DIABETES, RAT (2993)
ULTRASTRUCTURE, RAT (5083)
MAMMARY GLAND TUMORS
HORMONE-INDUCED STIMULANT EFFECTS,
MOUSE, REVIEW (5064)*
REGRESSION AND RECURRENCE, RAT
(3013)
MAMMARY TUMOR
ESTRADIOL-BINDING CHROMATIN,
FRACTIONATION, RAT (1263)
IMMUNOELECTROPHORETIC ANALYSIS,
RAT (1258)
INHIBITORY EFFECT OF ESTROGEN,
PITUITARY ESOGRAFT, RAT (2305)
OOPHORECTOMY, BIOCHEMICAL CHANGE,
RAT (0959)
RECURRENCE, RAT (2310)

- REGRESSION, ERBOCORNINE, RAT (2929)
- METABOLISM
- CYTOTOXICITY, MAMMALIAN CELL (2311)
- DIGESTIVE TRACT, 3-METHYLCHOL-ANTHRENE PRETREATMENT, RAT (1570)
- STOMACH HOMOGENATE, INTESTINAL HOMOGENATE, MICE (1260)
- 3-METHYLCHOLANTHRENE, BENZO(A)PYRENE, TERATOGENESIS, TOAD (0067)
- NEONATAL CARCINOGENESIS, ANAMNESTIC IMMUNE RESPONSE, MOUSE (2970)
- NEOPLASTIC FIBROBLASTS, MOUSE (5634)*
- ORAL CARCINOMA, ACID PHOSPHATASE, DNA, HAMSTER (0672)*
- OVARIAN, TUMOR INDUCTION, HAMSTER (2307)
- PAPILLOMA, INDUCTION, MOUSE (0350)
- RHABDOMYOSARCOMA, ULTRASTRUCTURE, HAMSTER (0987)*
- SALIVARY GLAND CARCINOMA, HORMONE, SEX, RAT (0351)
- SKIN
- ESTERASE, ISOZYME PATTERN, MOUSE (0960)
- TUMOR INITIATION, MOUSE (5773)
- SKIN TUMOR INDUCTION, DOSE LEVEL, RAT (2923)
- SKIN TUMORIGENESIS, ARYL HYDROCARBON HYDROXYLASE, INHIBITION, 7,8-BENZO-FLAVONE, MOUSE (3678)
- SV40
- TRANSFORMATION INHIBITION, MOUSE (4504)
- TUMOR, LACTATE AND MALATE DEHYDROGENASES, HAMSTER (4582)*
- TELOCENTRIC CHROMOSOME, ABERRATION VULNERABILITY, BONE MARROW, RAT (3010)
- TUMOR INCIDENCE, TEFLON IMPLANT, MOUSE (0660)*
- TUMOR INDUCTION, MITOTIC RATE, MAMMARY GLAND, RAT (5797)
- TUMOR-SPECIFIC ANTIGEN INDUCTION, CELLS, MOUSE (5353)
- TUMORIGENESIS INHIBITION
- 7,8-BENZOFLAVONE, MOUSE (2928)
- STOMACH, MAMMARY GLAND, SKIN, ANTIOXIDANT, MOUSE, RAT (3689)
- TUMORS, CROTON OIL, PEROXIDATION, MOUSE (3245)*
- UTERUS, ADENOCARCINOMA, RAT (5086)
- UV RADIATION, SKIN, MOUSE (3719)*
- VIRUS, TUMOR HETEROGENIZATION, HAMSTER (1285)*
- X-RAY, MAMMARY NEOPLASIA, RAT (2309)
- 7,12-DIMETHYLBENZ(A)ANTHRACENE-D16
- DEUTERIUM, TUMORIGENESIS, MOUSE (0055)
- 9,10-DIMETHYL-1,2-BENZANTHRACENE
- CARCINOGENESIS, TUMOR PROMOTION, INSULIN, GROWTH HORMONE, GENITAL TRACT, RAT (3007)
- CHALONE, SKIN CARCINOGENESIS, MOUSE (0053)
- CIGNOLIN, SKIN TUMORS, MOUSE (5777)
- DNA REPAIR INHIBITION, TRANSFORMING ACTIVITY, MUTATION FREQUENCY (5845)*
- MAMMARY GLAND TUMOR, VITAMIN B15, RAT (3667)
- MAMMARY TUMOR, MILK, RAT (1284)*
- MEMBRANE-ACTIVITY AGENTS, MITOTIC FREQUENCY, EPITHELIUM, MOUSE (5828)*
- PRECANCEROUS CHANGE, CEREBELLUM, RAT (1606)*
- SUBMANDIBULAR TUMOR, FLUCOURACIL, RAT (0057)
- THYMECTOMY, SUBMANDIBULAR TUMOR, RAT (0056)
- TUMOR INDUCTION, THYMECTOMY, CHEEK POUCH, HAMSTER (5805)
- TUMOR METASTASIS, ANTISERUM, RAT (1876)*
- URINARY 7-METHYL GUANINE EXCRETION, RAT (5076)
- VASCULAR CHANGES, HAMSTER (2303)
- 10-DIMETHYL-1,2-BENZANTHRACENE
- DNA LINKAGE, MUTAGENICITY, TRANSFORMATION INHIBITION, DNA TEMPLATE INHIBITION (1572)
- DIMETHYLCARBAMYL CHLORIDE
- CARCINOGENESIS, MOUSE (3647)
- N,N'-DIMETHYLETHYLENEDINITROSOAMINE
- ESOPHAGEAL CARCINOMA, RAT (2944)
- 1,2-DIMETHYLHYDRAZINE
- BLOOD VESSEL, TUMORIGENESIS, MOUSE (0940)
- COLON DNA, EQUILIBRIUM CENTRIFUGATION, MOUSE (4417)
- COLONIC TUMOR, TRNA METHYLATION, MOUSE (5093)
- 1,2-DIMETHYLHYDRAZINE DIHYDROCHLORIDE
- ANGIOSARCOMA, MORPHOLOGY, HAMSTER (5842)*
- TUMORIGENESIS, HAMSTER (2349)
- DIMETHYLNITROSOAMINE
- ADRENAL GLAND, PROTEIN SYNTHESIS, RAT (5171)
- BILE FLOW RATE, RAT (1614)*
- CARCINOGEN EFFECT, METABOLISM, METHYLATION OF DNA, MOUSE (2323)
- CARCINOGENICITY, REVIEW (1511)
- CIRRHOSIS, LIVER REGENERATION, HEPATIC COLLAGEN DEPOSITION, RAT (4479)*
- DNA, 3-METHYLTHYMINE FORMATION, RAT (1585)
- DNA SYNTHESIS INHIBITION, HISTONE, LIVER, RAT (0643)
- ETHIONINE, DNA METHYLATION, LIVER, RAT (0355)
- FIBROBLAST ALTERATIONS, KIDNEY, RAT (4398)
- HEMANGIOMAS, RETICULOENDOTHELIAL SYSTEM, MOUSE (3701)
- HEPATOCARCINOGENIC EFFECTS, NEWT (4467)*
- HEPATOTOXICITY, VENO-OCCLUSION, RAT (2411)*
- IN VIVO PRODUCTION, AMINOPYRINE, NITRITE, RAT (3653)
- KIDNEY, EPITHELIAL TUMOR, MORPHOGENESIS, RAT (1266)
- KIDNEY TUMOR, ANGIOGRAPHY, RAT (1286)*
- LASIOCARPINE, ETHANOL, POLYSOMAL DISAGGREGATION, LIVER, MOUSE (1287)*
- LIVER
- CARCINOMA, HEPATECTOMY, RAT (1267)
- PROTEIN LABELING, 3-METHYLCHOL-ANTHRENE PRETREATMENT, RAT (1586)
- RIOSOME, MONOMER, RAT (4393)
- LIVER CARCINOGENESIS, INHIBITION, AMINOACETONITRILE, RAT (0967)
- LIVER POLYRIOSOME, AMINO ACID INCORPORATION, RAT (5166)

LIVER POLYSOMAL DISAGGREGATION,
 2-DIETHYLAMINOETHYL-2,2-DIPHENYL-
 VALERATE, MOUSE (1652)*
 METABOLISM
 DNA, MOUSE (2997)
 MUTAGENIC COMPOUND, LIVER ENZYME,
 MOUSE (1584)
 PROTEIN, CARBOHYDRATE, DIET, RAT
 (0965)
 MUTAGENICITY, HYDROXYLATION SYSTEM,
 SACCHAROMYCES (2325)
 NITROSOMETHYLUREA, LUNG, HYPERPLASIA,
 MOUSE (0650)*
 NUCLEIC ACID SYNTHESIS, LIVER, KIDNEY,
 RAT (1587)
 PHORBOL, LUNG CARCINOGENESIS, HEPATOMA
 MOUSE (4392)
 PROTEIN METHYLATION, METHIONINE,
 NUCLEUS, RAT (0966)
 TOXICITY REDUCTION, DISULFIRAM, RAT,
 MOUSE (1615)*
 TRANSPLACENTAL BLASTOGENESIS, MOUSE
 (1607)*
 TRNA METHYLASE, KIDNEY, RAT (5123)
 TUMOR, REVERSION, HAMSTER (5808)
 URINARY 7-METHYL GUANIDE EXCRETION,
 RAT (5076)
 N-DIMETHYLNITROSAMINE-3H
 METHYLATION, NUCLEAR AND CYTOPLASMIC
 RNA, LIVER, MOUSE (2322)
 N-DIMETHYLNITROSAMINE
 TOBACCO, SMOKE CONDENSATE (2955)
 TOBACCO CONDENSATE, CIGARETTE SMOKE
 (2372)*
 NN-DIMETHYLNITROSAMINE
 RNA METHYLATION, LIVER, RAT (5122)
 N,N'-DIMETHYLNITROSOUREA
 ADENOVIRUS 12, CRANIAL TUMOR, MOUSE
 (5252)
 CARCINOGENESIS, HAMSTER (2974)
 LYMPHOMA, INDUCTION, MICE, REVIEW
 (2215)
 N-METHYLSULFOXIDE
 FRIEND VIRUS, ULTRASTRUCTURAL CHANGE
 (1366)*
 LEUKEMIA, HEMOGLOBIN, MICE, VIRUS
 (0412)
 VIRUS ACTIVATION, HUMAN (2493)
 N-METHYL SULPHATE
 DNA, ALKYLATION, 3-METHYLGUANINE
 (3674)
 MUTAGEN, NUCLEIC ACID, ALKYLATION
 (2971)
 2,4-DINITROPHENYL
 DISTRIBUTION, EPIDERMIS, GUINEA PIG
 (2398)*
 MYELOMA, PROTEIN LABELING, MOUSE
 (0665)*
 DISEASE
 IMMUNE RESPONSE, VIRUS, HUMAN (6013)*
 RADIATION
 SEQUELAE
 ATOMIC BOMB, REVIEW (0332)*
 ATOMIC EXPLOSION (0334)*
 DISTAMYCIN A
 CONGOICIDINE, ROUS SARCOMA VIRUS,
 REVERSE TRANSCRIPTASE (1744)
 VIRUS MULTIPLICATION, INHIBITION
 (1350)
 DISTILLED SPIRITS
 NITROSAMINE, ESOPHAGEAL CARCINOMA,
 EAST AFRICA (1583)
 DISULFIRAM
 DIMETHYLNITROSAMINE TOXICITY,
 REDUCTION, RAT, MOUSE (1615)*
 DNA
 ACUTE LEUKEMIA, CHROMOSOMES, CLINICAL
 STUDY (6108)
 AFLATOXIN B₂, BINDING (0346)
 ALKYLATION, HEPATOCARCINOGENIC
 DIALKYLNITROSAMINES, FLOW DICHROISM
 SPECTRUM MODIFICATION, LIVER, RAT
 (5105)
 BINDING
 AFLATOXINS, RNA POLYMERASE INHIBI-
 TION, NUCLEAR EFFECTS, RAT
 (5174)
 BENZO(A)PYRENE, MOUSE (2961)
 SYNTHESIS INHIBITION,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 PREREPLICATIVE PHASE, REGENERAT-
 ING RAT LIVER (4400)
 URETHANE, LUNG, KIDNEY AND LIVER
 TISSUES, MOUSE, RAT (2988)
 BIOSYNTHESIS
 AUTORADIOGRAPHY STUDY, HERPES
 SIMPLEX VIRUS-INFECTED CELLS
 (2598)*
 TETRAHYDROHOMOFOLATE, LEUKEMIA,
 MOUSE (1457)*
 BREAKAGE REPAIR, 4-HYDROXYAMINO-
 QUINOLINE 1-OXIDE, RADIATION,
 MAMMALIAN CELL (4494)
 BREAST CARCINOMA, CHROMOSOME NUMBER,
 SURVIVAL RATE, HUMAN (4270)*
 7-BROMOMETHYLBENZ(A)ANTHRACENE
 TREATMENT, DOUBLE HELICER, CROSS
 LINKING (3659)
 CHAIN ELONGATION, XERODERMA
 PIGMENTOSUM, UV IRRADIATION, HUMAN
 (4496)*
 CHARACTERIZATION, P815 CELLS, MOUSE
 (2371)*
 CHEMICAL MUTAGEN, TUMORIGENESIS,
 HAMSTER CELL (0379)*
 CHICK EMBRYO LETHAL ORPHAN VIRUS,
 CHARACTERIZATION (1005)
 CIGARETTE-SMOKE CONDENSATE EFFECT,
 BENZO(A)PYRENE FIXATION, RAT (5130)
 CLEAVAGE, SV40, RESTRICTION
 ENDONUCLEASE, HEMOPHILUS INFLUENZAE
 (1752)
 COCARCINOGEN, REPAIR SYNTHESIS
 INHIBITION, LYMPHOCYTE, HUMAN (5139)
 COLON, 1,2-DIMETHYLHYDRAZINE,
 EQUILIBRIUM CENTRIFUGATION, MOUSE
 (4417)
 COMPLEMENT SYNTHESIS, NATURAL RNA'S,
 GENERAL APPROACH (3769)
 CONSTANCY, HETEROPLIIDY, TUMOR (1439)
 CONTENT
 MASTOCYTOMA, RNA SYNTHESIS,
 INHIBITION (2020)
 SYNTHESIS, LYMPHORETICULAR TISSUE,
 ADENOCARCINOMA GROWTH, MOUSE
 (0760)
 COVALENT BINDING, N-ACETOXY-N-2-
 ACETYLAMINOFLUORENE, LIVER (5825)*
 CROSS-LINKING, BROMOMETHYLBENZ(A)-
 ANTHRACENE, T7 BACTERIOPHAGE (5181)
 CYTOPLASMIC, CHLOROBLASTOMYXOMA,
 STRONTIUM 90, RAT (0673)
 9,10-DIMETHYL-1,2-BENZANTHRACENE,
 BENZO(A)PYRENE, REPAIR INHIBITION,
 TRANSFORMING ACTIVITY, MUTATION
 FREQUENCY (5845)*
 DISTRIBUTION PATTERNS, PRENEOPLASTIC
 CONDITIONS, NEOPLASTIC CONDITIONS,

- MAMMARY GLAND, HUMAN (078H)
DNA-PROTEIN COMPLEX, ADENOVIRUS 12,
HAMSTER CELL (4529)
EFFECT OF GAMMA IRRADIATION, LYMPH
GLANDS (2462)*
ENDONUCLEASE, ADENOVIRUS, VIRAL
PEPTON, KB CELL (0704)
EPIDERMAL CONCENTRATION,
7,12-DIMETHYLBENZ(A)ANTHRACENE,
URETHAN, CROTON OIL, MOUSE (2969)
EPITHELIAL CELLS, GASTRIC MUCOSA,
ULCER, CANCER, HUMAN (3954)*
EPSTEIN-BARR VIRUS, TUMOR CELLS, HUMAN
(5225)
ETHYLATION, ETHIONINE, LIVER, RAT
(0342)
FATE, ADENOVIRUS, KB CELL (1715)
FIBROBLASTS, NORMAL, MALIGNANT, MOUSE
(1976)
FLUORESCENCE STUDIES, INTERACTION,
ACKIDINE ORANGE (3461)*
FRAGMENT, SIMIAN ADENOVIRUS 7,
TUMORIGENESIS, HAMSTER (0128)
GASTRIC CANCER, CHRONIC GASTRITIS,
GASTRIC MUCOSA, CELL EXFOLIATION,
MAN (0496)*
HERPESVIRUS, HORSE (2542)
HETEROPLGIDY, ORIGIN, TUMOR, HUMAN,
HAMSTER (1440)
HOST, POLYOMA VIRUS, INFECTED CELL,
HIGH TEMPERATURE, MOUSE (1760)
HYBRIDIZATION, HERPES VIRUS, TYPES
1 AND 2, GENETIC RELATEDNESS (4548)
HYBRIDIZATION PROPERTIES, RNA
SYNTHESIS, L CELL (0851)
DNA - CONTINUED
INDUCED SYNTHESIS, RNA TUMOR VIRUS,
MOUSE (2505)
INFECTIOUS INTERMEDIATE, ROUS SARCOMA
VIRUS TRANSFORMATION, CHICK CELLS
(2552)
INTEGRATION, SV40, PERMISSIVE KIDNEY
CELLS, MONKEY (3124)
INTERSTRAND CROSS-LINKING, MUSTARD
GAS ALKYLATION, HELA CELLS (4397)
INTRACELLULAR REPAIR, REVIEW (2228)*
LEUKEMIA, FRACTIONATION ANALYSIS,
HUMAN (1479)*
LINKAGE, 10-DIMETHYL-1,2-BENZANTHRA-
CENE, BENZO(A)PYRENE, MUTAGENICITY,
TRANSFORMATION INHIBITION, DNA
TEMPLATE INHIBITION (1372)
LIVER
REGENERATION, NUCLEAR PROLIFERA-
TION, MOUSE (3390)*
TUMOR, N,N'-2,7-FLUORENYLENE-
BISACETAMIDE, MOUSE (0047)
LYMPH NOSES, LYMPHOPROLIFERATIVE
DISEASE, HUMAN (6225)*
LYMPHOCYTE PROLIFERATION, HUMAN (1397)
LYMPHOCYTES, TRANSFORMATION,
POLYMERASE (1980)
MAMMARY TUMOR, GRAFT REJECTION, CELL
DEBRIS TREATMENT, RAT (4695)
METABOLISM
DIMETHYLNITROSAMINE, CARCINOGEN
EFFECT, MOUSE (2323)
LEUKEMIC CELLS, MOUSE LEUKEMIA,
RIBONUCLEOTIDE REDUCTASE, SPLEEN
(0849)
METHYLATION
DIMETHYLNITROSAMINE, CARCINOGEN
EFFECT, MOUSE (2323)
LIVER, DIMETHYLNITROSAMINE,
ETHIONINE, RAT (0355)
SYNTHESIS, CHRONIC GRANULOCYTIC
LEUKEMIA, HUMAN (4036)
METHYLATION OF GUANINE, METHYL
METHANESULPHONATE, ALKYLATING
MUTAGENS (4480)*
METHYLATION PRODUCTS, METHYL-
NITROSOUREA, MOUSE (0359)
3-METHYLTHTYME FORMATION, DIMETHYL-
NITROSAMINE, RAT (1585)
MITOCHONDRIAL
HUMAN-MOUSE HYBRID (2865)
LEUKEMIA, CHICKEN (0855)
METHYLATION, RAT, HAMSTER (2618)
REPLICATION, SV40, HUMAN, MONKEY,
RODENT (5894)
SYNTHESIS, STIMULATION, CYTO-
PLASMIC FACTOR, TUMOR, RAT
(4022)
TRANSFORMED CELLS, ADENOVIRUS,
SV40 (3117)
MODIFIED, CROWN-GALL (1120)
MOLECULAR JOINING, SV40 (5895)
MOLECULE, REPLICATION, POLYOMA VIRUS,
MOUSE (0436)
MURINE LEUKEMIA-SARCOMA VIRUS,
ISOLATION (1015)
MURINE LEUKEMIA VIRUS, MOUSE CELL
(0413)
MUTAGEN SPECIFICITY (1634)*
NASCENT SYNTHESIS, ULTRAVIOLET, L-CELL
(1685)*
NEVUS, MELANOMA, SEX CHROMATIN, MAN
(0546)
NITROSOGUANIDINE-TREATED, INDUCED
MUTATIONS, HAEMOPHILUS INFLUENZAE
(3657)
NUCLEAR DISTRIBUTION, MAMMARY CYSTIC
DISEASE, CARCINOMA, HYPERPLASTIC
LESION, HUMAN (0785)
NUCLEAR DNASE, AFLATOXIN, LIVER, RAT
(0043)
NUCLEOTIDE COMPOSITION, ELASTOMO-
GENESIS, URETHANE, LUNG TISSUE,
MOUSE (5813)*
ONCOGENIC RIBOVIRUSES, CHICKEN, MOUSE
(3794)
ONCOGENIC VIRUSES, CELL TRANSFORMATION
REVIEW (5030)*
ORAL CARCINOMA,
7,12-DIMETHYLBENZ(A)ANTHRACENE,
ACID PHOSPHATASE, HAMSTER (0672)*
PARENCHYMA, MAMMARY GLAND,
7,12-DIMETHYLBENZ(A)ANTHRACENE,
BINDING, RAT (1564)
PHYSICO-CHEMISTRY, HERPESVIRUS (1716)
POLYADENYLIC ACID, VACCINIA VIRUS
(1766)*
DNA - CONTINUED
POLYMERASE
AVIAN MYELOBLASTOSIS VIRUS (0147)*
RNA-DNA LINKAGE (5219)
BACTERIOPHAGE T4 GENE 43, E.COLI
(2871)
EHRlich ASCITES TUMOR CELL (1455)*
EXOGENOUS PRIMER, AVIAN MYELO-
BLASTOSIS VIRUS, ROUS SARCOMA
VIRUS (5901)
FELINE LEUKEMIA VIRUS, ENZYME
ACTIVITY (0149)*
FELINE SARCOMA VIRUS,
CARCINOGENESIS MECHANISM (0697)
INHIBITION, RNA C-TYPE VIRUS, RAT
ANTISERA (1698)

INHIBITOR, RAUSCHER MURINE
 LEUKEMIA VIRUS (0411)
 ISOLATION, TUMOR CELLS (5623)*
 LANDSCHUTZ ASCITES-TUMOR CELLS
 (5541)*
 LYMPHOCYTE, NORMAL HUMAN (5445)
 PHYTOHEMAGGLUTININ, LYMPHOCYTE,
 HUMAN (5906)
 POLYRIBOADENYLIC ACID-DEPENDENT,
 EUKARYOTIC CELLS (6286)*
 PRAGUE STRAIN ROUS SARCOMA VIRUS
 (0426)
 PRIMER REQUIREMENT, TEMPLATE
 SPECIFICITY, RNA TUMOR VIRUS
 (1706)
 PURIFICATION FROM NUCLEAR
 MEMBRANE-CHROMATIN FRACTION,
 PROPERTIES, ASCITES HEPATOMA
 CELLS (4924)*
 PURIFICATION FROM SOLUBLE FRACTION
 PROPERTIES, ASCITES HEPATOMA
 CELLS (4923)*
 RAUSCHER LEUKEMIA VIRUS,
 REVERSIBLE INACTIVATION (5257)
 REVERSE TRANSCRIPTASE DISTINCTION,
 RNA TUMOR VIRUS (1704)
 RNA-DEPENDENT
 ACTIVITY, MURINE LEUKEMIA VIRUS,
 MURINE SARCOMA VIRUS, MOUSE
 (3132)
 VIPUSES, CELLS (3799)
 RNA-DNA MOLECULE PRODUCT, AVIAN
 MYELOBLASTOSIS VIRUS (1012)
 RNA TUMOR VIRUS, INHIBITION,
 RIFAMYCIN DERIVATIVES (1730)
 ROUS SARCOMA VIRUS (1343)
 ROUS-ASSOCIATED VIRUS, INFECTED
 CELL, CHICKEN (5220)
 TEMPLATE, RNA TEMPLATE, ROUS
 SARCOMA VIRUS (1739)
 TEMPLATE SPECIFICITIES, COMPARA-
 TIVE STUDY, AVIAN MYELOBLASTOSIS
 VIRUS, E. COLI, M. LUTENS (3073)
 TEMPLATE UTILIZATION, HELA CELL
 (0680)
 TUMOR VIRUS, ETHIDIUM BROMIDE
 EFFECT, SYNTHETIC TEMPLATES
 (3766)
 VIRUS, MAMMARY CARCINOMA, MONKEY
 (1696)
 POLYMERASE ACTIVITY
 AVIAN MYELOBLASTOSIS VIRUS (5876)
 C-TYPE VIRUS, MOUSE (2496)
 TUMORS, A-TYPE PARTICLES (3103)
 POLYMERASE DEFICIENCY
 CHEMICAL CARCINOGEN, MUTAGEN,
 DETECTION, BACTERIA (0590)*
 ROUS SARCOMA VIRUS, ALPHA (5233)
 POLYMERASE INHIBITION, DAUNOMYCIN,
 RNA TUMOR VIRUS, MOUSE, CHICKEN
 (3787)
 POLYMERASE TEMPLATE, RNA SUBUNIT,
 ROUS SARCOMA VIRUS (5207)
 POLYOMA VIRUS
 ISOLATION, MOUSE (0395)
 PHI X 174, STRUCTURE (1444)
 REPLICATION, MOUSE EMBRYO (3827)*
 SECONDARY STRUCTURE (3139)
 POLYRIBONUCLEOTIDE BINDING, STRAND
 SEPARATION, ADENOVIRUS (0702)
 QUINOLINES, INTERACTION, CHARGE
 TRANSFER (5776)
 PRECANCEROUS CONDITION, SKIN (1900)*
 PRECURSOR INCORPORATION, PHORBOL,
 EPIDERMIS, MOUSE (1245)
 PROTEIN, SCISSION, REPAIR,
 4-NITROQUINOLINE-1-OXIDE, MOUSE
 (2936)
 PROTEIN-DNA RATIO, TUMOR, RAT, MOUSE
 (0296)*
 PURIFICATION, AVIAN MYELOBLASTOSIS
 VIRUS (1352)*
 REASSOCIATION KINETICS, RNA-DEPENDENT
 POLYMERASE, ROUS SARCOMA VIRUS
 (0686)
 DNA - CONTINUED
 REPAIR
 AROUND CARCINOGEN REMOVAL, NON-
 DIVIDING LYMPHOCYTES, HUMAN
 (4410)
 DEOXYRIBONUCLEOSIDE INCORPORATION,
 HYDROXYUREA, LYMPHOCYTE, HUMAN
 (1117)
 LYMPHOCYTE
 CHEMICAL CARCINOGEN, ALKYLATING
 AGENT, HUMAN (0935)
 4-NITROQUINOLINE-REPLICATION,
 NUCLEAR MEMBRANE, LEUKEMIA
 CELLS (4975)*
 PYRIMIDINE ISOSTICHS, THYMIDINE
 LABELING, N-ACETOXY ACETYL-
 AMINOFLUORENE, HUMAN (1297)
 UV RADIATION, SKIN CARCINOMA,
 HUMAN (1305)*
 REPAIR INHIBITION, COCARCINOGENS
 (1536)
 REPAIR SYNTHESIS
 ERYTHROCYTES, HETEROKARYONS,
 CHICKEN (3731)
 MECHANISMS, UV RADIATION, 4-NITRO-
 QUINOLINE 1-OXIDE, 4-NITRO-
 PYRIDINE 1-OXIDE, E. COLI MUTANTS
 (5143)
 REPAIR SYNTHESIS REDUCTION,
 4-NITROQUINOLINE-1-OXIDE,
 4-HYDROXYQUINOLINE-1-OXIDE,
 XERODERMA PIGMENTOSUM (1596)
 REPLICATING UNITS, MURINE LYMPHOMA
 (4035)
 REPLICATION
 INITIATION POINT, SV40 (3776)
 MOUSE (1965)
 SHOPE VIRUS-INDUCED PAPILLOMAS,
 MOLECULAR HYBRIDIZATION, RABBIT
 (5881)
 SV40 (5243)
 VIRAL INFECTION, REVIEW (5717)
 REPLICATION CONTROL, NAD PYROPHOS-
 PHORYLASE ACTIVITY, PHYSARUM POLY-
 CEPHALUM (3434)*
 REPLICATION MODEL, POLYOMA VIRUS
 (1758)
 REPLICATOR SITES, MAMMALIAN NUCLEI
 (3494)*
 REVERSE POLYMERASE, C-TYPE VIRUS,
 HYBRIDIZATION (0121)
 REVERSE TRANSCRIPTASE
 AVIAN VIRUS, MURINE VIRUS, INHIBI-
 TION, ANTISERUM (3867)
 ROUS SARCOMA VIRUS, DISTAMYCIN A,
 CONGOICIDINE (1744)
 TYPE C VIRUS PARTICLE, BURKITT'S
 LYMPHOMA, HUMAN (0688)
 RNA-DEPENDENT POLYMERASE
 INHIBITION, ANTIBODY, MURINE
 LEUKEMIA VIRUS (0450)
 MEDULLORBLASTOMA, HUMAN (1984)
 MURINE LEUKEMIA VIRUS, PRIMER

(5900)
 THYMUS, RAT (0701)
 RNA-HYBRIDIZATION, HERPESVIRUSES,
 RELATEDNESS (1721)
 RNA-SENSITIVE POLYMERASE, ROUS SARCOMA
 VIRUS, INFECTED CELL, RAT (1745)
 ROUS SARCOMA VIRUS
 HYBRIDIZATION, CHICKEN (0423)
 INFECTED CELL, RNA, CHICKEN
 (1326)*
 SOURCE AND SIGNIFICANCE (3086)
 VIRUS RELEASE, CHICKEN CELL (5916)
 SCISSION, REPAIR, 4-NITROGUANOLINE-1-
 OXIDE, MOUSE (3005)
 SEQUENCE HETEROGENEITY, SV40 (4546)
 SHOPE FIBROMA VIRUS, SIZE (5241)
 SINGLE STRAND BREAK FORMATION, X-RAY
 (2453)
 SINGLE STRAND BREAK REJOINING,
 X-IRRADIATION, EHRlich TUMOR, MOUSE
 (5863)
 SINGLE STRAND BREAKS, NITROSOGUANIDINE
 METHYL METHANESULFONATE, HAEMOPHILUS
 INFLUENZAE (1540)
 STRUCTURE, POLYOMA VIRUS, REPLICATIVE
 INTERMEDIATE (1763)
 SV40
 CLEAVAGE
 BACTERIAL RESTRICTION ENZYME
 (5278)*
 ENDONUCLEASE R1, PARTIAL
 DENATURATION MAPPING (5279)*
 ENDONUCLEASE ACTIVITY (3088)
 ETHIDIUM BROMIDE, MONKEY (4566)
 HOST CELL, HOMOLOGY, MONKEY CELL
 (3816)
 HYBRIDIZATION, RNA (5235)
 INFECTION, HOST INTEGRATION,
 NONPERMISSIVE CELLS (5269)
 REPLICATION
 MOLECULAR ORIGIN (5231)
 MONKEY (0718)
 ULTRASTRUCTURAL STUDY (5909)
 TRANSFORMED CLONES, MOUSE (5915)
 SV40 OLIGOMER INFECTION, RECOMBINANT
 ISOLATION, KIDNEY CELLS, MONKEY
 (3060)
 SV40 STRAIN DIFFERENCE (3741)
 DNA - CONTINUED
 SYNTHESIS
 ADENOVIRUS, SV40, CELL SURFACE
 (0433)
 AMINO ACID DEPRIVATION, SV40
 TRANSFORMATION, KIDNEY CELLS,
 HAMSTER (3063)
 ARGININE DEPRIVATION, BURKITT'S
 LYMPHOMA, EPSTEIN-BARR VIRUS
 (0402)
 BLOOD LYMPHOCYTES, HUMAN (2125)*
 BONE MARROW CELLS, MOUSE (5446)
 CANCER CELLS (4903)*
 CANINE HERPESVIRUS REPLICATION,
 TEMPERATURE SUPPRESSION (1720)
 CELL CYCLE DEPRESSION, METHYL-
 NITROSUREA, MOUSE EMBRYO (2934)
 CELLS, MOUSE (2170)*
 CHRONIC MYELOGENOUS LEUKEMIA CELLS
 FOLATE BINDING FACTOR, HUMAN
 (4969)*
 COLCEMID, CELL CULTURE, MOUSE
 (0281)*
 CULTURE (2174)*
 DIMETHYLBENZ(A)ANTHRACENE,
 PROGESTERONE, CARCINOGENESIS,
 MAMMARY GLAND, RAT (4364)
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 HERPES SIMPLEX VIRUS, INFECTED
 CELL, RABBIT (4520)
 EHRlich ASCITES TUMOR, CYTO-
 CHEMICAL INVESTIGATION (2018)
 FELINE LEUKEMIA VIRUS, MURINE
 SARCOMA VIRUS, INTERACTION,
 CAT CELL (1327)*
 FERRITIN, HEPATOMA, HEPATECTOMY,
 RAT (1472)*
 FRAGMENTATION, EPSTEIN-BARR VIRUS
 INFECTION, RAJI CELLS (3792)
 GROSS VIRUS LEUKEMIA, IMMUNOLOGY,
 MOUSE (3719)*
 HEPATOMA, GROWTH RATE (2014)
 HERPESVIRUS INFECTION, RIBONUCLEO-
 TIDE REDUCTASE, KB CELLS (3059)
 INDUCTION, MAREK'S DISEASE VIRUS,
 ONCOGENICITY, BIRD (4586)*
 INFECTED CELL, POLYOMA VIRUS,
 MOUSE (0726)
 INHIBITION
 ARABINOFURANOSYL ADENINE, TRANS-
 FORMATION, ROUS SARCOMA VIRUS,
 RAT (3754)
 CHEMICAL (2392)*
 KILHAM RAT VIRUS, RAT EMBRYO
 CELL (1702)
 LEUKEMIA CELL, HUMAN (1107)
 LIVER, 3'-METHYL-4-DIMETHYLAMINO-
 AZOBENZENE, RAT (1560)
 LIVER REGENERATION, METABOLIC
 ALTERATIONS, 5-AZACYTIDINE
 TREATED RATS (4466)*
 LYMPHOCYTES, UV RADIATION, HUMAN
 (2467)*
 MAMMARY TUMOR, STROMA CELL, MOUSE
 (1468)*
 METHYLATION, FIBROBLASTS, MOUSE
 (3992)
 MORRIS HEPATOMA, RAT (3504)*
 MURINE SARCOMA VIRUS REPLICATION,
 SV40, EMBRYO CELLS, MOUSE (4534)
 MYELOMA, HUMAN TUMOR CELL NUMBER,
 IGE SYNTHESIS (0516)
 NONPRODUCTIVE INFECTION AND
 INDUCTION, BOVINE ADENOVIRUS
 TYPE 3, CONTACT-INHIBITED CELL
 LINE, MOUSE (2530)
 NORMAL, UNSCHEDULED, AUTO-
 RADIOGRAPHY, HELA CELL (1306)
 NUCLEI, LIVER, RAT (5608)*
 OLIGO-ISOLATES, HELA CELLS,
 IN VITRO (3406)*
 POLYMERASE ACTIVITY, MYELOMA,
 MOUSE (6288)*
 POLYNUCLEOTIDE LEFGASE, ASCITES
 HEPATOMA, RAT (4043)
 PRECURSOR METABOLISM, LEUKOCYTE,
 LEUKEMIA, HUMAN, REVIEW (0609)
 PROTEIN SYNTHESIS, PROSTATE
 NUCLEI (1476)*
 RADIATION EFFECTS, SYNCHRONIZED
 CELL SYSTEM, MOUSE (0837)
 RIBONUCLEASE, ROUS SARCOMA VIRUS
 (0425)
 RNA, HUMAN CANCER RESEARCH REVIEW
 (5057)*
 RNA DIRECTED, DNA POLYMERASE, ROUS
 SARCOMA VIRUS (2553)
 SHOPE FIBROMA VIRUS, RABBIT CELLS,
 IN VITRO (0682)
 SKIN, TUMOR PROMOTER, DIMETHYL-

*INDICATES * PLAIN CITATION WITHOUT ACCOMPANYING ABSTRACT

BENZANTHRACENE, MOUSE (3644)
 STIMULATION, AUTOCHTHONOUS TUMOR
 CELL, SARCOMA, BENIGN TUMOR,
 HUMAN (0156)
 SUCROSE, LIVER CELL NUCLEI,
 MORRIS HEPATOMA (1484)*
 SUPPRESSION, ADENOVIRUS, HUMAN,
 MONKEY (1335)
 SV40
 ABORTIVE INFECTION, ANTIGEN
 PRODUCTION, MOUSE (0434)
 MACROPHAGE, MOUSE (0148)*
 MONKEY (1030)
 TEMPERATURE SENSITIVE MUTANT
 (5216)
 SV40-TRANSFORMED CELL, METHIONINE
 DEPRIVATION, MOUSE CELL (1349)
 SV40 VIRUS, GEL ELECTROPHORESIS
 ANALYSIS (5227)
 UV IRRADIATION
 GERM CELL, HUMAN (1301)
 SPONTANEOUS TUMOR, HUMAN (5861)
 VITAMIN B12, FOLIC ACID, MOUSE
 (0553)
 X-IRRADIATION, UV RADIATION, MOUSE
 (2461)*

DNA - CONTINUED
 SYNTHESIS CONTROL, MITOTIC REGULATION,
 CANCER THEORY (0224)
 SYNTHESIS INDUCTION
 MITOCHONDRIA, SV40, MONKEY (0427)
 ULTRAVIOLET, HYDROXYUREA, HELA
 CELL (1676)*
 SYNTHESIS INHIBITION, HISTONE,
 DIMETHYLNITROSAMINE, LIVER, RAT
 (0643)
 SYNTHESIS INTERMEDIATE, ADENOVIRUS
 TYPE 2 (1334)*
 SYNTHESIS REINITIATION, INFECTED CELL,
 SV40, HAMSTER (1751)
 SYNTHESIS STIMULATION
 AVIAN MYELOBLASTOSIS VIRUS,
 CHICKEN FIBROBLASTS (3777)
 SERUM, HEPATECTOMY, LIVER CELL,
 RAT (1791)
 TEMPLATE EFFECT, ALKYLATING AGENTS,
 HELA CELL CULTURE (2353)
 THYMUS, THYMIDINE INCORPORATION,
 X-IRRADIATION, RAT (1670)*
 TRANSFER, POLYOMA VIRUS, HUMAN CELL,
 MOUSE CELL (1761)
 TRANSFORMATION, DIFFERENTIAL INACTIVA-
 TION, 4-HYDROXYAMINOQUINOLINE-
 1-OXIDE, BACILLUS SUBTILIS (3666)
 TRANSLOCATION, MAMMARY TUMOR, BLOOD,
 RAT (1130)
 TRITIATED THYMIDINE INCORPORATION,
 ELECTRON MICROSCOPIC AUTORADIOGRAPHY
 ASCITES CELLS, RAT (3487)*
 TURNOVER, MOUSE (4034)
 URETHANE BINDING, LIVER, PARTIAL
 HEPATECTOMY, MOUSE (2933)
 VALUE, PALATAL CARCINOMA (1477)*
 VIRAL, CANCER CELL, MOLECULAR
 HYBRIDIZATION, REVIEW (4311)
 VIRAL DNA SYNTHESIS, ADENOVIRUS-
 INFECTED KB CELLS (3819)
 VIRAL GENOMES, MAMMALIAN CELL
 ORGANIZATION, CARCINOGENESIS
 MECHANISM, REVIEW (3611)
 VIRAL REPLICATION REPRESSOR, PAPOVA
 VIRUS, TRANSFORMED CELLS, REVIEW
 (2235)*
 VIRUS

CELL MEMBRANE, BIOCHEMICAL CHANGE,
 TRANSFORMATION, MOUSE (1315)
 FPSTEIN-BARR VIRUS INFECTION,
 LYMPHOID CELL LINES, HUMAN
 (5882)
 VISCOSITY AT ELEVATED TEMPERATURES,
 4-NITROQUINOLINE 1-OXIDE (4471)*
 DOMESTIC ANIMAL
 LEUKEMIA, EPIDEMIOLOGY, HUMAN, REVIEW
 (5706)
 DOPAMINE
 EFFECT REVERSAL, GROWTH STIMULATION,
 NEUROBLASTOMA, IPRONIAZID, MOUSE
 (1631)*
 DOWN'S SYNDROME
 ACUTE LEUKEMIA, LEUCOCYTE FUNCTION,
 CLINICAL STUDY (6301)*
 CHRONIC MYELOID LEUKEMIA, CHROMOSOME,
 HUMAN (0836)
 LEUKEMIA SUSCEPTIBILITY, IMMUNOLOGIC
 FACTORS, HUMAN (1834)
 SKIN FIBROBLAST, TRANSFORMATION,
 SV40, HUMAN (0435)
 DRUG ABUSE
 LSD, TESTICULAR CHORIOCARCINOMA, HUMAN
 (0986)*
 PHENACETIN, RENAL PELVIC CARCINOMA,
 HUMAN (0973)*
 DUODENUM
 CARCINOMA, CLINICAL STUDY (5573)*
 CARCINOMA, HUMAN (3526)*
 POLYPOSIS, CARCINOMA, CASE REPORT
 (4294)*
 TUMORS, CASE REPORTS (5563)*
 ULCERS, PROPIONITRIL, RAT (5194)*
 DUST
 ASBESTOS-LIKE PARTICLES, TUMOR
 FORMATION, RAT (5135)
 GLASS-FIBER RODIES, LUNG, GUINEA PIG
 (0081)*
 ECCRINE
 TUMOR (1961)
 EHRLICH ASCITES
 CARCINOMA
 BRAIN-PASSAGED SUBLINE ESTABLISH-
 MENT, CHARACTERISTICS, MOUSE
 (5518)*
 GROWTH KINETICS, ALTERED IMMUNO-
 LOGICAL CONDITIONS (5377)*
 LIVER, LIPIDS, MOUSE (2088)*
 CARCINOMA CELLS, QUARAIN RESISTANT,
 ION TRANSPORT (5588)*
 CELLS, MITOCHONDRIA, MALATE-ASPARTATE
 SHUTTLE (2176)*
 TUMOR CELLS
 ADENOSINE TRIPHOSPHATE ACTIVITY,
 NACE CONTENT OF CULTURE MEDIUM
 (4901)*
 FATTY ACID SYNTHESIS (5664)*
 HEMATOGENOUS DISSEMINATION,
 METASTASES FORMATION, MOUSE
 (5502)*
 OXYGEN CONSUMPTION, SERIAL
 CULTIVATION IN HYPERTONIC MEDIA
 (5619)*
 PROLIFERATION, CYTOPLASMIC AND
 NUCLEAR GROWTH, MOUSE (5644)*
 RNA COMPONENTS (5436)
 EHRLICH ASCITES TUMOR
 CELL
 NA+ AND K+ POTENTIAL, ACTIVE
 TRANSPORT, AMINO ACIDS (3432)*
 PHOSPHORUS INCORPORATION (3447)*
 CELL METABOLISM, ASCITES SERUM

- ADDITION, IN VITRO (4246)*
CYTOLOGY, MORPHOLOGY, ULTRASTRUCTURE,
MOUSE (3536)*
GROWTH, POLYAMINE AND NUCLEIC ACID
CONCENTRATIONS, LIVER, MOUSE (4870)
METABOLITE ACTIVATION, GLYCINE
ACCUMULATION, MOUSE (4956)*
RIBONUCLEOTIDE
CATABOLISM (4850)
DNA SYNTHESIS, MOUSE (4212)*
SUBLINE, ULTRASTRUCTURE, MOUSE (1165)*
TYROSINE, 2-OXOGLUTARATE AMINO-
TRANSFERASE, LIVER, MOUSE (0874)*
ULTRASTRUCTURE, ENERGY PRODUCTION,
MEMBRANE FUNCTION (2064)*
- ELECTROGENESIS
MOUSE, NEUROBLASTOMA, CELL MEMBRANE
(0552)
- ELECTRON MICROSCOPY
BASAL CELL, CARCINOMA, HUMAN (2079)*
HEMANGIOBLASTOMA, MENINGIOMAS, HUMAN
(2081)*
LEUKEMIA, LYMPHOID CELLS, HUMAN
(2078)*
MENINGIOMA, HUMAN (2197)*
MYOBLASTOMA (2010)
SHOPE LIBROMA, LAMELLAE, RABBITS
(2023)*
- ELECTROPHORESIS
ANTIGEN DETECTION, RNA-VIRUS, RAPID
METHOD, FELINE LEUKEMIA VIRUS (2336)
CYTIDINE-3H INCORPORATION, SKIN,
MOUSE (2342)
TUMOR, OVARY, PROTEINS, HUMAN (2107)*
TUMOR HISTONES, PHOSPHORYLATION,
CELL REPLICATION RATE (4087)*
VIRAL RNA, LEUKEMIA, MOUSE (4580)*
- EMBRYO
AGE FACTOR, URETHAN SUSCEPTIBILITY,
MOUSE (0367)*
ANTIGEN, CARCINOGENIC, HUMAN, REVIEW
(2220)*
BLASTOMIC TUMOR, HISTOGENESIS, REVIEW
(0605)
CHORIOALLANTOIC MEMBRANE
CARR-ZILBER ROUS SARCOMA VIRUS,
FIBROSARCOMA, CHICK (1027)
TUMOR CELL DIFFUSION, CHICK (0251)
FIBROBLAST TRANSFORMATION, ROUS
VIRUS, HAMSTER, IN VITRO (0444)*
GENETICALLY-CAUSED TUMOR, TRANS-
PLANTATION, RAT (2828)
- EMBRYOGENESIS
TUMORIGENESIS, RNA TUMOR VIRUS (0308)
- ENDOCRINE
DISEASE, LUNG CANCER (2870)
MALIGNANT, ADRENAL, EVOLUTION, HUMAN
(1978)
MEDIASTINAL NEOPLASM, CARCINOID TUMOR,
HUMAN (3525)*
MEDIASTINAL NEOPLASM, CLINICAL STUDY
(5575)*
MULTIPLE ADENOMATOSIS, MEDIASTINAL
NEOPLASM, CASE REPORTS (5576)*
POLYPEPTIDE TUMORS, APUDAMYOID
GENESIS, HUMAN (3396)*
TUMORS, HORMONE DEPENDENCY, MOUSE
(5633)*
- ENDOCRINE DISORDER
PHARMACOLOGY, GROSS, PROGNOSIS,
REVIEW (1527)*
- ENDOCRINE GLAND
HORMONE SECRETION, CANCER CELL, HUMAN,
REVIEW (4319)
- METASTASIS, INCIDENCE, DISTRIBUTION,
HUMAN (6273)*
SPONTANEOUS TUMORS, MASTOMYS (2861)
TUMOR, ADENYL CYCLASE RESPONSE,
HORMONE, HUMAN (4653)
- ENDOMETRIAL CANCER
AIRPLANE ENGINE SOOT, BENZO(A)PYRENE,
MOUSE (3011)
MESOTHELIAL CELLS, INCREASED PROLIF-
ERATION, RAT (3535)*
RESULTS OF STUDIES ON 600 WOMEN
(3598)*
- ENDOMETRIAL CARCINOMA
CLINICAL STUDY (6298)*
HYSTERECTOMY, RECURRING (1954)
- ENDOMETRIUM
ADENOACANTHOMA, ADENOSQUAMOUS
CARCINOMA, CLINICO-PATHOLOGIC STUDY
(4927)*
- ADENOCARCINOMA
HYPERPLASIA, CHROMOSOMAL ANOMALIES
HUMAN (4253)*
ULTRASTRUCTURE, HUMAN (4233)*
- CARCINOMA
ALDOOLASE, LACTATE AND MALATE
DEHYDROGENASE, HUMAN (4156)*
ALKALINE PHOSPHATASE, HUMAN
(0864)*
CLINICAL STUDY (6298)*
DEVELOPMENT, ESTROGEN EFFECT,
HUMAN (5399)
ENZYME ACTIVITY (6066)*
HUMAN, REVIEW (5731)*
LACTIC DEHYDROGENASE ACTIVITY,
SERUM AND TISSUES, CLINICAL
STUDY (5679)*
LOCAL SPREAD, HUMAN (0828)*
METHYLCHOLANTHRENE, ULTRASTRUCTURE
HISTOLOGY, MOUSE, RAT (1632)*
MORPHOLOGY, ORGAN CULTURES (6369)*
PROGESTERONE, HUMAN (2818)
ULTRASTRUCTURE, GLANDULAR CELL,
HUMAN (4245)*
ULTRASTRUCTURE, HUMAN (0886)*
HYPERPLASIA, PRE-MALIGNANT LESION,
HUMAN (6063)*
NONMALIGNANT, NEW CELL LINE ESTABLISH-
MENT, HUMAN (5517)*
PARAFFIN, POLYMER, SQUAMOUS CELL
CARCINOMA, RAT (0948)
PRECANCEROUS CHANGES, HUMAN, REVIEW
(5058)*
SARCOMA, CELLULAR STROMA, HISTOLOGY,
CLINICAL STUDY (6173)*
- ENDOPLASMIC RETICULUM
PROLIFERATION, LIVER CELL ULTRA-
STRUCTURE, PHENOBARBITAL, 3-METHYL-
CHOLANTHRENE, RAT (1655)*
PROTEINS, 3-METHYLCHOLANTHRENE, RAT
(1579)
TUBULES, THYROID TUMOR CELLS, ULTRA-
STRUCTURE, DOG (6193)*
- ENDOTOXIN
HYPERPLASTIC GROWTH, INDUCTION,
BACTERIA (1548)
- ENVIRONMENT
ATMOSPHERIC CARCINOGENS, STANDARDIZA-
TION, REVIEW (5002)
CARCINOGENIC POLLUTION, BENZO(A)PYRENE
AIRCRAFT ENGINEER (3652)
- CARCINOGENS
NITROSAMINES, REVIEW (2222)*
REVIEW (2250)*
OCCUPATIONAL HAZARD

CANCER, HUMAN, REVIEW (2279)*
 CARCINOGENESIS, MODEL SYSTEM (0310)*
 SKIN CANCER OCCURRENCE, ATMOSPHERIC FACTORS, HUMAN (4447)
 SOIL, CANCER PREDISPOSITION, REVIEW (4318)
 WATER RESERVOIR CONTAMINATION, CARCINOGENIC HYDROCARBONS (2441)*
 ENVIRONMENTAL FACTOR
 ASBESTOS RODIES, LUNG, MAN (0662)*
 ENVIRONMENTAL HAZARD
 ALDRIN, DIELDRIN, BLOOD, HUMAN (0647)*
 BRACKEN FERN, HUMAN (0938)
 CARCINOGENESIS, HUMAN, REVIEW (2281)*
 CARCINOGENS
 MAXIMUM CONCENTRATIONS, REVIEW (2251)*
 PREVENTION, REVIEW (2282)*
 CHEMICAL CARCINOGEN, MUTAGENS, TERATOGENS, REVIEW (3620)
 CYCLAMATE, REVIEW (0920)*
 DIETHYL PYROCARBONATE, URETHANE, BEVERAGE (4428)
 ENDRIN, HYPERPLASIA, TROUT (0668)*
 LEUKEMIA
 HOUSEHOLD PET, INCIDENCE (6084)
 PESTICIDE, POLAND (5417)
 MICROSOmal ENZYMES, INSECTICIDE, CIGARETTE SMOKING, CHEMICAL CARCINOGEN, HUMAN REVIEW (0306)
 NITROSAMINE, CARCINOGENICITY, ANIMAL, HUMAN, REVIEW (0303)
 OIL MIST POLLUTION, REVIEW (5750)*
 POLLUTION, OZONE, NITROGEN DIOXIDE, LUNG, BENZO(A)PYRENE HYDROXYLASE, RABBIT (5803)
 STEEL MANUFACTURE, FLUORIDE, LUNG CANCER, CANADA (5414)
 URANIUM, LANDFILL, CANCER MORTALITY, COLORADO (5412)
 ENZYME
 ACCUMULATION, EHRlich CARCINOMA CELLS, MOUSE (4147)*
 N-ACETYLATION, N-HYDROXY-2-AMINO-FLUORENE, LIVER, MAMMALIAN SPECIES (0372)*
 ACETYLCHOLINE ESTERASE, NEUROBLASTOMA, MOUSE (0881)*
 ACID AND ALKALINE PHOSPHATASES, HISTOCHEMISTRY, GRAFFI VIRUS LEUKEMIA, MOUSE (0116)
 ACID PHOSPHATASE
 CEREBRAL TUMOR, HUMAN (1154)*
 DNA, 7,12-DIMETHYLBENZ(A)ANTHRACENE, ORAL CARCINOMA, HAMSTER (0672)*
 HEPATOCELLULAR CARCINOMA, N-2-FLUORENYLDIACETAMIDE, RAT (0048)
 LEUKOCYTE, CHRONIC GRANULOCYTIC LEUKEMIA, HUMAN (4158)*
 RETICULOENDOTHELIOSIS, HAIRY CELLS ULTRASTRUCTURE, LEUKEMIA PATIENT (6332)*
 ACID PHOSPHATASE ACTIVITY, LEUKEMIA CELLS, MOUSE (5697)*
 ACID PHOSPHATASE CHANGE, AZO DYE CARCINOGENESIS, LIVER, RAT (3714)
 ACID PHOSPHATASE INDUCTION, ACTINOMYCIN D, LEUKEMIA CELLS, MOUSE (5698)*
 ACID PHOSPHATASE AND CATHEPSIN D ACTIVITY, MALIGNANT TUMOR, MUSCLE TISSUE, CLINICAL STUDY (4930)*
 ACTIVATION, 4-HYDROXYAMINOQUINOLINE-1-OXIDE, CELLULAR INTERACTION, RAT (2341)
 ACTIVITY, STROMAL CELL, OVARIAN TUMOR, HUMAN (1153)*
 ACUTE LEUKEMIA, LYSOSOMES, HUMAN (3493)*
 ADENINE PHOSPHORIBOSYLTRANSFERASE ACTIVITY, EHRlich ASCITES TUMOR, MOUSE (2992)
 ADENOSINE DEAMINASE
 LEUKOCYTE, LEUKEMIA, HUMAN (3302)
 RICH VIRUS, LEUKEMIA, MOUSE (1331)
 ADENOSINE 3',5'-MONOPHOSPHATE ADENYL CYCLASE, LIVER, RAT (4161)*
 ADENOSINE TRIPHOSPHATASE
 N,N-DIMETHYLAMINOAZOBENZENE, RAT (4784)
 ELEVATED LYMPHOCYTE ACTIVITY, GASTROINTESTINAL CARCINOMA, HUMAN (2631)
 MOUSE, MAMMARY TUMOR VIRUS-ASSOCIATED, ULTRASTRUCTURAL CYTOCHEMISTRY (4604)*
 ADENOSINE TRIPHOSPHATASE ACTIVITY, NACE CONTENT OF CULTURE MEDIUM, EHRlich ASCITES TUMOR CELLS (4901)*
 ADENYL CYCLASE
 ADRENALIN RESPONSE, 2-ACETYLAMINO-FLUORENE, RAT (5125)
 HORMONE, ENDOCRINE TUMOR, HUMAN (4853)
 HORMONE RECEPTOR, ADRENOCORTICAL CARCINOMA, RAT (1486)*
 PHOSPHODIESTERASE
 CYCLIC AMP DEPENDENT PROTEIN KINASE, MALIGNANT GLIAL CELLS (1904)*
 SV40, TRANSFORMED ASTROCYTE, HAMSTER (1750)
 SOMATIC HYBRIDS, GLIAL CELLS, RAT (5441)
 ADENYLATE CYCLASE, -ADRENOCORTICOTROPHIC HORMONE, ADRENAL TUMOR (6119)
 ADENYLIC ACID, ADENOSINE DEAMINASE, MAMMARY CARCINOMA, MOUSE (0793)*
 AEROBIC GLYCOLYSIS, CYTOLOGY, CHLOROLEUKEMIA, HUMAN (0561)*
 ALDOLASE
 HEPATOMA CELL, RAT (4849)
 LACTATE, MALATE DEHYDROGENASES, ENDOMETRIAL CARCINOMA, HUMAN (4156)*
 POLYMORPHISM, LEUKOSIS, HENS (5639)*
 ALDOLASE C, GLIOBLASTOMA, CELL CULTURE MOUSE (4211)*
 ALDOLASE ISOZYME
 BRAIN TUMOR, HUMAN (1152)*
 LUNG CANCER TISSUES (6196)*
 ENZYME - CONTINUED
 ALKALINE PHOSPHATASE
 BREAST CARCINOMA, STROMA, HUMAN (0184)
 CARBAMYL PHOSPHATE HYDROLYSIS, TUMOR TISSUES, RAT (5641)*
 CHRONIC MYELOID LEUKEMIA, REVIEW (1213)*
 CRANIOPHARYNGIOMA, DENTAL CYST, HUMAN (1175)*
 DEFICIENCY, BLADDER EPITHELIUM, N-DIBUTYLNITROSAMINE, RAT

- (1085)
ENDOMETRIAL CARCINOMA, HUMAN
(0864)*
LEUKEMIA, MOUSE (4089)*
LUNG CANCER TISSUE, HUMAN (4010)
PHAGOCYTE ACTIVITY, LEUKEMIA,
HUMAN (1495)*
PLACENTAL-TYPE, RADIOIMMUNOASSAY,
HUMAN (4770)*
REVERSIBLE SUPPRESSION, THYROID
MEDULLARY CARCINOMA CELLS, HUMAN
(5880)
UPTAKE, HELA CELL (1112)
ALKALINE PHOSPHATASE ACTIVITY
LEUKEMIA, MOUSE (5272)
PLASMA MEMBRANE, LIVER, RAT
(3450)*
VIRUS-INDUCED THYMIC LYMPHOMA,
MOUSE (3775)
ALKALINE PHOSPHATASE VARIANT
HEPATOCELLULAR CARCINOMA, SERA,
HUMAN (4922)*
NEURAMINIC ACID REMOVAL, HEPATOMA,
CELLS (5505)*
ALTERATION, RESPIRATION, MORRIS
HEPATOMA, REVIEW (5011)
AMINO ACID NAPHTHYLAMIDASE, MALIGNANT
CELL, HUMAN (0567)*
AMINOPEPTIDASE ACTIVITY, LEUKOCYTES,
HUMAN (3550)*
AMINOTRANSFERASES, ASPARTATE AND
ALANINE, SARCOMAS, RAT (3998)
AMP DEAMINASE, 3'-METHYL-4-DIMETHYL-
AMINOAZOBENZENE, BINDING, LIVER, RAT
(3710)
ANILINE HYDROXYLATION, LIVER,
BENZO(A)PYRENE, ACIDITY, RAT (0657)*
ARGINASE, GLUCOSE-6-PHOSPHATE
DEHYDROGENASE, MAMMARY TUMOR, MOUSE
(0187)
ARYL HYDROCARBON HYDROXYLASE
BENZ(A)ANTHRACENE, CELL HYBRID,
MOUSE HAMSTER, HUMAN (4409)
CHEMICAL CARCINOGEN, TRANSFORMA-
TION, CYTOTOXICITY, CHROMOSOME
BREAKAGE (4433)
CYCLOHEXIMIDE, ACTINOMYCIN D,
POLYCYCLIC HYDROCARBON, RAT
LIVER (1241)
INDUCTION
BENZ(A)ANTHRACENE, GENETICS,
MOUSE (0349)
TUMORIGENESIS, POLYCYCLIC
HYDROCARBONS, RODENT (0348)
INHIBITION, SKIN TUMORIGENESIS,
7,8-BENZOFLAVONE, 7,12-DIMETHYL-
BENZ(A)ANTHRACENE, MOUSE (3678)
PHYTOHEMAGGLUTININ, 3-METHYL-
CHOLANTHRENE, LEUKOCYTE, HUMAN
(5121)
RIBOFLAVIN DEFICIENCY, EPITHELIAL
NEOPLASIA, MOUSE (3668)
STIMULATION, BENZ(A)ANTHRACENE,
MITOGEN, HUMAN LYMPHOCYTES
(4443)
STIMULATION, LIVER CELL,
POLYCYCLIC HYDROCARBON, RAT
(1252)*
ARYL HYDROCARBON HYDROXYLASE ACTIVITY,
QUANTITATION, INDIVIDUAL FETAL CELLS
HAMSTER (5081)
L-ASPARAGINASE
CELL CYCLE, NUCLEIC ACID
SYNTHESIS, ACUTE LYMPHOBLASTIC
LEUKEMIA, HUMAN (4026)
LYMPHOCYTE BLASTOGENESIS, RAT
(2691)*
LYMPHOMA, PLASMA MEMBRANE,
GLYCOPROTEIN (4040)
METASTASIS ENHANCEMENT SARCOMA,
MOUSE (1069)*
L-ASPARAGINASE ACTIVITY, MALIGNANT
TUMORS, HUMAN, RAT (3440)*
ASPARTATE AMINOTRANSFERASE ACTIVITY,
BRAIN TUMORS, HUMAN (5657)*
ASPARTATE TRANSCARBAMYLASE, CONCEN-
TRATIONS, GROWTH RATE, FETAL, ADULT
AND NEOPLASTIC TISSUE, RAT (4791)
ASSAY, YABA POXVIRUS (1004)
ATP-SULFURYLASE, ENZYME-SUBSTRATE
COMPLEXES, MASTOCYTOMA, MOUSE (4860)
ATPASE
CELL SURFACE, NEOPLASTIC CELL,
HUMAN (1442)
HISTOCHEMISTRY, HEPATOMA CELL
NUCLEI, MOUSE (6236)*
LYMPHOCYTES, HUMAN (5988)*
PLASMATIC CELL MEMBRANE, HEPATOMA,
MOUSE (4123)*
ATPASE ACTIVITY, CYTOPLASMIC MEMBRANE,
HEPATOMA CELL, MOUSE (3950)
ENZYME - CONTINUED
BENZO(A)PYRENE HYDROXYLASE
INTESTINE, RAT (0369)*
LIVER, 3-METHYLCHOLANTHRENE, FETAL
RAT (1580)
LUNG, OZONE, NITROGEN DIOXIDE,
RABBIT (5803)
SPIRONOLACTONE, ETHYLSTRENOL,
LIVER MICROSOME, RAT (1138)*
BETA-GLUCURONIDASE, MASTOCYTOMA, MOUSE
(0861)*
BETA-HYDROXY-BETA-METHYLGLUTARYL
COENZYME A REDUCTASE, LIVER, MORRIS
HEPATOMA, CHOLESTEROL, RAT (4851)
REDUCTASE, STEROL SYNTHESIS
REGULATION, LIVER, HEPATOMA, MOUSE
(1483)*
BRANCHED CHAIN AMINO ACID TRANSAMINASE
ISOZYMES, CANCER CELLS, LIVER, RAT
(4859)
BRINASE, AUTOCYTOTOXICITY, ACUTE
LEUKEMIA, IMMUNOTHERAPY, HUMAN
(3205)
1-CARBON, HEPATIC ACTIVITIES,
HEPATOCARCINOGEN ADMINISTRATION, RAT
(3022)*
CARCINOGENIC AMIDE HYDROLYSIS, LIVER
MICROSOMES, GUINEA PIG (2926)
CATALASE, LIVER, BLOOD, TUMOR-BEARING,
MOUSE (4187)*
CATALASE SYNTHESIS, INHIBITION, LIVER,
MOUSE (5532)*
CATALASE-DEPRESSING ACTIVITY,
RHODAMINE SARCOMA, LIVER, RAT (2949)
CATALASE-DEPRESSING FACTOR, FRIEND
VIRUS INFECTION, SPLEEN, MOUSE
(3077)
CATALASE SYNTHESIS, TRANSLATION
REGULATION, MORRIS HEPATOMA (3511)*
CELLULAR, LEUKOCYTES, METABOLISM,
REVIEW (1517)
CHOLINESTERASE
INTRACELLULAR LOCALIZATION,
HEPATOMA, RAT (6373)*
JENSEN SARCOMA, RAT (0560)*
COLLAGENASE, CARCINOMA CELLS, RABBIT
(4962)*

RELATIONSHIP (3275)
 ENZYME - CONTINUED
 COLLAGENASE DISTRIBUTION, MALIGNANT
 MELANOMAS, HUMAN (3528)*
 COLLAGENOLYTIC, BASAL CELL EPITHELIOMA
 HUMAN (5600)*
 ULTRASTRUCTURE, SKIN, HUMAN
 (5604)*
 COLLAGENOLYTIC, NEOPLASMS, HUMAN
 (3990)
 CYCLIC AMP-PHOSPHODIESTERASE ACTIVITY,
 REGULATION BY INTRACELLULAR CAMP,
 FIBROBLASTS, MOUSE (3308)
 CYCLIC NUCLEOTIDE PHOSPHODIESTERASE,
 ADRENOCORTEX, CARCINOMA, RAT (4071)*
 CYCLIC 3',5'-NUCLEOTIDE PHOSPHO-
 DIESTERASES, NOVIKOFF RAT HEPATOMA,
 MOUSE L AND HELA CELLS (4869)
 CYTIDINE-5'-MONOPHOSPHATE-N-ACETYL
 NEURAMINATE SYNTHETASE, LEUCOCYTE,
 LEUKEMIA, HUMAN (0563)*
 CYTOCHROME OXIDASE
 HISTAMINASE, 1-NAPHTHYLAMINE,
 2-NAPHTHYLAMINE, RAT (0366)*
 REDUCTION CAPACITY ASCITES TUMOR,
 MOUSE (1499)*
 DEDIFFERENTIATED PATTERN, LIVER,
 TUMOR-BEARING RATS (5515)*
 DEFICIENT ISLAND, DIETHYLNITROSAMINE,
 LIVER CARCINOGENESIS, RAT (0356)
 DEHYDROGENASE, MAMMARY CARCINOMA,
 PROLACTIN DEPENDENCE, HUMAN (5129)
 DEHYDROGENASE ACTIVITY, CIRCADIAN
 RHYTHM, BLOOD CELLS, ACUTE LEUKEMIA,
 CHILDREN (6183)*
 DEOXYRIBONUCLEASE, AFLATOXIN, CHEMICAL
 STRUCTURE, COW (1254)
 DEOXYTHYMIDINE KINASE, PURIFICATION
 AND PROPERTIES, YOSIDA SARCOMA
 (3502)*
 DEOXYTHYMIDINE KINASE ACTIVITY,
 THERMAL STABILITY DIFFERENCES,
 HERPES SIMPLEX VIRUS TYPE 1 AND 2
 (3083)
 DETECTION, 4-NITROGUINOLINE 1-OXIDE,
 MICROBIAL ASSAY, SALMONELLA
 TYPHIMURIUM (4419)
 DIAMINEOXIDASE, ROUS SARCOMA VIRUS
 INFECTION, FIBROBLASTS, CHICKEN
 (5930)*
 DIMETHYLNITROSAMINE DEMETHYLASE,
 REPRESSION, HYDROCARBON, MOLECULAR
 SIZE REQUIREMENT, RAT (0642)
 DNA POLYMERASE
 AVIAN MYELOBLASTOSIS VIRUS (5876)
 AVIAN ONCORNAVIRUS, SEROLOGIC
 ANALYSIS (5234)
 DNA SYNTHESIS, RNA DIRECTED, ROUS
 SARCOMA VIRUS (2553)
 ISOLATION, TUMOR CELLS (5623)*
 LANDSCHUTZ ASCITES TUMOR CELLS
 (5541)*
 LYMPHOID LEUKEMIA, LYMPHOCYTES, OX
 (5940)*
 MONOSPECIFIC ANTISERUM, AVIAN
 ONCORNAVIRUS (5214)
 POLYRIBOADENYLIC ACID-DEPENDENT,
 EUKARYOTIC CELLS (6286)*
 PURIFICATION FROM NUCLEAR MEMBRANE
 CHROMATIN FRACTION, PROPERTIES,
 ASCITES HEPATOMA CELLS (4924)*
 PURIFICATION FROM SOLUBLE FRACTION
 PROPERTIES, ASCITES HEPATOMA
 CELLS (4923)*
 RNA-DEPENDENT, VIRUSES CELLS
 (3799)
 RNA-DEPENDENT ACTIVITY, MURINE
 LEUKEMIA VIRUS, MURINE SARCOMA
 VIRUS, MOUSE (3132)
 ROUS SARCOMA VIRUS-ASSOCIATED,
 PURIFICATION AND CHARACTERIZA-
 TION (3110)
 TEMPLATE SPECIFICITIES COMPARATIVE
 STUDY, AVIAN MYELOBLASTOSIS
 VIRUS, E.COLI, M. LUTENS (3073)
 TUMOR DEVELOPMENT, BLOOD SERUM,
 ASCITIC FLUID (6351)*
 TUMOR VIRUS, ETHIDIUM BROMIDE
 EFFECT, SYNTHETIC TEMPLATES
 (3766)
 DNA POLYMERASE ACTIVITY, TUMORS,
 A-TYPE PARTICLES (3103)
 DNA POLYMERASE INHIBITION, RAUSCHER
 LEUKEMIA VIRUS, SINGLE-STRANDED
 POLYRIBONUCLEOTIDES (2510)
 DOPAMINE, NEUROBLASTOMA, SERUM, MOUSE
 (2095)*
 DOPAMINE-B-HYDROXYLASE, NEUROBLASTOMA,
 MOUSE (4023)
 DRUG METABOLIZING
 EFFECT OF HEPATOMA ASCITES FLUID,
 LIVER MICROSOME, RAT (3460)*
 INDUCTION, REPRESSION, POLYCYCLIC
 HYDROCARBON, PHENOBARBITAL,
 THEORETICAL MODEL (1578)
 ENDONUCLEASE
 POLYOMA VIRUS (1772)*
 SV40 VIRIONS-ASSOCIATED,
 CHARACTERIZATION (4596)*
 ENDONUCLEASE R1, SV40 DNA, CLEAVAGE,
 PARTIAL DENATURATION MAPPING (5279)*
 ENDONUCLEASE ACTIVITY
 DNA, SV40 (3088)
 SIMIAN VIRUS 40 (2513)
 ENDORIBONUCLEASE ACTIVITY, NOVIKOFF
 HEPATOMA, RAT (2813)
 ESTERASE, INHIBITION, LEUKOCYTE
 CYTOSOL, HUMAN (3433)*
 ESTERASE ACTIVITY, POLYCYCLIC HYDRO-
 CARBONS, TOBACCO CONDENSATES,
 SEBACEOUS GLANDS, MOUSE (2331)
 ESTERASE DEFECT, LEUKEMIA, GRANULOCYTE
 HUMAN (1158)*
 FETAL MOLECULAR FORMS, HEPATOMA, RAT,
 HUMAN, REVIEW (5716)
 FETAL THYMIDINE KINASE, TUMORS, HUMAN
 (4867)
 FETAL-TYPE ISOENZYMES, HEPATIC AND
 NONHEPATIC TUMORS, RAT (4004)
 FIBRINOLYTIC SYSTEM, HEPATIC CIRRHOSIS
 MALIGNANT METASTASES, HUMAN (3452)*
 GLUCOSE METABOLISM, SV40, HUMAN CELL
 (1367)*
 GLUCOSE-6-PHOSPHATASE, LIVER,
 4-DIMETHYLAMINOAZOBENZENE, RAT
 (0669)*
 GLUCOSE-6-PHOSPHATASE DEFICIENCY,
 LIVER TUMOR, ULTRASTRUCTURE, HUMAN
 (0241)
 GLUCOSE-6-PHOSPHATE DEHYDROGENASE
 CERVICAL CARCINOMA (0249)
 WART, HUMAN (0396)
 BETA-GLUCURONIDASE, CHORIOCARCINOMA,
 CULTURED HUMAN CELLS (6309)*
 GLUCURONYL TRANSFERASE, LIVER
 MICROSOME, 3-METHYLCHOLANTHRENE,
 GUINEA PIG, RAT (0963)
 GLUTAMATE DEHYDROGENASE ACTIVITY,

BRAIN TUMORS, HUMAN (5657)*
 GLUTAMIC-OXALACETIC TRANSAMINASE,
 ISOZYME PATTERNS, HEPATOMAS, GROWTH
 RATE, RATS (4001)
 GLUTAMIC-PYRUVIC TRANSAMINASE, ISOZYME
 PATTERNS, HEPATOMAS, GROWTH RATE,
 RAT (4001)
 GLUTAMINE SYNTHETASE ACTIVITY, CLONAL
 DIFFERENCES, HEPATOMA CELLS (5688)*
 L-GLUTAMINE, D-FRUCTOSE 6-PHOSPHATE
 AMIDOTRANSFERASE, YOSHIDA SARCOMA,
 LIVER, RAT (0544)
 GLUTATHIONASE, HEPATOMA, RAT, MOUSE
 (3682)
 GLYCEROLPHOSPHATE DEHYDROGENASE,
 THYROID HORMONE, HEPATOMA, RAT
 (0980)*
 GLYCOGEN PHOSPHORYLASE, HEPATOMA,
 FETAL LIVER, MUSCLE, RAT (5339)
 GLYCOGEN SYNTHETASE, CHLOROMA TUMOR,
 RAT (1446)*
 GLYCOLYTIC
 LIVER, CANCER, HUMAN (0867)*
 LUNG CANCER, INCREASED ACTIVITY,
 HUMAN (4442)
 T ANTIGEN SYNTHESIS, POLYOMA VIRUS
 INFECTION, HAMSTER, MOUSE (5255)
 GLYCOLYTIC ACTIVITY, BLADDER TUMORS,
 HUMAN (2722)
 GLYCOSIDASE, PROTEOLYTIC, ELEVATION,
 TRANSFORMED CELL, RNA TUMOR VIRUS,
 MOUSE (1741)
 GLYCOSYL TRANSFERASE, CELL MEMBRANE,
 VIRAL TRANSFORMATION (4552)
 GLYOXALASE I, PURIFICATION, CHARACTER-
 IZATION, LYMPHOSARCOMA, LIVER, MOUSE
 (4939)*
 GUANYL CYCLASE, ADRENAL, ADRENO-
 CORTICAL CARCINOMA, RAT (0239)
 GUANYLATE-SPECIFIC TRANSFER RNA
 METHYLASE, ASCITES HEPATOMA, RAT
 LIVER (4248)*
 ENZYME - CONTINUED
 HEPATIC CATALASE ACTIVITY, OXIDATION
 INHIBITION, LIVER TUMOR, RAT (3322)*
 HEXOKINASE
 ASCITES TUMOR, TUMORIGENIC CELLS,
 NONTUMORIGENIC CELLS, MOUSE
 (0238)
 EHRLICH ASCITES TUMOR, LIVER,
 MOUSE (6126)
 GLUCOKINASE, ACTIVITIES, HUMAN AND
 ANIMAL TUMORS (3292)
 PLASMA MEMBRANE, MORRIS HEPATOMA,
 MOUSE (1137)*
 SARCOMAS, RAT (3998)
 HEXOKINASE ISOENZYMES
 GROWTH, HEPATOMA CELLS, RAT
 (5556)*
 MALIGNANT TUMOR TISSUES, HUMAN
 (5670)*
 UTERINE CARCINOMA, HUMAN (4095)*
 HEXOSAMINIDASE, CHORIOCARCINOMA,
 CULTURED HUMAN CELLS (6309)*
 HISTOCHEMISTRY, PALATE, PAPILLARY
 HYPERPLASIA, HUMAN (1193)*
 HYDROLASE ACTIVITY, TRNA, HUMAN TUMORS
 RAT TISSUES (3986)
 HYDROLYTIC, HARDING-PASSEY MELANOMA,
 KIDNEY TUMOR, CYTOCHEMISTRY, MOUSE
 HAMSTER (5458)*
 HYDROXYMETHYLGLUTARYL COENZYME,
 FEEDBACK CONTROL, CHOLESTEROL,
 HEPATOMA, RAT (0536)

INDUCER, POLYCYCLIC NAPHTHYRIDINES,
 SYNTHESIS (0387)*
 INDUCTION, URETHAN, SODIUM PENTO-
 BARBITONE, ETHER, LIVER, RAT (1611)*
 INHIBITION, 3-METHYL-4-DIMETHYLAMINO-
 AZOBENZENE, LIVER, RAT (2299)
 INVASIVE TUMOR GROWTH, HISTOCHEMICAL
 STUDIES, RAT, HUMAN (5673)*
 ISOCITRATE DEHYDROGENASE, ISOENZYMES,
 CYTOPLASM, SQUAMOUS CELL CARCINOMA,
 HUMAN (3311)
 ISOENZYMES, MOLECULAR FORMS, CANCER
 (5538)*
 ISOZYME PATTERNS
 BRANCHED-CHAIN AMINO ACID TRANS-
 AMINASE, HEPATOMAS, RAT (5474)*
 ROUS SARCOMA VIRUS, TUMOR, RAT
 (0424)
 KINASE ACTIVITY, PHOSPHORYLATION,
 TUMORS, MOUSE, HUMAN (5603)*
 LACTATE DEHYDROGENASE
 ACTIVITY, LEUKEMIA, ASCITIC
 SARCOMA 180, MOUSE (2827)
 DIAGNOSTIC TESTING, HUMAN (2891)*
 DIFFERENTIAL RELEASE DURING
 REPLICATION, ADENOVIRUS TYPES 5
 AND 12 (3150)*
 ISOZYME PATTERN, HEPATOMAS, GROWTH
 RAT (4001)
 LEUKEMIA, HEPATOMA, HUMAN, RAT
 (4845)
 MALATE DEHYDROGENASE, SV40,
 7,12-DIMETHYLBENZ(A)ANTHRACENE-
 INDUCED, TUMOR, HAMSTER (4582)*
 PROSTATIC CARCINOMA, HUMAN (0503)*
 SERUM, LEUKEMIA, MYELOMA, ANEMIA,
 HUMAN (1191)*
 LACTATE DEHYDROGENASE ISOENZYMES
 BRAIN TUMOR, HUMAN (3443)*,
 (6220)*
 NERVOUS SYSTEM TUMORS, HUMAN
 (3425)*
 LACTATE DEHYDROGENASE ISOZYME,
 ACTIVITY, LUNG CANCER, 4-NITRO-
 QUINOLINE-1-OXIDE, MOUSE (2982)
 LACTIC DEHYDROGENASE ACTIVITY,
 CARCINOMA OF ENDOMETRIUM, SERUM AND
 TISSUES, CLINICAL STUDY (5679)*
 LEYDIG CELL TUMOR, CADMIUM, RAT
 (0952)
 LIVER
 ADENOSINE 5'-PHOSPHATE DEAMINASE,
 HEPATOCARCINOGEN INDUCTION,
 KINETIC, IMMUNOCHEMICAL,
 PHYSICAL PROPERTIES, RAT (2990)
 CYTOPLASM, THIOACETAMIDE, RAT
 (0341)
 DIHYDROURACIL DEHYDROGENASE,
 REGENERATION, MORRIS HEPATOMA,
 RAT (0578)*
 MAMMARY CARCINOMA, MORRIS HEPATOMA
 RAT (0364)
 LIVER CATALASE, IMPAIRED SYNTHESIS,
 RAT (3491)*
 LUNG CANCER CAVERNS, NEOPLASTIC
 AUTOPHAGY, HUMAN (4106)*
 LYSOSOMAL
 AFLATOXIN, MITOMYCIN C, LIVER,
 RAT (5075)
 MAMMARY TUMOR REGRESSION, RAT
 (6290)*
 LYSOSOMAL AND NONLYSOSOMAL, MORRIS
 HEPATOMA, RAT (4092)*
 LYSOZYME, MURAMIDASE, LEUKEMIA, HUMAN

(0255)*
MALATE DEHYDROGENASE
DETECTION, LEUKEMIA, HUMAN (6143)*
ISOZYME PATTERN, HEPATOMAS, GROWTH
RATE, RAT (4001)
MAMMARY CARCINOMA, DNA, FLUPHENAZINE
HYDROCHLORIDE, RAT (0833)
MICROSOMAL, LUNG, LIVER,
BENZO(A)PYRENE, PHENOBARBITAL,
CARBON TETRACHLORIDE, RAT (4403)
MICROSOMAL AZOREDUCTASE, LIVER, BETA-
DIETHYLAMINOETHYL DIPHENYLPROPYL-
ACETATE, 2,4-DICHLORO-6-PHENOXY-
ETHYLAMINE, PHENOBARBITAL,
3-METHYLCHOLANTHRENE, RAT (1627)
MICROSOMAL MIXED-FUNCTION OXIDASE
INDUCTION, POLYCYCLIC AROMATIC
HYDROCARBON, TRANSFORMATION,
MOUSE PROSTATE CELL (5173)
LIVER, BENZO(A)PYRENE, RAT, MOUSE
(1650)*
MONOAMINEOXIDASE, ROUS SARCOMA VIRUS
INFECTION, FIBROBLASTS, CHICKEN
(5930)*
MONOAMINEOXIDASE ACTIVITY, CELL
NUCLEI, SARCOMA DEVELOPMENT, LIVER,
MOUSE (5700)*
MURAMIDASE, MONOCYTIC LEUKEMIA, HUMAN
(4274)*
MYELOPEROXIDASE, CHLOROMA,
7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT
(1567)
ENZYME - CONTINUED
NAD PYROPHOSPHORYLASE ACTIVITY,
CONTROL OF DNA REPLICATION, PHYSARUM
POLYCEPHALUM (3434)*
NEUROAMINIDASE, EFFECT ON GROWTH,
FIBROSARCOMA, 3-METHYLCHOLANTHRENE-
INDUCED, MOUSE (2968)
NICOTINAMIDE ADENINE DINUCLEOTIDE
GLYCOHYDROLASE, EHRLICH ASCITES
TUMOR CELL NUCLEI, MOUSE (5631)*
NUCLEASE, MALIGNANT TUMOR, CENTRAL
NERVOUS SYSTEM, HUMAN (0236)
NUCLEOSIDE DEAMINASE, SPLEEN, FRIEND
LEUKEMIA VIRUS, MOUSE (0447)*
NUCLEOTIDE, ROUS SARCOMA VIRUS (1345)
L-ORNITHINE CARBAMYL TRANSFERASE
ACTIVITY, HEPATOMA, ORNITHINE
METABOLISM, LIVER, RAT (4989)*
ORNITHINE DECARBOXYLASE, INDUCTION
CULTURED HEPATOMA CELLS, RAT
(6293)*
PHYTOHEMAGGLUTININ, CULTURED
LYMPHOCYTES, HUMAN (6294)*
OXIDO-REDUCTASE, EPITHELIAL TUMOR,
URINARY BLADDER (1465)*
PATHOLOGY, HISTOPATHOLOGY, CEREBELLUM,
CHEMICAL CARCINOGENESIS (1416)
PEPTIDYLPROLINE HYDROXYLASE, COLLAGEN
SYNTHESIS, MAMMARY CANCERS, MOUSE
(6331)*
PHENYLALANINE AMMONIA-LYASE, DNA
SYNTHESIS INHIBITION, LEUKOCYTES,
LEUKEMIA PATIENTS (4861)
PHOSPHATASE ACTIVITY, MALIGNANT
MELANOMA, HUMAN (3528)*
PHOSPHODIESTERASE
HEPATOMAS, RAT (6114)
SOMATIC HYBRIDS, GLIAL CELLS, RAT
(5441)
PHOSPHOENOLPYRUVATE CARBOXYKINASE,
DIBUTYRYL CYCLIC AMP, HEPATOMA
(4011)
PHOSPHOFRUCTOKINASE
KINETICS, EHRLICH ASCITES TUMOR
(5434)
MULTIPLE FORMS, TUMOR TISSUES,
RAT (5510)*
PHOSPHORYLASE, METABOLISM, SQUAMOUS
CELL CARCINOMA, LUNG, HISTOCHEMICAL
STUDY (6121)
POLYADENYLIC ACID HYDROLASE, CARCINO-
GENESIS, DIMETHYLAMINOAZOBENZENE,
LIVER, RAT (3654)
POLYMERASE
ROUS SARCOMA VIRUS-ASSOCIATED,
PURIFICATION, CHARACTERIZATION
(3110)
TEMPLATE PREFERENCE, ONCOGENIC RNA
VIRUS, CAFT THYMUS (2503)
H-POLYMERASE, LEUKEMIA, VIRAL ORIGIN,
HUMAN, REVIEW (2205)
POLYNUCLEOTIDASE, ASCITIC TUMOR CELLS,
MOUSE (6370)*
POLYNUCLEOTIDE LIGASE, POLYOMA VIRUS,
MOUSE CELL (3818)
PROTEASE
ASCITES HEPATOMA INVASION, LUNG
METASTASIS, RAT (1142)*
INHIBITORS, GROWTH, CULTURE CELLS,
HAMSTER (5455)
LYSOSOMES, POLYMORPHONUCLEAR
LEUKOCYTES, HUMAN (3478)*
PROTEASE RESISTANCE, TUMOR CELL A-LIKE
ANTIGEN, HELIX POMATIA (1863)*
PROTEIN KINASE, PHOSPHATE ACCEPTOR
PROTEIN, RAUSCHER MURINE LEUKEMIA
VIRUS (1016)
PROTEIN METHYLASE, HEPATOMAS, RAT
(3988)
PROTEIN SYNTHESIS, PEPTIDE ELONGATION,
EHRLICH TUMOR, NOVIKOFF TUMOR, RAT
(0277)*
PROTEOLYTIC
CATABOLISM, LEUKEMIA, MOUSE (1989)
INHIBITORS, HUMAN (5450)
PROTEOLYTIC ENZYME INHIBITOR,
LYMPHOCYTE TRANSFORMATION, GUINEA
PIG (6125)
PROTOCOLLAGEN PROLINE HYDROXYLASE,
HEPATOCELLULAR CARCINOMA, UGANDANS
(4882)*
PYRROLIDONECARBOXYLIC ACID DECYCLASE,
PROTEIN BIOSYNTHESIS, PLASMACYTOMA,
HUMAN (0890)*
PYRUVATE KINASE, EHRLICH ASCITES TUMOR
LIVER, MOUSE (6126)
PYRUVATE KINASE ACTIVITY, EHRLICH
ASCITES TUMOR CELLS, LIVER, MOUSE
(5539)*
ENZYME - CONTINUED
REDOX, MONKEY ADENOVIRUS, HISTOCHEMIS-
TRY, HAMSTER (5897)
REGAN ISOENZYME, CARCINOPLACENTAL
ANTIGEN, HUMAN (0486)*
REGULATION
ISOZYME, CANCER (0624)*
NEUROBLASTOMA CELLS, MOUSE (5627)*
RESTRICTION ENDONUCLEASE, DNA CLEAVAGE
SV40, HEMOPHILUS INFLUENZAE (1752)
REVERSE TRANSCRIPTASE
AVIAN MYELOBLASTOSIS VIRUS (5921)
DNA POLYMERASE, RAUSCHER MURINE
LEUKEMIA VIRUS, RIFAMYCIN (3790)
IMMUNOLOGICAL MARKER, PRIMATE
VIRUS (5970)
INHIBITOR, RIFAMYCIN, MURINE

- SARCOMA VIRUS (3782)
 MURINE LEUKEMIA VIRUS, RAUSCHER
 LEUKEMIA VIRUS, RIFAMYCIN (3742)
 MURINE MAMMARY TUMOR VIRUS, GEL
 ELECTROPHORESIS, MOUSE (5953)*
 ONCOGENE HYPOTHESIS, REVIEW
 (3622)*
- REVERSE TRANSCRIPTASE INDUCTION,
 ROUS SARCOMA VIRUS, ARGININE
 DEPRIVATION (5262)
- RIBONUCLEASE
 FOCAL LOSS OF ACTIVITY, PRENEO-
 PLASTIC LIVER, RAT (4780)
 ISOLATION, CHARACTERIZATION,
 LEUKEMIA PATIENTS (6161)*
- RIBONUCLEASE H
 DNA-RNA HYBRID DEGRADATION (5892)
 RNA TUMOR VIRUSES (5922)
- RIBONUCLEASE INACTIVATION, GAMMA
 RADIATION (2465)*
- RIBONUCLEASE-SENSITIVE DNA POLYMERASE
 ACTIVITY, DNA-DIRECTED POLYMERASE,
 TISSUE CULTURE CELL LINES, HUMAN
 (4571)
- RIBONUCLEOTIDE REDUCTASE
 FRIEND LEUKEMIA VIRUS, SPLEEN,
 MOUSE (0849)
 HERPESVIRUS INFECTION, DNA
 SYNTHESIS, KB CELLS (3059)
- RNA DEGRADING, ACTIVITY CHANGES,
 ACTINOMYCIN D, EHRICH ASCITES CELLS
 MOUSE (2980)
- RNA-DEPENDENT DNA POLYMERASE
 AVIAN MYELOBLASTOSIS VIRUS,
 STIMULATING FACTOR (4551)
 HEPATOMA, LIVER, RAT (4017)
 ROUS SARCOMA VIRUS, MITOCHONDRIA,
 TUMOR, CHICKEN (3810)
 TEMPLATE REQUIREMENTS (3047)
- RNA DEPENDENT POLYMERASE, TISSUE
 CULTURE (1958)
- RNA-DIRECTED DNA POLYMERASE, MAMMARY
 CARCINOMA, MOUSE (3803)
- RNA METHYLASE
 AVIAN MYELOBLASTOSIS VIRUS (1709)
 HEPATOMA, N-NITROSODIETHYLAMINE,
 MONKEY (0631)
- RNA POLYMERASE
 ALPHA-AMANITIN-SENSITIVE FORMS,
 EHRICH ASCITES TUMOR CELLS
 (6289)*
 CHROMATIN TEMPLATE ACTIVITY,
 FIBROBLASTS, HUMAN (5535)*
 MELANOMA, HAMSTER (6390)*
 OVARY, PRENEOPLASTIC STATE,
 ESTRADIOL, MOUSE (0190)
 RIFAMPICIN-INSENSITIVE PURIFICA-
 TION, EHRICH ASCITES TUMOR
 CELLS (6349)*
 SELECTIVE INHIBITION, AFLATOXIN B1
 LIVER, RAT (5150)
 TRANSCRIPTION, NUCLEOLUS, LIVER,
 RAT (4925)*
 TRANSPLANTABLE BRAIN TUMOR,
 MOUSE (6345)*
- RNA POLYMERASE ACTIVITY, MAMMARY GLAND
 TUMOR, RAT (5829)*
- RNA POLYMERASE B, TEMPLATE SPECIFICITY
 MYELOMA, MOUSE (6120)
- RNA POLYMERASE REGULATION, AMINO ACIDS
 EHRICH ASCITES TUMOR CELLS, MOUSE
 (6109)
- SERINE BIOSYNTHESIS, LEUKEMIA,
 LEUKOCYTE, HUMAN (3316)
- SERUM ALKALINE PHOSPHATASE ISOENZYMES,
 CANCER METASTASIS STUDIES (3556)*
 SERUM MURAMIDASE, MYELOPROLIFERATIVE
 DISEASE, LEUKEMIA, CASE REPORTS
 (3233)
- SIALIC ACID SYNTHESIS, LIVER, TUMOR,
 RAT (1452)*
- SIALYL TRANSFERASE ACTIVITY, RNA- AND
 DNA-VIRUS, TRANSFORMED CELLS (5878)
- SURFACE 3'-EXONUCLEASE, NOVIKOFF
 HEPATOMA ASCITES CELL (4084)*
 TERATOCARCINOMA, EMBRYO-DERIVED,
 HISTOCHEMISTRY, MOUSE (3462)*
 TETRAHYDROFOLATE DEHYDROGENASE,
 PURIFICATION, LEUKEMIA, CHROMATO-
 GRAPHY, MOUSE (3325)*
- THYMIDINE KINASE
 ENDUCING ABILITY, HERPESVIRUS
 TYPES 1 AND 2, RABBIT (2534)
 HERPES SIMPLEX VIRUS, INFECTED
 CELL, HAMSTER (0713)
 HORMONE, ADRENAL CARCINOMA, RAT
 (1437)
- TISSUE PROTEOLYSIS, CANCER, REVIEW
 (3623)*
- TRANSYDROGENASE, CELL ACTIVITY,
 HEPATOMA, RAT (3997)
- TRANSPLANTED NERVE TUMOR, RAT (4141)*
- TRNA N2-GUANINE DIMETHYLASE, TUMORS,
 LIVER, KIDNEY, RAT (4862)
- TRNA-GUANINE METHYLTRANSFERASE,
 PARTIAL PURIFICATION, EHRICH
 ASCITES TUMOR CELLS, MOUSE (6312)*
- TRNA METHYLASE
 NOVIKOFF ASCITES HEPATOMA CELLS,
 CELLS, RAT (4005)
- TRNA METHYLASE ACTIVITY
 ADENOVIRUS-18-INDUCED TUMOR,
 CELL-FREE EXTRACTS, HAMSTER
 (5288)*
 EFFECT OF N-NITROSOMETHYLUREA,
 CELLS, HAMSTER (3009)
 LEUKEMIC CELLS, MOUSE (3155)*
- TROPHOBLAST, CHORIOCARCINOMA, HUMAN
 (0259)*
- TUMOR GIANT CELL, HARVEY MURINE
 SARCOMA VIRUS, HAMSTER (0418)
- ENZYME - CONTINUED
- TYROSINASE
 ANTISERUM, MELANOMA, MOUSE (4714)*
 MALIGNANT MELANOMA, IMMUNOLOGY,
 HUMAN (0779)*
 MELANOMA CELL (4871)
- TYROSINE, 2-OXOGLUTARATE AMINO-
 TRANSFERASE, LIVER, EHRICH ASCITES
 TUMOR, MOUSE (0874)*
- TYROSINE AMINOTRANSFERASE
 AMINO ACID TRANSPORT, MORRIS
 HEPATOMA, RAT (4271)*
 HEPATOMA, HYBRID, MOUSE (0242)
 HORMONAL INDUCTION, HEPATOMA CELLS
 (6186)*
 INDUCTION VARIATION, HTC CELL
 CLONES (4896)*
- TYROSINE HYDROXYLASE, ACTIVITY
 REGULATION, NEUROBLASTOMA CELLS,
 MOUSE (4998)*
- TYROSINE-ALPHA-KETOGLUTARATE TRANS-
 AMINASE, REGULATION, LIVER, HEPATOMA
 CELLS, RAT (3295)
- UDP-GAL, LACTOSYLCERAMIDE ALPHA-
 GALACTOSYLTRANSFERASE, CONTACT
 INHIBITION, POLYOMA VIRUS,
 TRANSFORMATION, HAMSTER (0437)

UREASE EFFECT, EHRLICH ASCITES TUMOR, MOUSE (2420)*
 URIDINE DIPHOSPHATE GLUCURONYLTRANSFERASE, 3-METHYLCHOLANTHRENE, LIVER, RAT, GUINEA PIG (0671)*
 VIRAL REVERSE TRANSCRIPTASE, RNA MOIETY DEGRADATION OF RNA-DNA HYBRID (2519)
 VIRUS-ASSOCIATED, DNA VIRUS, RNA DEGRADATION (2490)
 ZOXAZOLAMINE HYDROXYLASE INDUCTION, PHOTODYNAMIC ACTIVITY, POLYCYCLIC COMPOUNDS (0635)
 ENZYME ACTIVITY
 LEUKEMIA, ACUTE (2037)*
 PENDYMOMA
 SUBCUTANEOUS SACROCOCCYGEAL, METASTASIS, ULTRASTRUCTURE, CASE REPORT (5628)*
 SURVIVAL, HISTOLOGY, GERMANY (6180)*
 EPIDEMIOLOGY
 ADENOCARCINOMA, NASAL CAVITY, SINUSES, ENGLAND, WALES (2751)
 BREAST CANCER
 ETHNIC, SOCIOECONOMIC, ISRAEL (2758)
 INCIDENCE, SLOVENIA (0808)
 INDIA (6086)
 MALE, GERMANY (6103)*
 SURVIVAL, INCIDENCE RISK FACTORS, UNITED STATES, ENGLAND (2783)*
 UNITED STATES (2799)*
 BREAST CANCER RISK, SALIVARY GLAND CARCINOMA, U.S. (2774)*
 BREAST AND GENITAL CANCER, MORTALITY, NEW ZEALAND (2749)
 BRONCHIAL CARCINOMA, NECROPSY MATERIAL INCIDENCE, POLAND (2803)*
 BURKITT'S LYMPHOMA, HODGKIN'S DISEASE, MULTIPLE MYELOMA, AFRICA, REVIEW (0005)
 CANCER
 AFRICA (0323)*
 ESOPHAGEAL, GASTRIC, COLONIC, BRONCHIAL, BREAST, REVIEW (2209)
 FEMALE GENITAL ORGANS, INCIDENCE, ALGERIA (2801)*
 GASTROINTESTINAL TRACT, DAKAR (0521)*
 INCIDENCE, INTERNATIONAL, REVIEW (3636)*
 MORTALITY, NEW ZEALAND (2789)*
 PATTERNS, INCIDENCE, AFRICA (2755)
 PROSTATE, HUMAN (0512)
 STUDY METHOD, YUGOSLAVIA (2802)*
 TOBACCO, UNITED STATES (2791)*
 CANCER PREVENTION, FRANCE (2792)*
 CANCER RISK, SMOKING, CHEWING TOBACCO (0534)*
 CANCER TRENDS, 1935-1965, CONNECTICUT (4809)
 CARCINOGENESIS, MULTI-STAGE MODEL (0513)
 CARCINOMA
 FEMALE ORGANS, SPAIN (2806)*
 HIGH-RISK GROUP, REVIEW (1235)*
 DATA COLLECTION, MAMMARY CARCINOMA, GERMANY (2784)*
 EPIDERMAL CARCINOMA, VULVA, TEXAS (2770)
 ETIOLOGICAL FACTORS, NEOPLASIA, AFRICA (0203)
 EXTRAGENITAL CARCINOMA, FERTILITY, HUMAN, SPAIN (2807)*
 GOITER, MALIGNANT TRANSFORMATION, RUMANIA (2780)*
 HEPATITIS, CIRRHOSIS, PRIMARY LIVER CANCER, DAKAR (4018)
 HIGH-RISK GROUP
 COLON, RECTUM, NEOPLASIA, REVIEW (1233)*
 DIGESTIVE TRACT CARCINOMA, REVIEW (1238)*
 INCIDENCE, U.S.S.R. (6073)
 KAPOSI'S SARCOMA, BANTU OF MOZAMBIQUE (3982)*
 LEUKEMIA
 AFRICA (0520)*
 CHILDREN, BULGARIA (6095)*
 FREQUENCY, DISTRIBUTION, FRANCE (2805)*
 LYMPHOMA, COLOMBIA (0461)
 LUNG CANCER
 CASE REGISTRATION, SWEDEN (0210)
 MALE, CZECHOSLOVAKIA (6101)*
 LUNG CARCINOMA, HIGH-RISK GROUP, REVIEW (1236)*
 MALIGNANT MELANOMA
 AUSTRALIA (6105)*
 ENGLAND (6106)*
 MAMMARY CANCER, ITALY (0205)
 MAMMARY CARCINOMA, HIGH-RISK GROUP, REVIEW (1234)*
 MULTIPLE PRIMARY MALIGNANT NEOPLASIA, ITALY (3978)*
 NEOPLASIA
 LARYNX, UKRAINE (0531)*
 MAMMARY GLAND, SENEGAL (0204)
 REVIEW (1530)*
 SKIN, MEXICO (0207)
 NEOPLASMA, POLAND (2794)*
 NEPHRITIS, URINARY TRACT CANCER, INCIDENCE, EUROPE (2777)*
 ORAL CANCER, TOBACCO, U.S. (2790)*
 OVARIAN CARCINOMA, BULGARIA (5423)
 OVARIAN TUMOR, CALIFORNIA (2785)*
 PENILE CARCINOMA, GERMANY (6100)*
 PLEURAL MESOTHELIOMA, INCIDENCE, GERMANY (2800)*
 PRIMARY CARCINOMA, LIVER, AFRICA, AUSTRALIA ANTIGEN, REVIEW (0006)
 PROSTATE, CARCINOMA, SEXUAL FACTORS (0514)
 SARCOMA, RETICULUM CELL, INCIDENCE, SENEGAL (2796)*
 SMALL INTESTINE, MALIGNANT TUMORS, INCIDENCE, FINLAND (2798)*
 TOXIC ADENOMA, GREECE (0530)*
 TUMOR
 CHILDHOOD, HUNGARY (0522)
 INCIDENCE, GOLD MINERS, AFRICA (2756)
 MALIGNANT, INFANCY, CHILDHOOD, INCIDENCE, INDONESIA (2757)
 TESTIS, GERMANY (0519)*
 TRENDS, AFRICA (2759)
 TUMOR MORTALITY, YUGOSLAVIA (2795)*
 URINARY TRACT CANCER, OCCUPATION HAZARD, INCIDENCE, U.S. (2763)
 UTERINE CANCER
 JAPAN (6085)
 MORTALITY RATE, INTERNATIONAL (2750)
 UTERINE CARCINOMA, STERILITY, MULTI-GRAVIDITY, HUMAN, SPAIN (2808)*
 UTERINE CERVIX CANCER, CUBA (3979)*
 UTERINE CERVIX CARCINOMA
 GERMANY (6093)*
 HUNGARY (6091)*

- JAPAN (6102)*
POLAND (6097)*
- EPIDERMAL
CARCINOMA, MITOTIC INHIBITION, MICE (2073)*
GROWTH FACTOR
FREE NUCLEOTIDES, AMINO ACID TURNOVER, TUMOR CELLS, MOUSE (5669)*
PRECURSOR UPTAKE, HELA CELL, KB CELL (5444)
- EPIDERMIS
BASAL CELL, MITOTIC INHIBITION, MOUSE (1133)
CARCINOGENESIS, REVIEW (2226)*
CARCINOMA
ANTIGENS, 3-METHYLCHOLANTHRENE, MOUSE (5361)
LIGHT INDUCED, HUMAN, REVIEW (2271)*
2,4-DINITROPHENYL, DISTRIBUTION, GUINEA PIG (2398)*
EPIDERMOLYTIC ACANTHOMA, HUMAN (3370)*
N-HEXADECANOL, ULTRASTRUCTURAL ABNORMALITIES, GUINEA PIG (0034)
SCALP, PRECANCEROUS, HUMAN (2737)*
TUMOR INDUCTION, CARCINOGENS, MOUSE (2424)*
EPIDERMODYSPLASIA VERRUCIFORMIS
PAPOVAVIRUSES, ONCOGENESIS (3793)
VIRUS PARTICLE, ULTRASTRUCTURE, IMMUNOLOGY, HUMAN (1764)*
- EPIDERMOID
CYSTIC TERATOMA, CASE REPORTS (5659)*
- EPIDIDYMISS
PRIMARY TUMORS, HUMAN (4952)*
- EPITHELIOMA
BASAL CELL, COLLAGENOLYTIC ENZYMES SKIN, HUMAN (5600)*
ULTRASTRUCTURE, SKIN, HUMAN (5604)*
BREAST, REGRESSION, DOG (4116)*
CALCIFYING, MALHERBE, CHILD, CASE REPORT (5625)*
KERATINIZATION, RESPIRATORY METABOLISM DMBA, MICE, REVIEW (2247)*
KERATOACANTHOMA, CASE REPORT (1906)*
KROMPECHER, INVOLUTIONAL ELASTOSIS, MORPHOLOGY, HUMAN (4278)*
LARYNX, MAST CELLS, HUMAN (5647)*
MALIGNANT MEDULLO CILIARY EPITHELIAL CARCINOMA, CASE REPORT (5555)*
MIDDLE EAR, PATHOGENESIS, CHILD, CASE REPORT (5408)*
NEUROHISTOLOGY, EVOLUTIONARY ASPECTS (1897)*
OROPHARYNX, LARYNX, SARCOMATOUS STROMA HUMAN (4138)*
PAROTID GLAND, PATHOLOGICAL ANATOMY, CASE REPORT (4208)*
SEBACEOUS, HISTOLOGY, CASE REPORT (6210)*
SERUM ALPHAI-GLOBULIN, MAN (0576)*
SKIN, CLIMATIC FACTORS (0331)*
SMALLPOX VACCINATION SITE, CASE REPORT (4715)*
ULTRASTRUCTURE, EVOLUTIONARY ASPECTS (1898)*
- EPITHELIUM
ALTERATIONS, EXTRALOBULAR DUCTS, BREAST, HUMAN (2721)
BASAL CELLS, UREMIA EFFECT, MOUSE (3459)*
BASAL LAYER, ABNORMAL CLONE SPREAD,
- STOCHASTIC MODEL (3957)*
CELL DIFFERENTIATION, VITAMIN A, MODE OF ACTION (4487)*
CYTIDINE-3H INCORPORATION, ELECTROPHORESIS, MOUSE (2342)
DIFFERENTIATION, RETINOL, RAT, HAMSTER (5846)*
EMBRYONAL LUNG TISSUE, PRETUMOR CHANGES, NITROSOMETHYLUREA, MOUSE (4438)
EPITHELIAL ATYPIA, BETEL GUID INDUCEMENT, BUCCAL MUCOSA, BABBOONS (4477)*
GROWTH, MAMMARY GLAND, HUMAN (4940)*
MALIGNANT TUMORS, BLOOD BORNE METASTASES, HISTOGENESIS, HUMAN (3560)*
MEMBRANE-ACTIVITY AGENTS, MITOTIC FREQUENCY, DMBA TREATMENT, MOUSE (5828)*
MITOTIC VALUES, ORAL KERATOSIS, LICHEN PLANUS, HUMAN (2734)*
ODONTOGENIC CYSTS, MALIGNANT CHANGE, HUMAN (2728)*
ORAL, MITOTIC ACTIVITY, NEOPLASTIC CELLS, RAT, MOUSE (2853)
ORAL TUMOR, HUMAN, ULTRASTRUCTURE (4785)
TRACHEAL, BIOCHEMICAL AND MORPHOLOGIC EXAMINATIONS, HAMSTER (4394)
TRACHEOBRONCHIAL, BENZO(A)PYRENE, ULTRASTRUCTURAL CHANGES, HAMSTER (4437)
- EPOXIDES
LIVER, MICROSOMAL METABOLITES, POLYCYCLIC HYDROCARBONS, RAT (1533)
PLASMA (2000)
POLYCYCLIC HYDROCARBON, TRANSFORMATION HAMSTER CELL (4445)
K-REGION, DIBENZ(A,H)ANTHRACENE, BENZ(A)ANTHRACENE, MACROMOLECULAR BINDING, TRANSFORMED CELL (5774)
SERUM INHIBITOR LOSS, THYMOMA, ERYTHROCYTE APLASIA, CASE REPORT (1849)*
- EPOXYSUCCINIC ACID
DIETHYL ESTERS, CHROMATOGRAPHY (2437)*
- EPSILON-N-TRIMETHYLLYSINE
TUMOR PROMOTION, ASCITES, MOUSE (0670)*
- ERGOCORNINE
MAMMARY TUMOR, REGRESSION, 7,12-DIMETHYLBENZANTHRACENE, RAT (2929)
MAMMARY TUMOR GROWTH INHIBITION, RAT (4455)*
- ERGOT DRUGS
REGRESSION, MAMMARY TUMORS, RAT (1951)
- ERYTHROBLAST
EARLY PROLIFERATING CELLS, HEMOPOIETIC COLONIES (3515)*
MRNA, PROTEINS, AVIAN (1991)
- ERYTHROBLASTOSIS
MALIGNANT, CYTOCHEMISTRY, HUMAN, REVIEW (4344)*
PROLIFERATION, ERYTHROLEUKEMIA (1910)*
- ERTHYROCYTE
ANEMIA, RETICULOENDOTHELIAL SYSTEM (1997)
APLASIA, THYMOMA, ERYTHROPOIESIS, SERUM INHIBITOR LOSS, CASE REPORT (1849)*
CHICK, HUMAN NUCLEAR ANTIGEN (1808)
DNA REPAIR SYNTHESIS, HETEROKARYONS,

CHICKEN (3731)
 FETAL, JUVENILE CHRONIC MYELOGENOUS
 LEUKEMIA, CASE REPORT (6128)
 FRIEND VIRUS, POLYCYTHEMIA, MOUSE
 (4533)
 GLUCOSE-6-PHOSPHATASE, LIVER,
 BRAIN, RATS (2142)*
 GLYCOLYSIS, MORRIS HEPATOMA TRANSPLANT
 RAT (4126)*
 LABELED, INSECT TRANSFER, CIRCULATING
 TUMOR CELLS (4865)
 MEMBRANE-SPECIFIC ANTIGEN, FRIEND
 VIRUS, TUMOR CELL (1831)
 PHOSPHORUS COMPOUNDS, TRANSPLANTED
 MORRIS HEPATOMA, RAT (4128)*
 PLASMA MEMBRANE, FELINE C-TYPE VIRUS
 REPLICATION (4608)*
 PYRUVATE KINASE ACTIVITY, ACUTE
 LEUKEMIA, CHILDREN (6256)*
 RYTHROLEUKEMIA
 COLD AGGLUTININ SYNDROME, THERAPY,
 HUMAN (2067)*
 ERYTHROBLASTOSIS, PROLIFERATION
 (1910)*
 RYTHROPOIETIN
 BONE MARROW, LEUKEMIA, POLYCYTHEMIA
 VERA, HUMAN (4039)
 ESOPHAGUS
 CANCER
 ALCOHOLIC DRINK, EAST AFRICA
 (4454)*, (4825)*
 EPIDEMIOLOGY, INTERNATIONAL
 (4833)*
 INCIDENCE
 NEAR EAST (2753)
 NORWAY (2787)*
 MAIZE RELATIONSHIP, INCIDENCE,
 AFRICA (3277)
 CARCINOMA
 CASE REPORTS (3398)*
 N,N'-DIMETHYLETHYLENEDINITROSAMINE
 RAT (2944)
 ESOPHAGITIS, BARRETT'S EPITHELIUM,
 TRANSMURAL POTENTIAL, HUMAN
 (3437)*
 INCIDENCE
 IRAN (1935)*
 NEBRASKA (0208)
 RHODESIA (6079)
 SOUTH CAROLINA (1420)*
 NITROSAMINE, DISTILLED SPIRITS,
 EAST AFRICA (1583)
 CERVICAL, CANCER, TREATMENT, CASE
 REPORTS (5494)*
 CHEMICAL BURN SCAR, TRANSFORMATION,
 CASE REPORT (1609)*
 EPITHELIUM, ADENOCARCINOMA, CASE
 REPORT (0887)*
 LEIOMYOMA, PATHOLOGY, CASE REPORT
 (6249)*
 MEGAESOPHAGEAL CANCER, POST-SURGICAL,
 CASE REPORTS (3514)*
 PRECANCEROUS, HUMAN (2739)*
 SCAR TISSUE, CARCINOMA, HUMAN (0507)*
 THORACIC CANCER, X-IRRADIATION, CASE
 REPORT, HUMAN (2469)*
 THYROID DISEASE, CARCINOMA, INCIDENCE
 (0248)
 TUMORS
 N-METHYLBENZYLAMINE, SODIUM
 NITRITE, RAT (1608)*
 N-NITROSOPIPERIDINE,
 HISTOPATHOLOGY, ULTRASTRUCTURE,
 RAT (4385)
 ESTERASE
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 ISOZYME PATTERN, SKIN, MOUSE (0960)
 ESTERS
 PHORBOL TREATMENT, ELECTROPHORESIS,
 CYTIDINE-3H INCORPORATION, MOUSE
 (2342)
 ESTRADIOL
 BINDING, THIOLS, MALIGNANT BREAST
 TUMORS, HUMAN (6339)*
 ESTROGEN RECEPTORS, TUMORS (1959)
 METHYLCHOLANTHRENE, PROGESTERONE,
 CERVICAL CARCINOGENESIS, MONKEY
 (0095)*
 3H-ESTRADIOL
 ACCUMULATION, TESTES, PITUITARY GLAND,
 MOUSE (4373)
 ESTRADIOL RECEPTORS
 GENITAL TRACT, HUMAN CANCER TISSUE,
 FEMALES (5638)*
 MAMMARY, CARCINOMA (2007)
 ESTROGEN
 BASAL CELL CARCINOMA, TRANSPLANTATION,
 VAGINA, MOUSE (3298)
 BINDING, 3-METHYLCHOLANTHRENE, UTERUS
 (5771)
 CARCINOGENESIS
 MAMMARY ADENOCARCINOMA, MONKEY
 (3669)
 MAMMARY TUMOR, PROLACTIN,
 PITUITARY, MOUSE (2950)
 CARCINOGENIC, CERVICAL, MOUSE (2346)
 CERVIX, 3-METHYLCHOLANTHRENE, MOUSE
 (4370)
 5 ALPHA-DIHYDROTESTOSTERONE, METABOL-
 ISM, PROSTATE CARCINOMA, HUMAN
 (4854)
 EFFECT ON DNA SYNTHESIS, INDUCED
 MAMMARY TUMOR, RAT (2306)
 GROWTH INHIBITION, MAMMARY ADENO-
 CARCINOMA, PROLACTIN, RAT (0830)
 INDUCED PITUITARY TUMORS, CELL CHANGES
 RAT (2416)*
 INHIBITORY EFFECT, MAMMARY TUMORS,
 PITUITARY ISOGRAFT,
 7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT
 (2305)
 LIVER CANCER, DIMETHYLAMINOAZOBENZENE,
 RAT (2956)
 LONG-TERM ADMINISTRATION, MAMMARY
 CANCER, WOMEN (4449)*
 MAMMARY CARCINOGENESIS, BACTERIA,
 DIET, EPIDEMIOLOGY, HUMAN, REVIEW
 (0611)
 MAMMARY TISSUE, BENIGN CONDITION,
 HUMAN (4429)
 MAMMARY TUMOR, MOUSE (0340)
 3-METHYLCHOLANTHRENE, UTERUS,
 MAMMARY GLAND, CASTRATION, MOUSE
 (4435)
 ORAL CONTRACEPTIVE, MAMMARY
 CARCINOGENESIS, HUMAN (0604)
 RECEPTOR, LACTATING MAMMARY GLAND,
 MAMMARY ADENOCARCINOMA, RAT (6116)
 REPLACEMENT THERAPY, BREAST CARCINOMA,
 WOMEN (4450)*
 SYNTHETIC, CARCINOMA, VAGINA, HUMAN
 (0083)*
 UROGENITAL TRACT, CARCINOGENIC ACTION,
 HUMAN (2345)
 VAGINAL CANCER, VAGINAL DEVELOPMENT,
 WOMEN (4464)*
 ESTROGEN RECEPTORS
 ESTRADIOL, TUMORS (1959)

ETHANOL
LASIOCARPINE, DIMETHYLNITROSAMINE,
POLYSOMAL DISAGGREGATION, LIVER,
MOUSE (1287)*

ETHER
LIVER, ENZYME INDUCTION, RAT (1611)*

ETHIDIUM BROMIDE
DNA SYNTHESIS, SV40, MONKEY (4566)
MITOCHONDRIAL FUNCTION INHIBITOR,
ROUS SARCOMA VIRUS REPLICATION,
MALIGNANT TRANSFORMATION, CHICK
EMBRYO CULTURE (3771)

ETHIONINE
DIMETHYLNITROSAMINE, DNA METHYLATION,
LIVER, RAT (0355)
DNA ETHYLATION, LIVER, RAT (0342)
HEPATOCARCINOGENESIS, HISTOPATH-
OLOGICAL STUDY, RAT (4361)
LIVER CARCINOGENESIS, ULTRASTRUCTURE,
RAT (3717)*
LIVER CARCINOMA, ULTRASTRUCTURE, RAT
(3695)
MALIGNANT HEPATIC NODULES, CYCLIC AMP
LEVELS, LIVER, RAT (5806)
METHIONINE, LIVER CELL, NUCLEOLI,
GUINEA PIG, TOXICITY (0363)
PROTEIN SYNTHESIS, NORMAL CELLS,
TUMOR CELLS, RAT (5583)*
TRNA METHYLASE, YEAST CELLS (5126)

DL-ETHIONINE
LIVER CARCINOGENESIS, LITHOCHOLIC
ACID, RAT (1554)

ETHNIC GROUP
CHINESE, MALAY, INDIAN, HL-A ANTIGEN
DISTRIBUTION, SINGAPORE (3890)

2-ETHYL-P-BENZOQUINONE
CARCINOGENICITY, RAT (0377)*

(3H)ETHYL CARBAMATE
INTERACTION WITH NUCLEIC ACIDS, LIVER
REGENERATION, MOUSE (2436)*

ETHYLENE OXIDE
MAMMARY TUMOR VIRUS, GROWTH,
CARCINOGENICITY, MOUSE (1728)

ETHYLENEIMINOPYRIMIDINE
MUTAGENIC EFFECT, ASPERGILLUS NIDULANS
(1653)*

ETHYLNITROSOBIURET
CARCINOGENESIS, TRANSPLACENTAL AND
NEONATAL, RAT (0345)

ETHYLNITROSOUREA
ALKYLATION, NUCLEIC ACIDS, LIVER,
EMBRYO, RAT (5854)*
CYTOTOXICITY, NERVE CELLS, RAT (5078)
DEAE-DEXTRAN, SARCOMA INDUCTION, MOUSE
(3001)
HEART TUMOR, MORPHOLOGY, RAT (1594)
INDUCED NEURINOMA, HISTOCHEMISTRY,
TISSUE CULTURE, RAT (4459)*
MALIGNANT NEURINOMA, CLONAL LINE,
SCHWANN CELL, RAT (5167)
NERVOUS SYSTEM TUMORS
RAT (1588)
TRANSPLACENTAL INDUCTION, RAT
(5830)*
NEURINOMA, TISSUE CULTURE, RAT (3700)
NEUROGENIC TUMORS, MALIGNANT
NEURINOMAS, TRANSPLACENTAL INDUCTION
MORPHOLOGY, HAMSTER (5110)
THYMIC LYMPHOMA, MYELOID LEUKEMIA, RAT
(2996)
TRANSPLACENTAL TUMOR INDUCTION,
QUANTITATIVE ASPECTS, RAT (5789)

N-ETHYL-N-NITROSOUREA
BRAIN, ULTRASTRUCTURE, RAT (1638)*

ETHYLATION, NUCLEIC ACID, FETUS, ADULT
RAT (5172)

ETHYLUREA
LUNG ADENOMA INDUCTION, NITROSAMIDE
FORMATION, MOUSE (2966)

ETHYLURETHAN
HYPERGLYCEMIA, RAT (1275)*

ETIOLOGY
BLADDER CANCER, HUMAN (6168)*
BURKITT'S LYMPHOMA, REVIEW (5736)*
CANCER
SPREAD (0328)*
UTERINE CERVIX, REVIEW (3629)*
EPIDEMIOLOGY, NEOPLASIA, ENVIRONMENTAL
FACTOR, AFRICA (0203)
HODGKIN'S DISEASE, REVIEW (3625)*
LEUKEMIA, EPIDEMIOLOGY, PATHOLOGY,
REVIEW (5746)*
LIVER CANCER, REVIEW (3631)*
MELANOMA, COMMUNICABLE (1519)*
NEOPLASIA, MYCOTOXINS, ANIMALS, MAN
(4446)
OSTEOSARCOMA, IMMUNOLOGICAL EVIDENCE,
VIRUS, HUMAN (4515)
POLYPS, COLON (0195)*
SARCIDOSIS, HODGKIN'S DISEASE,
IMMUNOLOGY, HUMAN (4209)*
SKIN CANCER, HUMAN (3952)*
SQUAMOUS CELL SKIN CANCER, HUMAN,
REVIEW (4313)
STOMACH TUMORS, N-NITROSO COMPOUNDS,
HUMAN, REVIEW (4302)
THYROID CARCINOMA, CHILDREN (4045)
TUMOR
URETER, PELVIS, HUMAN (1198)*
VIRUS (0318)*

VIRAL
LEUKEMIA, LYMPHOMA, MOUSE, REVIEW
(5724)*
MALIGNANT TUMORS, CHROMOSOME
ABERRATIONS, HUMAN, REVIEW
(5042)*
RENAL ADENOCARCINOMA, FROG, REVIEW
(4343)*
VIRAL CANCER THEORIES, RESEARCH
(4610)*
VIRUS, CANCER, HUMAN (0002)

EWING SARCOMA
CYTOLOGY, VIRUS PARTICLES, TISSUE
CULTURE (2405)*
PATHOLOGY, CHILDREN (4230)*

EXCRETO-URINARY TRACT
CANCER, ANATOMICOPATHOLOGICAL STUDY,
HUMAN (3555)*

EXPERIMENTAL ANIMAL
CANCEROGENESIS, INVERTEBRATES, SNAIL
(1956)

EYE
ADENOMA OF RETINAL PIGMENT EPITHELIUM,
ULTRASTRUCTURE, CASE REPORT (4076)*
CANCER, IMMUNOLOGY, REVIEW, CASE
REPORT (3914)*
CATARACT, RETINAL ATROPHY, N-METHYL-
N-NITROSOUREA, MOUSE (2421)*
CHOROID MEMBRANE, MELANOMA PROPAGATION
HISTOPATHOLOGY, CASE REPORT (3371)*
CHOROID METASTASIS, CLINICAL STUDY,
(5578)*
CHOROID METASTASIS, HUMAN (3527)*
CORNEA, HERPESVIRUS HOMINIS TYPE 2,
RABBIT (1355)*
CORNEAL EPITHELIUM, PREINVASIVE
CANCER, ULTRASTRUCTURE (1886)
FIBROSARCOMA, CONJUNCTIVA, GILDIARY *

BODY* CASE REPORT (6297)*
 MALIGNANT MELANOMA, IMMUNE RESPONSE,
 GRAFTING ON HAMSTER, CASE REPORT
 (3174)
 MEDULLOEPITHELIOMA, RHABDOMYOSARCOMA-
 TOUS, DIFFERENTIATION, CASE REPORTS
 (5643)*
 METASTASIS, PRIMARY MALIGNANT SKIN
 MELANOMA, CASE REPORTS (6326)*
 OCULAR PATHOGENICITY, HERPESVIRUS
 TYPE 1 AND 2, RABBIT (2537)
 ORBIT, RETICULUM CELL SARCOMA, CASE
 REPORTS (6174)*
 ORBITAL TUMORS, INCIDENCE, IRAQ
 (6327)*
 ORBITO-OCULAR TUMOR, INCIDENCE, AFRICA
 (3983)*
 PROTEIN, ANTI-IDIOTYPIC ANTIBODY,
 HAPTEN-BINDING SITE, RABBIT (3175)
 RETINAL PIGMENT EPITHELIUM, SV40,
 TUMOR, HAMSTER (5891)
 RETINOBLASTOMA
 D-CHROMOSOME DELETIONS, HUMAN
 (6130)
 GENETIC TRANSMISSION, REVIEW
 (5704)
 IRIS NEOVASCULARIZATION, ULTRA-
 STRUCTURE, HUMAN (3352)*
 UVEAL MELANOMA, AUTOIMMUNE SERUM,
 HUMAN (3889)
 UVEAL TRACT MELANOMA, MORPHOLOGY,
 HUMAN (4134)*
 ACE
 CUTANEOUS TUMOR, IGA DISEASE, HUMAN
 (0177)*
 NECK, DEBREUILH'S MELANOSIS (3557)*
 TUMORS, INTRA-ARTERIAL CYTOSTATIC
 PERFUSION, HISTOLOGY, HUMAN (3496)*
 ALLOPIAN TUBE
 CARCINOMA, CHROMOSOME ANALYSIS, CASE
 REPORT (6197)*
 AMILIAL NEUROBLASTOMA
 CASE REPORT (1939)*
 AMILIAL OCCURRENCE
 CANCER, HUMAN (1498)*
 PAGET'S DISEASE, SCLEROSIS, CASE
 REPORT (1490)*
 AMILIAL POLYPOSIS
 COLON
 ADENOCARCINOMA, CANCER FAMILY
 (0288)*
 CASE REPORT, HUMAN (0791)*
 RECTUM, HUMAN (1192)*
 MILY
 LYMPHOBLASTIC LEUKEMIA PATIENT, HL-A
 ANTIGEN (1825)
 NCONI'S ANEMIA
 CHROMOSOME ABERRATION, ADENOVIRUS
 (0143)*
 SCIITIS
 NODULAR, PSEUDOSARCOMATOUS, CLINICO-
 MORPHOLOGICAL STUDY (6138)*
 T
 'DARK YELLOW', BORDERLINE, CARCINOMA
 (1150)*
 T CELLS
 METABOLISM, GROWTH HORMONE, RAT
 (2063)*
 TTY ACIDS
 EFFECT ON INDUCED TUMORS, 2-ACETYL-
 AMINOFLUORENE, RAT (2442)*
 SYNTHESIS, EHRlich ASCITES TUMOR CELLS
 (5664)*
 RRIC OXIDE
 BENZO(A)PYRENE, CARCINOGENESIS, LUNG,
 HAMSTER (2312)
 RESPIRATORY TRACT CARCINOGENESIS,
 HAMSTER (5176)
 FERRITIN
 LABELED ANTIBODY STUDIES, FELINE
 SARCOMA VIRUS, CAT (0696)
 FERTILITY
 DISORDER, N-METHYL-N-NITROSOUREA, RAT
 (0978)*
 FETOPROTEIN
 TUMOR CELLS, HUMAN, REVIEW (5069)*
 FETUS
 ADULT, ETHYLNITROSOUREA, ETHYLATION,
 NUCLEIC ACID, RAT (5172)
 CYCLAMATE, TISSUE DISTRIBUTION, RAT
 (0951)
 FIBRIN
 FIBRINOLYTIC ACTIVATORS, TUMORS,
 HUMAN (4983)*
 FIBRINOLYTIC ACTIVITY, BLADDER
 CARCINOMA, HUMAN (1492)*
 FIBRINOGEN
 DISTRIBUTION, LUNG CANCER, AUTORADIO-
 GRAPHIC STUDY, RABBIT (4384)
 FIBRINOLYSIN
 ANTICOAGULANTS (1521)*
 FIBROADENOMA
 BREAST CARCINOMA, DAUNOMYCIN,
 ADRIAMYCIN, RAT (2343)
 MAMMARY, PROGESTERONE, ESTROGEN, RAT
 (4420)
 MAMMARY GLAND
 POPULATION KINETICS, SERIAL
 TRANSPLANTATION, RAT (3303)
 SEX CHROMATIN, HUMAN (4122)*
 FIBROBLAST
 ALTERATIONS, DIMETHYLNITROSAMINE,
 KIDNEY, RAT (4398)
 CYTOTOXICITY, LEUKEMIA, CELL CULTURE
 (1998)
 DNA, NORMAL, MALIGNANT, MOUSE (1976)
 GROWTH, MORPHOLOGY, PROSTAGLANDINS,
 MOUSE EMBRYO, IN VITRO (4222)*
 HAMSTER, POLYOMA-TRANSFORMED HYBRID
 CLONES, MORPHOLOGICAL REVERTANTS
 (0725)
 MALIGNANT ASTROCYTES, ULTRASTRUCTURE,
 HUMAN, MURINE (5447)
 MELANOMA, HYBRIDS, GENETIC (2177)*
 MORPHOLOGICAL TRANSFORMATION,
 EPSTEIN-BARR VIRUS, HUMAN (3107)
 MORPHOLOGY AND GROWTH REGULATION,
 ADENOSINE MONOPHOSPHATE, MOUSE,
 HAMSTER (3314)
 MULTIPLICATION, SERUM, CANCER PATIENTS
 (5982)*
 NEOPLASTIC, LAMELLAR CYTOPLASM,
 DEFECTIVE FORMATION, MOUSE (2825)
 POLYOMA VIRUS-TRANSFORMED, GLYCO-
 SPHINGOLIPIDS, MOUSE (4587)*
 PROLIFERATION
 ADENOSINE 3'-5'-CYCLIC MONOPHOS-
 PHATE, HUMAN (6303)
 FOLIC ACID, SERUM FACTOR, CHICK
 (1623)*
 SV40 VIRUS, DOWN'S SYNDROME, HUMAN
 (0435)
 TRANSFORMATION
 HERPES SIMPLEX VIRUS TYPE 2,
 HAMSTER EMBRYO (5918)
 SULFATED ACID MUCOPOLYSACCHARIDE
 SYNTHESIS, DIBUTYRYL CYCLIC
 ADENOSINE MONOPHOSPHATE (4508)

UV RADIATION, HERPES SIMPLEX
TYPE 2 VIRUS, ULTRASTRUCTURE,
HAMSTER (5890)
TUMOR-FORMING ACTIVITY, MOUSE,
HAMSTER (4792)
FIBROEPITHELIOMA
RADIATION INDUCED, GROIN, CASE REPORT
(2452)
FIBROHEMANGIOSARCOMA
HOST SEX, TUMOR MASS, HAMSTER (5655)*
FIBROMA
CHONDROMYXOID, CLINICOPATHOLOGIC STUDY
(5520)*
FIBROSARCOMA, BRAIN, HISTOLOGY,
ULTRASTRUCTURE, HUMAN (1491)*
GASTRIC, CASE REPORT (5660)*
SPONTANEOUS DISSEMINATED, POXVIRUS,
SQUIRREL (4584)*
FIBROSARCOMA
ARTERIAL PROSTHESIS, CASE REPORT
(1690)*
BILATERAL, OVARY, HYSTERECTOMY, CASE
REPORT (5622)*
BRAIN TUMOR, PROTON RADIATION, MONKEY
(0390)
CASE REPORT, HUMAN (3327)*
CELLS, STIMULATION OR SUPPRESSION OF
METASTASES, MOUSE (4074)*
COLONY FORMATION, SPLEEN, MOUSE
(0299)*
CONJUNCTIVA, CILIARY BODY, CASE REPORT
(6297)*
C-TYPE VIRUS, MONKEY (1493)*
FELINE LEUKEMIA VIRUS, DETECTION, DOG
(1767)*
FIBROMA, BRAIN, HISTOLOGY, ULTRA-
STRUCTURE, HUMAN (1491)*
GARDNER-FELINE VIRUS, MELANOMA
INDUCTION, GNOTOBIOTIC, CAT (3066)
HUMAN, REVIEW (3637)*
LARYNX, CASE REPORT (4957)*
METHYLCHOLANTHRENE-INDUCED
GROWTH, MYCOBACTERIUM BOVIS,
NEURAMINIDASE-TREATED CELLS,
COMPARATIVE EFFECT, MOUSE (4682)
IRRADIATION, IMMUNE STATUS, MOUSE
(4686)
3-METHYLCHOLANTHRENE-INDUCED
CELL LINE ESTABLISHMENT, RAT
(4465)*
NEURAMINIDASE EFFECT, GROWTH, RAT
(2968)
3-METHYL-4-NITROSPYRIDINE 1-OXIDE,
MOUSE (1593)
RADIATION RESPONSE, IMMUNE RESPONSE,
VITAMIN A, MOUSE (3730)
REGRESSION, NEURAMINIDASE, BCG, MOUSE
(5993)*
SKIN, HISTOPATHOLOGY, CASE REPORT
(6214)*
TRANSFORMATION, DENATURED DNA, ROUS
SARCOMA-TRANSFORMED CELLS, CHICK
EMBRYO (2557)
TRANSPLANT RESISTANCE, SENSITIZING
IMPLANT, MOUSE (3169)
TRANSPLANTATION, C-TYPE VIRUS PARTICLE
CAT (0405)
VIRUS-LIKE PARTICLE, TRANSMISSIBILITY,
ULTRASTRUCTURE, CAT (1699)
FIBROUS GLASS
MESOTHELIOMA INDUCTION, PLEURA, RAT
(3676)
FIBROXANTHOMA
ULTRASTRUCTURE, HUMAN (0584)*

FIBROXANTHOSARCOMA
HISTIOCYTOMA, SOFT TISSUES, HISTOLOGY,
HUMAN (3355)*
FINGER
CARTILAGINOUS TUMOR, CASE REPORT
(6135)*
FLAVONOID COMPOUNDS
NEOPLASTIC CELLS, PROLIFERATION,
DEVELOPMENT (3366)*
FLUORANTHENE
CIGARETTE SMOKE, FORMATION BY
PYROLYSIS, TUMOR-INITIATING
ACTIVITY (4478)*
BIS-DEAE-FLUORENONE
DNA POLYMERASE SPECIFIC INHIBITOR,
RNA TUMOR VIRUSES (2504)
2-FLUORENYLACETAMIDE
HEPATOCARCINOGENESIS, HYPOPHYSECTOMY,
HISTOPATHOLOGICAL STUDY, RAT (4361)
HYPERPLASTIC LESION, HEPATOMA,
HISTOCHEMISTRY, RAT (0953)
N-2-FLUORENYLACETAMIDE
ALPHA-FETOPROTEIN, HEPATOCARCINOGENE-
SIS, RAT (5098)
AUDITORY MEATUS TUMOR, ORGANOTROPY,
RAT (1553)
CARCINOGEN INHIBITION, 8-HYDROXY-
QUINOLINE, RAT (0969)
HEPATOCELLULAR CARCINOMAS, HEPATIC
NODULES, PLASMA PROTEIN SYNTHESIS,
LIVER, RAT (4402)
HEPATOMA, POLYNUCLEOTIDE LIGASE
ACTIVITY, RAT (2945)
HEPATOMA INDUCTION, CELL LOSS AND
PROLIFERATION, LIVER, RAT (4434)
LIVER
CHOLESTEROL SYNTHESIS, RAT (4782)
HYPERPLASTIC NODULE, RAT (5772)
LIVER CARCINOGENESIS, LIPOPROTEIN,
RAT (0792)*
LIVER CARCINOMA
MITOCHONDRIAL FUNCTION, RAT (1415)
ULTRASTRUCTURE, RAT (3695)
LIVER NODULE, HEPATOCELLULAR CARCINOMA
CHROMOSOME, RAT (0046)
LIVER TUMOR INDUCTION, TESTOSTERONE
EFFECT, RAT (2338)
METABOLISM
CARCINOGENESIS, LIVER, RAT (4430)
EXCRETION, RAT (0656)*
PRECANCEROUS LIVER, METABOLIC CONTROLS
CHOLESTEROL SYNTHESIS, RAT (2963)
2,7-FLUORENYLBISACETAMIDE
BILE-DUCT CELL PROLIFERATION, FEMALE
MICE (4453)*
N-2-FLUORENYLDIACETAMIDE
HEPATOCELLULAR CARCINOMA, ACID
PHOSPHATASE, RAT (0048)
N,N'-2,7-FLUORENYLENEBISACETAMIDE
INTESTINAL ADENOMA, RAT (5089)
IRRADIATION, COCARCINOGENESIS, RAT
(0941)
LIVER TUMOR
DNA, MOUSE (0047)
LIVER ISOZYME, MOUSE (1551)
X-RAY, ADENOCARCINOMA, GLANDULAR
STOMACH, RAT (2960)
FLUORIDE
LUNG CANCER, HUMAN, REVIEW (4353)*
STEEL INDUSTRY, LUNG CANCER, INCIDENCE
CANADA (4823)
STEEL MANUFACTURE, LUNG CANCER, CANADA
(5414)
5-FLUOROURACIL

ANTIMETABOLITE, THYMIDYLATE BIOSYNTHESIS, LEUKEMIA, MOUSE (4439)
 CARCINOGENIC ACTIVITY, MOUSE (3662)
 INHIBITION RNA SYNTHESIS, EHRLICH ASCITES TUMOR, MOUSE (2422)*
 LUPHENAZINE HYDROCHLORIDE
 MAMMARY CARCINOMA, RAT, DNA, ENZYME (0833)
 OCUS FORMATION
 FELINE SARCOMA VIRUS, HELPER ACTIVITY, MARMOSET CELL, CAT CELL (4532)
 OLIC ACID
 BINDING, FOLATE ANTISERUM, RABBIT (0888)*
 OOD
 SMOKED MEAT PRODUCTS, CARCINOGENESIS, REVIEW (5754)*
 OOD ADDITIVE
 CARCINOGENICITY, GOVERNMENT REPORT (1599)
 SARCOMA PRODUCTION, PHYSICOCHEMICAL FACTORS (1601)
 FOREIGN BODY
 TUMORIGENESIS, PRENEOPLASTIC EVENT, MOUSE (0995)
 (4-(5-NITRO-2-FURYL)-2-THIAZOLYL) FORMAMIDE
 MITOTIC ACTIVITY, URINARY-BLADDER EPITHELIUM, RAT (2360)
 RMIC ACID 2-(4-(5-NITRO-2-FURYL)-2-THIAZOLYL) HYDRAZIDE
 STRUCTURAL ANALOGUES, COMPARATIVE CARCINOGENICITY, RAT (0634)
 RMIMINOGLUTAMINIC ACID
 URINE, BRONCHIAL CARCINOMA PATIENTS (6184)*
 ECKLE
 MELANOTIC, MALIGNANT MELANOMA, ULTRA-STRUCTURE, CASE REPORTS (6368)*
 EUND ADJUVANT
 BENZO(A)PYRENE, TUMORIGENESIS, POTENTIATION, HAMSTER (0058)
 DELAYED HYPERSENSITIVITY, DEPRESSION, GUINEA PIG (1370)
 HYPERSENSITIVITY DEPRESSION, GUINEA PIG (1371)
 RAUSCHER VIRUS, LEUKEMOGENESIS, MOUSE (0445)*
 RETICULOSARCOMA, ONCOGENIC ALTERATIONS RAT (5965)
 IEND DISEASE
 BCG IMMUNOTHERAPY, MOUSE (3161)
 NGUS
 ASPERGILLUS FLAVUS, AFLATOXIN, PARANASAL ASPERGILLOMA, SUDAN (0655)*
 INFECTION, ACUTE LEUKEMIA, POSTMORTEM RECORD STUDY (5580)*
 RFURAL
 BENZO(A)PYRENE, RESPIRATORY TRACT TUMOR, HAMSTER (1574)
 RYLFURAMIDE
 TOXICITY, MOUSE, RAT (1274)*
 LBLADDER
 ATOMIC BOMB RADIATION, TUMOR, INCIDENCE, HUMAN, REVIEW (3027)
 CARCINO-SARCOMA, CASE REPORT (1181)*
 CARCINOMA
 DEEP CHOLECYSTIC FOSSA, RELATIONSHIP, HUMAN (3455)*
 INCIDENCE, CALIFORNIA (4829)*
 IMMUNOGLOBULIN-CARRYING CELLS, AUTOIMMUNE DISEASE, NZB MICE (3185)
 LYMPHOCYTIC LYMPHOSARCOMA, CASE REPORT (4891)*
 GALLIUM
 ACCUMULATION, TUMOR, MAMMARY GLAND, HUMAN (2826)
 SUBCELLULAR DISTRIBUTION, LIVER, TUMORIGENESIS, MOUSE (6384)*
 GAMMA GLOBULIN
 IGG SUBCLASS ASSEMBLY, MYELOMA CELL MOUSE (1806)
 SYNTHESIS, SECRETION, IGA ASSEMBLY, MYELOMA CELLS, MOUSE (3844)
 GANGLIONEUROMA
 NEUROBLASTOMA, CATECHOLAMINE, CLINICAL STUDY (6035)*
 GANGLIOSIDE
 DETERMINATION, GAS CHROMATOGRAPHY, SV40, MOUSE (1351)*
 GARDNER'S SYNDROME
 VIRAL ETIOLOGY, HUMAN, REVIEW (0620)*
 GASTRIC
 CANCER
 HISTOLOGY, PROGNOSIS, HUMAN (2105)*
 SEROLOGICAL REACTION, HUMAN (2104)*
 STUMP CANCER, ANATOMOPATHOLOGICAL CHARACTERISTICS (3596)*
 GASTRIC CARCINOMA
 HUMAN (2026)*
 INCIDENCE, COAL MINING REGION (3974)
 METASTASIS, HYPERNEPHROID CANCER, KIDNEY, CASE REPORT (3554)*
 PATHOGENESIS, LYMPHOCYTIC LEUKEMIA (1907)*
 SERUM PROTEIN CHANGES, ALPHA GLOBULIN FRACTIONS, HUMAN (3378)*
 GASTRITIS
 STOMACH CARCINOMA, CASE REPORTS (4781)
 GASTROINTESTINAL
 TUMOR, PRIMARY, METASTASES, SKIN, HUMAN (2122)*
 GASTROINTESTINAL TRACT
 ADENOCARCINOMA, CARCINOEMBRYONIC ANTIGEN, HUMAN (0761)
 CANCER
 BLOOD SERUM PROTEIN FRACTIONS, PROPERDIN TITER, HUMAN (3553)*
 INCIDENCE, IRAN (2761)
 INCIDENCE, SURVIVAL, ISRAEL (3258)
 CARCINOMA
 DIAGNOSIS, DIRECT VISION BRUSHING CYTOLOGY, HUMAN (1141)*
 EARLY DETECTION, MORTALITY (6376)*
 ELEVATED LYMPHOCYTE ADENOSINE TRIPHOSPHATASE ACTIVITY, HUMAN (2631)
 LYMPHOCYTE, CARCINOEMBRYONIC ANTIGEN, HUMAN (0483)*
 MORTALITY (0209)
 GASTRIC MELANOMA, HISTOPATHOLOGY, CASE REPORT (6229)*
 LIVER, STOMACH, PAROTID GLAND, HODGKIN'S DISEASE, CASE REPORT (6276)*
 MALIGNANCIES, ABSENCE OF CIRCULATING ANTIBODIES TO CARCINOEMBRYONIC ANTIGEN, HUMAN (4625)
 MALIGNANT LYMPHOMA, INCIDENCE, OKINAWA (1929)
 NITROSOPIPERIDINE, SYNTHESIS, RAT (0378)*
 PARTIAL GASTRECTOMY, GASTRIC STUMP CANCER, HUMAN (6213)*
 PRIMARY LYMPHOMA, CASE REPORT (6198)*

RESPIRATORY TRACT, MULTIPLE TUMORS
(0329)*
TUMOR, ANTIGENIC CHANGE, X-RAY, RODENT
(1659)
GEMMAHEMANGIOMA
MORPHOLOGY, HUMAN (1089)*
GENE
ACTIVATION, CELL PROLIFERATION,
PROTEIN SYNTHESIS REQUIREMENT,
HUMAN FIBROBLAST (1884)
DEREPRESSION, RNA, PRIMARY HEPATOMAS,
RAT (4800)*
EXPRESSION CONTROL MECHANISMS, TRANS-
SCRIPTIONAL LEVEL, REVIEW (4346)*
FACTOR, VACCINIA VIRUS, METHYL-
CHOLANTHRENE, NEOPLASTIC EFFECT,
MOUSE (1319)
GENETIC EXPRESSION REGULATION, ENZYME
ACTIVITY, CARBOHYDRATE METABOLISM,
NUCLEIC ACID METABOLISM, CANCER CELL
DETECTION (6141)*
GENETIC RESISTANCE, AVIAN RNA TUMOR
VIRUS, INFECTION (1324)
GIX ANTIGEN EXPRESSION, MURINE
LEUKEMIA VIRUS, MOUSE (5336)
HISTOCOMPATIBILITY
MAMMARY TUMOR, VIRUS, SUSCEPT-
IBILITY, MOUSE (1727)
PARENTAL VARIANT (1821)
HOMOZYGOUS ALEUTIAN, LYMPHORETICULAR
PROLIFERATIVE DISEASE, MINK (5612)*
HOST-GENE CONTROL, C-TYPE TUMOR VIRUS,
TUMORIGENICITY, MOUSE, HUMAN
(1207)
HUMORAL IMMUNE RESPONSE, LEUKEMIA,
MOUSE (5338)
LINKAGE
CELL RESPONSE, SARCOMA VIRUS,
FOWL (1323)
7,12-DIMETHYLBENZANTHRACENE,
INFLAMMATORY RESPONSE, MOUSE
(1262)
MURINE LEUKEMIA VIRUS, MOUSE (5258)
RNA-FORMING, MUTATION, CHEMICAL
CARCINOGEN, DROSOPHILA (5780)
GENETICS
ANTIBODY PRODUCTION, BENZO(A)PYRENE,
TUMOR INCIDENCE, MOUSE (1573)
ANTIGEN, HOST RANGE, RNA TUMOR VIRUS,
REVIEW (0308)
AUTOSOMES, DOMINANT, HUMAN (2096)*
BLOOD GROUP, MONONUCLEOSIS, VIRUS
RECEPTOR, HUMAN (0133)*
CARCINOGENESIS, HUMAN, REVIEW (5023)
CELL RESISTANCE, AVIAN TUMOR VIRUS
(1748)
CERUMEN ALLELE, BREAST CANCER,
EPIDEMIOLOGY (0508)
CHROMOSOMES, QUINACRINE FLUORESCENT
KARYOTYPES, DIPLOID, HETEROPLOID
LINES, HUMAN (3473)*
CHRONIC MYELOCYTIC LEUKEMIA, MARROW
CELLS, HUMAN (4243)*
DEFECT, IGG MEMORY, MOUSE (1782)
DERMATOGLYPHICS, LEUKEMIA, CHILDREN
(0875)*
DOMINANT LETHAL EFFECTS, CYCLO-
HEXYLAMINE, MOUSE (1531)
FRIEND VIRUS SUSCEPTIBILITY, MOUSE
(2506)
GENE EXPRESSION CONTROL MECHANISMS,
TRANSCRIPTIONAL LEVEL, REVIEW
(4346)*
GENETICALLY-CAUSED TUMOR, EMBRYO,
TRANSPLANTATION, RAT (2828)
GONADOBLASTOMA, SIBLINGS, CASE REPORT
(0882)*
INFECTION, RESISTANCE, FRIEND MURINE
LEUKEMIA VIRUS, MOUSE (0408)
KARYOTYPE, CHROMOSOMAL ABERRATIONS,
MYELOID MONOCYTIC LEUKEMIA, CHILDREN
(4177)*
MELANOMA, INHERITANCE, FAMILY (0250)
MULTIPLE SKIN TUMOR, HUMAN (4140)*
NEOPLASTIC TRANSFORMATION
CHROMOSOME STABILITY, SERUM
EFFECTS, EMBRYONIC CELLS, MOUSE
(5430)
REVIEW (0607)
SKIN PATHOLOGY, CARCINOMA, HUMAN
(0622)*
SKIN TUMORS, MULTIPLE LEIOMYOMA, BLUE
RUBBER-BLEB NEVUS SYNDROME (4175)*
SUSCEPTIBILITY, VACCINIA VIRUS,
3-METHYLBENZANTHRACENE, MOUSE (3121)
TRANSMISSION, LYMPHOSARCOMA, PIG
(1478)*
TUMOR VARIABILITY, H102 TISSUE CULTURE
MORPHOLOGY (3475)*
TUMORIGENESIS DETERMINATION, CHEMICAL
CARCINOGEN, HAMSTER (2925)
TUMORS, PREDISPOSITION, RABBIT (2059)*
VIRAL INFECTIVITY, MURINE LEUKEMIA
VIRUS, MOUSE (0407)
GENITAL
MALIGNANT TUMOR, EPIDEMIOLOGICAL
STUDIES, WOMEN, GERMANY (3256)
GENITAL ORGANS
FEMALE
CANCER, INCIDENCE, IRAN (0220)*
CARCINOMA, SCREENING CENTER
(1941)*
HERPES SIMPLEX VIRUS, CERVICAL
CARCINOMA, EPIDEMIOLOGY (0216)*
GENITAL TRACT
BENIGN MESOTHELIOMA, ADENOMATOID TUMOR
ULTRASTRUCTURE, CASE REPORTS (3962)*
DIMETHYLBENZANTHRACENE, TUMOR
PROMOTION, INSULIN, GROWTH HORMONE,
RAT (3007)
ESTROGEN RECEPTORS, HUMAN CANCER
TISSUE, FEMALES (5638)*
GENITOURINARY TRACT
CARCINOMA, INCIDENCE, AFRICA (0821)*
TUMOR, VIRUS, HUMAN (0028)*
GERM CELL
DNA SYNTHESIS, UV IRRADIATION, HUMAN
(1301)
GERMINOMA
MEDIASTINAL, PATHOLOGY, HUMAN (4934)*
GIANT CELL
GRANULOMA, NITROSOQUINOLINE, MACRO-
PHAGE, RAT (5097)
TUMOR
ENZYME, HARVEY MURINE SARCOMA
VIRUS, HAMSTER (0418)
HARVEY MURINE SARCOMA VIRUS,
ULTRASTRUCTURE, HAMSTER (0421)
GLAND
SALIVARY, TUMOR, ULTRASTRUCTURE, MAN
(1480)*
GLIAL
TUMORS, LYSOSOMES, HUMAN (2121)*
GLIAL CELLS
CULTURE, CATECHOLAMINES, RAT (2164)*
GLIOBLASTOMA
ALDOLASE C, CELL CULTURE, MOUSE
(4211)*

ATYPICAL MITOSES, HUMAN (5452)
 CEREBELLUM, ADRENAL CORTEX FUNCTION,
 EXPERIMENTAL HYPERTHYREOSIS, RAT
 (6251)*
 GIANT-CELL, ULTRASTRUCTURE, CASE
 REPORT (5471)*
 GIGANTO-CELLULAR, LUMBO-SACRAL SPINAL
 CORD, CASE REPORT (5560)*
 INTRACRANIAL, FIBRINOLYSIS, HUMAN
 (4113)*
 MULTIFORME
 CRANIO-ORBITAL INVOLVEMENT, CASE
 REPORTS (4200)*
 TRANSFER RNA, CHEMICAL COMPOSITION
 HUMAN (0264)*
 ULTRASTRUCTURE (0235)
 IOMA
 BRAIN, CHROMOSOME, HUMAN (0554)
 CEREBRAL, ULTRASTRUCTURE, HUMAN
 (2070)*
 METASTASIS, YOUNG HUMAN (1195)*
 MIXED, POLYMORPHIC, PATHOGENESIS,
 NITROSOUREA-INDUCED BRAIN TUMORS,
 RAT (3014)*
 MORPHOLOGY, HISTOCHEMISTRY, MOUSE,
 IN VITRO (4055)*
 NUCLEUS, PARACRYSTALLINE ARRAY,
 ULTRASTRUCTURE, HUMAN (1174)*
 ULTRASTRUCTURE, SCHMIDT-RUPPIN ROUS
 SARCOMA VIRUS, DOG (0735)*
 DBULIN
 HEMATOLOGY, FIBRIN POLYMERIZATION,
 HUMAN (3394)*
 OMUS
 CAROTICUM, TUMOR, HISTOLOGY, HUMAN
 (0234)
 OMUS TUMOR
 HISTOCHEMICAL STUDIES, EPITHELOID
 CELLS (3580)*
 KIDNEY, CIRCULATION, HISTOLOGY (1912)*
 UCAGON
 TYROSINE AMINOTRANSFERASE ACTIVITY,
 YOSHIDA SARCOMA, RAT (4986)*
 UCOCORTICOID
 CYTOLYSIS, RECEPTOR, LYMPHOMA CELL,
 MOUSE (6127)
 UCOSAMINE
 ASCITES TUMOR CELL, ULTRASTRUCTURE,
 RAT (1534)
 TRANSFORMATION TO GLYCOGEN AND LACTATE
 ASCITES TUMOR CELLS, RAT, MOUSE
 (4012)
 TRANSPORT, INHIBITION, HEPATOMA, RAT
 (3510)*
 UPTAKE, ALKALINE PHOSPHATASE, HELA
 CELL (1112)
 LUCOSAMINE
 CYTOTOXIC EFFECTS, NORMAL AND
 NEOPLASTIC TISSUES, ULTRASTRUCTURE,
 RAT (2989)
 UCOSE
 HYPOGLYCEMIA, ASCITES TUMOR,
 MALIGNANCY, RAT (0240)
 INCORPORATION, OXYGEN CONSUMPTION,
 ATMOSPHERIC MICROCONSTITUENT
 INOCULATION, BUCCAL CELL CULTURES,
 CALF (5179)
 METABOLISM
 INCORPORATION, NOVIKOFF HEPATOMA
 CELLS, RAT (4900)*
 NOREPINEPHRINE, GLIOBLASTOMA CELLS
 NEUROBLASTOMA CELLS, RAT (5558)*
 ROUS SARCOMA VIRUS, TRANSFORMED
 CELL, CHICK EMBRYO (4558)
 SV40, HUMAN CELL (1367)*
 TRANSPORT
 INHIBITION, HEPATOMA, RAT (3510)*
 ONCOGENESIS MARKER, RNA VIRUS
 (1114)
 TUMOR CELL, PROLIFERATION, IN VITRO
 (0570)*
 UTILIZATION, DELAYED FEEDBACK CONTROL,
 ASCITES TUMOR CELLS (5547)*
 D-GLUCOSE SUPPRESSION
 HEPATOMA, TYROSINE AMINOTRANSFERASE,
 RAT (1963)
 B-GLUCOSIDASE
 MODULATION, CYCASIN-INDUCED TUMORS,
 PREWEANLING RATS (4416)
 GLUCURONIC ACID
 MAMMARY GLAND CARCINOMA, URINE, BLOOD,
 HUMAN (6122)
 BETA-GLUCURONIDASE
 RESOLUTION OF, EHRLICH ASCITES
 CARCINOMA CELLS, MOUSE BRAIN,
 ISOELECTROFOCUSING, POLYACRYLAMIDE
 (3593)*
 GLUTAMINE
 OXIDATIVE METABOLISM, MALIGNANT CELLS,
 RAT (4844)
 DL-GLYCERALDEHYDE
 EFFECT ON NEUROBLASTOMA CELLS, MOUSE
 (3465)*
 GLYCERATE 3-PHOSPHATE DEHYDROGENASE
 SERINE BIOSYNTHESIS, LEUKEMIA,
 LEUKOCYTE, HUMAN (3316)
 GLYCIDYL STEARATE
 CARCINOGENESIS, ACTIVITY BIOASSAY,
 MOUSE (2981)
 GLYCINE
 ACCUMULATION, METABOLITE ACTIVATION,
 EHRLICH ASCITES TUMOR, MOUSE (4956)*
 GLYCOGEN
 HISTOCHEMISTRY, UTERINE CERVIX
 CARCINOMA, HUMAN (4078)*
 LEVEL, LIVER, METHYL METHANESULPHONATE
 RAT (1646)*
 METABOLISM
 REGENERATING LIVER, LIVER NEOPLASM
 RAT, MOUSE (3996)
 SQUAMOUS CELL CARCINOMA, LUNG,
 HISTOCHEMICAL STUDY (6121)
 UTILIZATION, HEPATOMA GROWTH, LIVER,
 RAT (4894)*
 GLYCOGENESIS
 ASTROCYTOMA CELLS, MEDIATION, RAT
 (2173)*
 GLYCOLIPID
 SURFACE, TRANSFORMED CELL, ROUS
 SARCOMA VIRUS, TEMPERATURE-SENSITIVE
 MUTANT, CHICK EMBRYO (1738)
 SYNTHESIS, VIRUS TRANSFORMED AND
 NORMAL CELL LINES, HAMSTER (3796)
 GLYCOLYSIS
 AEROBIC, CYTOLOGY, CHLOROLEUKEMIA,
 HUMAN (0561)*
 CANCER, PROSTATE, HUMAN (4298)*
 CERVICAL CARCINOMA, HISTOGENESIS,
 HUMAN (4030)
 EHRLICH ASCITES TUMOR CELLS, IN VITRO
 (4082)*
 INHIBITION, 2-DEOXY-2-FLUORO-D-GLUCOSE
 ASCITES TUMOR CELLS (5435)
 OXYGEN UPTAKE, KIDNEY CARCINOSARCOMA,
 RAT, IN VIVO (4115)
 GLYCOPEPTIDE
 ISOLATION, ANALYSIS, MICROSOMES,
 ASCITES HEPATOMA, RAT (5534)*

GLYCOPROTEIN

ANTI-HUMAN BLOOD GROUP N AGGLUTININ;
TUMOR CELL, MOUSE (4764)*
CELL SURFACE ALTERATIONS, MAMMARY
GLAND TUMORS, HUMAN (6054)*
CROSS-REACTING ANTIGEN, CARCINO-
EMBRYONIC ANTIGEN, TISSUE EXTRACTS,
HUMAN (4755)*
MUCOSA, GASTRIC CARCINOMA, HUMAN
(1071)*
NEUROBLASTOMA, CELLS (2868)
SERUM LEVELS
ASCITES HEPATOMA 109A, RAT (5385)*
INFLAMMATION, MALIGNANT DISEASES,
FEMALE BREAST, CLINICAL STUDY
(6156)*
SURFACE, TRANSFORMED CELL, ROUS
SARCOMA VIRUS, TEMPERATURE-SENSITIVE
MUTANT, CHICK EMBRYO (1738)
SYNTHESIS
MITOCHONDRIA, MOUSE (5947)*
VITAMIN A, SKIN TUMORS, HUMAN
(4378)
GOITROGENESIS
ONCOGENESIS, METHYLTHIOURACIL, MOUSE
(2359)
GONAD
BLASTOMA, SIBLINGS, CASE REPORT
(0882)*
CANCER, INCIDENCE, QUAHAUG (4808)
GONADECCTOMY, LEUKEMIA INCIDENCE,
MOUSE (0871)*
GONADOBLASTOMAS, GONADIC PRIMORDIUM
TUMORS, CLINICAL STUDY, REVIEW
(5718)*
NEOPLASM, GONADUBLASTOMA-RELATED,
CASE REPORT (4935)*
GONADOBLASTOMA
GONADIC PRIMORDIUM TUMORS, CLINICAL
STUDY, REVIEW (5718)*
ULTRASTRUCTURE, HISTOCHEMISTRY, HUMAN
(4077)*
GRAFT-VERSUS-HOST REACTION
LYMPHOMA INDUCTION, VIRUS, MOUSE
(1780)
MALIGNANT LYMPHOMA
IMMUNOLOGIC INDUCTION, GENETIC
FACTORS (4628)
MOUSE (6039)*
NEOPLASIA, KARYOTYPE, MOUSE (4658)
SPLEEN, PLAQUE-FORMING CELL RESPONSE,
SHEEP RED BLOOD CELL, RAT (1790)
GRANULOCYTE
ALKALINE PHOSPHATASE, LIVER NEOPLASM,
HUMAN (4266)*
ALKALINE PHOSPHATASE ACTIVITY,
HODGKIN'S DISEASE (2856)
BASOPHILIC, EOSINOPHILIC, QUANTITATIVE
FEATURES, LEUKEMIA, CHILDREN (4263)*
COLONY FORMATION, ACUTE GRANULOCYTIC
LEUKEMIA, SERUM, HUMAN (5373)*
COLONY ORIGIN, CHRONIC MYELOID
LEUKEMIA (1453)*
KINETICS, PERIPHERAL BLOOD, CHRONIC
MYELOCYTIC LEUKEMIA, HUMAN (4197)*
GRANULOMA
ADJUVANT-INDUCED, IMMUNOSUPPRESSION,
MOUSE (4636)
BONE, MALIGNANT RETICULOENDOTHELIOSIS,
CASE REPORT (3484)*
CENTRAL GIANT-CELL, CASE REPORTS
(4877)*
ENERGY METABOLISM, INSULIN,
2-DEOXYGLUCOSE, RAT (5495)*

EOSINOPHILIC BONE, CUTANEOUS LESIONS,
INFILTRATED CELLS, ULTRASTRUCTURE,
CASE REPORT (6154)*
INDUCTION, LIVER, STREPTOCOCCUS, CELL
WALL, MOUSE (0283)*
JAW, PERIPHEPAL GIANT CELL, CASE
REPORTS (5405)*
LARYNX, INTUBATION ANESTHESIA, HUMAN
(1311)*
LETHAL MIDLINE, NOSOLOGY, REVIEW
(1224)*
LIPID, BONE MARROW, CLINICAL STUDY
(4961)*
MIDLINE, MALIGNANT RETICULOSIS, CASE
REPORTS (4064)*
NITROSOQUINOLINE, MACROPHAGE, GIANT
CELL, RAT (5097)
TALCUM, CASE REPORT (5836)*
GRANULOSA CELL TUMOR
OVARY, PREGNANCY, CASE REPORT (1463)*
THECA-, PROLIFERATIVE ENDOMETRIAL
RESPONSE, HUMAN (3681)
GRANULOSA-THECA TUMOR
FEMINIZING GONADAL TUMOR, OVARY,
TUMOR REGISTRY ANALYSIS (1445)*
GROSS
PHARMACOLOGY, ENDOCRINE GLANDS,
PROGNOSIS, REVIEW (1527)*
GROWTH
ADRENOCORTICAL CARCINOMA, ESTROGEN-
DEPENDENT TUMOR, RAT (0229)
ALLOGENEIC TUMOR, IMMUNOLOGIC ENHANCE-
MENT, HISTOCOMPATIBILITY ANTIGENS,
MOUSE (3909)
ASCITES TUMOR, MITOSIS, INHIBITION,
MOUSE (0831)
AUTOMATIC MONITORING, MYELOMA CELLS,
TISSUE CULTURE, MOUSE (5550)*
BREAST CARCINOMA, HISTOLOGY, HUMAN
(4217)*
BRONCHOGENIC CARCINOMA, HUMAN (0803)*
CARCINOGENESIS, METASTASIS, REVIEW
(2231)*
CELL, TRANSFORMATION, VIRUS, REVIEW
(0603)
CELL CYCLE, TUMORS, HUMAN, REVIEW
(5048)*
CELLULAR, PROLIFERATION INHIBITORY
FACTOR, MOUSE (2693)*
CHRYSOIDINE HEPATOMA, SPLENECTOMY,
MOUSE (6027)*
CONTACT INHIBITION
ADENOSINE 3',5'-CYCLIC MONOPHOS-
PHATE, CONCENTRATION, CELL
CULTURE (0856)
INDUCTION, ACIDITY, HUMAN (1115)
MAMMALIAN CELL (0845)
SV40
TRANSFORMED CELL
REVERTANT CELL LINE, SIALIC
ACID, MOUSE (0716)
ULTRASTRUCTURE, MOUSE (0721)
VIRUS, 3',5'-CYCLIC MONOPHOSPHATE,
WHEAT GERM AGGLUTININ (0439)*
CYTOPLASMIC AND NUCLEAR, EHRLICH
ASCITES TUMOR CELLS, MOUSE (5644)*
DECREASE OF SATURATION DENSITY,
CULTURED TUMOR CELLS, DEXTRAN
SULFATE, HAMSTER (5489)*
DOUBLING TIME, TUMOR, METASTASIS,
HUMAN (0493)
EHRLICH ASCITES TUMOR, INTERFEROMETRIC
MEASUREMENTS, CELLULAR PROLIFERATION
(6107)*

EHRlich CARCINOMA, LIPID FLUCTUATION, LIVER, MOUSE (6356)*
 ENDOMETRIAL CARCINOMA, HUMAN (0828)
 ENHANCEMENT, LEUKEMIA, LEUKEMIC CELL, MOUSE (1803)
 EPITHELIUM, MAMMARY GLAND, HUMAN (4940)*
 FIBROSARCOMA
 ENHANCEMENT, IGG2 FC REGION, MOUSE (4668)
 METHYLCHOLANTHRENE-INDUCED, MYCOBACTERIUM BOVIS AND NEURAMINIDASE-TREATED CELLS, COMPARATIVE EFFECT, MOUSE (4682)
 GENERATION TIME, LEUKEMIC MYELOBLAST, HUMAN (4013)
 HEPATOCELLULAR CARCINOMA, DIETHYL-NITROSAMINE-INDUCED, CELL POPULATION RAT (5073)
 HEPATOMA
 ETHER-LIPID LEVELS, ALPHA-GLYCEROL PHOSPHATE DEHYDROGENASE ACTIVITY CULTURED CELLS, RAT (4838)*
 GLYCOGEN UTILIZATION, LIVER, RAT (4894)*
 L-ORNITHINE METABOLISM, RAT (5516)*
 ULTRASTRUCTURE, MOUSE (6088)*
 HEPATOMA CELLS, HEXOKINASE ISOZYMES, RAT (5556)*
 HERPES SIMPLEX VIRUS, LYMPHOID CELLS, HUMAN (3746)
 INHIBITION
 LIVER EXTRACT, MAMMARY TUMOR, MOUSE (4047)
 MAMMARY ADENOCARCINOMA, ESTROGEN, PROLACTIN, RAT (0830)
 MAMMARY CARCINOMA, CIS-PLATINUM DIAMMINODICHLORIDE-II, RAT (1300)*
 MAMMARY TUMOR, ERGOCORNINE RAT (4455)*
 MELANOMA CELLS, C-REACTIVE PROTEIN ACTIVATED LYMPHOCYTES, HUMAN (2702)*
 INVASIVE TUMOR, HISTOCHEMICAL ENZYME STUDIES, RAT, HUMAN (5673)*
 KINETICS
 EHRlich ASCITES CARCINOMA, ALTERED IMMUNOLOGICAL CONDITIONS (5377)*
 TUMOR CELL, RADIATION, REVIEW (0301)
 LEUKEMIA CELL LINE, PROTEIN-FREE MEDIUM, HUMAN (4963)*
 LYMPHOID TUMOR, MOLONEY VIRUS, ULTRA-STRUCTURE, MOUSE (3097)
 LYMPHOMA, LUCITE CYLINDER IMPLANTATION ALLOGENEIC MICE (3733)*
 LYMPHORETICULAR TUMOR CELLS, IN VITRO (4020)
 MALIGNANT, NUTRIENT, CELL MEMBRANE, REVIEW (5016)
 GROWTH - CONTINUED
 MAMMARY CARCINOMA
 HUMAN (4822)
 INSULIN DEPRIVATION EFFECT, ALLOXAN DIABETES, RAT (2993)
 MALIGNANCY, IMMUNOCOMPETENCE, MOUSE (0457)
 OVARIAN HORMONE, RAT (1144)*
 MAMMARY TUMOR, HOST RESISTANCE, MOUSE (1396)
 MAMMARY TUMOR TRANSPLANT, C. PARVUM, ANTITUMOR GLOBULIN, MOUSE (5315)
 MAMMARY TUMOR VIRUS, CARCINOGENICITY, ETHYLENE OXIDE, MOUSE (1728)
 MECHANISM, TUMOR, MITOTIC RATE, MOUSE (0319)*
 METASTASIS, SYSTEMIC RELATIONSHIP, MOUSE (2855)
 MITOTIC INHIBITION, EPIDERMIS, BASAL CELL, MOUSE (1133)
 MORPHOLOGY, FIBROBLASTS, PROSTAGLANDIN MOUSE EMBRYO, IN VITRO (4222)*
 MYELOMA, PHAGOCYTTIC CELL FACTOR, IMMUNOCYTOLOGY, MOUSE (5302)
 MYELOMA CELLS, CHARACTERISTICS, MOUSE (3498)*
 MYXOMATOUS NEOPLASMS, HUMAN (6190)*
 NEOPLASTIC
 DNA CONTENT, NUCLEAR VOLUME, MOUSE RAT (5779)
 INHIBITION, TRACE ELEMENTS, REVIEW (3648)
 OSTEOSARCOMA, PU239, RAT (5865)*
 OVARIAN TUMOR, MALIGNANCY, PREGNANCY, HUMAN (2727)*
 PHASE, HARVEY MURINE SARCOMA VIRUS, TRANSFORMATION SUSCEPTIBILITY, MOUSE (0685)
 PLACENTAL, STEROID TREATMENT, RAT (5847)*
 PLASMACYTOMA
 PARAPROTEIN IMMUNOASSAY, MOUSE (5312)
 PERITONEUM, MINERAL-OIL CONDITION-ING, MOUSE (3946)
 POLYOMA TUMOR, FACILITATION, BLOCKING SERUM, TUMOR ELUATE, RAT (4649)
 PRECANCEROUS CELLS, IMMUNOLOGY, MORPHOLOGY, REVIEW (1512)
 PROLIFERATIVE KINETICS, HEMATOPOIETIC CELLS, HUMAN (1447)*
 PROMOTION, TRANSPLANTABLE CARCINO-SARCOMA, CREATININE, MOUSE (1629)*
 PROTEASE INHIBITORS, CULTURE CELLS, HAMSTER (5455)
 REGULATION
 ASCITES TUMOR, PARABIOTIC MOUSE (0527)* -
 MENINGIOMA, POLYAMINE (1451)*
 RETARDATION, CELL CYCLE TIME, TRANS-PLANTED TUMOR (3887)
 RETARDING MECHANISMS, LYMPHATIC TUMORS MOUSE, HUMAN (5726)*
 SARCOMA
 GENOTYPE-DEPENDENT MODIFICATION, CASTRATED MICE (4836)*
 MOLONEY VIRUS, SERUM FACTOR, MOUSE (0744)
 SERUM FACTOR
 SV40-TRANSFORMED CELLS, MOUSE (0429)
 TRANSFORMED CELL, VIRUS, RADIATION MOUSE (0720)
 SIMIAN ADENOVIRUS SA7, ARGININE STARVATION (5937)*
 SOLID EHRlich ASCITES TUMOR, CHONDROITINSULFATE, MOUSE (4899)*
 STIMULATING FACTOR, LEUKEMIC CELL CULTURE, HUMAN (4041)
 STIMULATION, DOPAMINE EFFECT REVERSAL, NEUROBLASTOMA, IPRONIAZID, MOUSE (1631)*
 TRANSPLANTABLE LEUKEMIA
 MORPHOLOGY, RAT (5531)*
 RABBIT IMMUNE SERA, MOUSE (5356)
 TRANSPLANTABLE PLASMACYTOMA, MOUSE

- (1905)*
 TRANSPLANTABLE TUMORS, PHAGOCYTOSIS,
 OPSONIN CHANGES, CELLULAR INFLUENCES
 RAT (3192)
 TROPHOBLASTIC CELL, POLYOMA VIRUS,
 MOUSE (1759)
 TUMOR
 BIOLOGICAL ENERGY, REVIEW (4316)
 BOVINE ADENOVIRUS TYPE-3, HAMSTER
 (5286)*
 DIETARY MODIFICATION, MOUSE
 (5540)*
 EFFECT OF INDUCED DIABETES, MOUSE
 (2833)
 EHRLICH'S CELLS, NK/LY LYMPHOMA,
 ENERGY EXCHANGE (3312)
 HISTOLOGICAL CHANGE, MOUSE (1197)*
 HISTOLOGY, MOUSE (1196)*
 HISTONE EFFECT, MOUSE (2938)
 HYPERGLYCEMIA, RAT (4000)
 IMMUNODEPRESSION, MOUSE (3213)
 IMMUNOSUPPRESSION, TUMORIGENESIS,
 REVIEW (5761)*
 INHIBITION MECHANISM, POLYINOSINIC
 POLYCYTIDYLIC ACID, IMMUNITY,
 RAT (5350)
 KINETICS (2743)*
 MAMMALIAN CELL SYSTEMS, PROLIFERA-
 TIVE PROPERTIES, REVIEW (5756)*
 POLYAMINE AND NUCLEIC ACID CONCEN-
 TRATIONS, EHRLICH ASCITES
 CARCINOMA, CELLS, LIVER, MOUSE
 (4870)
 RATE ENHANCEMENT, INTERFERON
 INDUCERS (4599)*
 VASCULARIZATION, CHEMICAL
 CARCINOGENESIS, CHEEK POUCH,
 HAMSTER (3664)
 VITAMIN B12, HUMAN, REVIEW (1216)*
 VITAMIN B12, RAT, MOUSE, HAMSTER,
 GUINEA PIG, REVIEW (5708)
 WATER INTAKE, WORK, RAT (2733)*
 GROWTH - CONTINUED
 TUMOR ALLOGRAFT, RADIATION, IMMUNO-
 COMPETENCE, MOUSE (0463)
 TUMOR CELLS
 DIFFERENTIATION, ULTRASTRUCTURE,
 MOUSE (4272)*
 PARASITIC LARVAE, HAMSTER, RAT
 (5301)
 TUMOR METHYLCHOLANTHRENE, SPLEEN SIZE,
 IMMUNE RESPONSE, RAT (3911)*
 WALKER 256 CARCINOMA, OXYPHENBUTAZONE,
 RAT (1626)*
 WALKER CARCINOSARCOMA
 ENHANCEMENT, ANTI-LYMPHOCYTE
 ANTISERUM, RABBIT (1387)
 MACROPHAGE, ANTIBODY, RAT (1406)*
 WOUND TUMOR VIRUS (5249)
 WOUND TUMOR VIRUS, VECTOR CELL
 MONOLAYERS, PLANTS (4609)*
 GUERIN TUMOR
 CELLS, ULTRASTRUCTURE (6147)*
 SERUM PROTEIN, ARGININE, RAT (0859)*
 HALO-ETHER
 BIS(CHLOROMETHYL)ETHER ANALOGS,
 CARCINOGENESIS, STRUCTURE ACTIVITY
 RELATIONSHIP, MOUSE (3002)
 HAPTENE
 ATTACHMENT, DINITROPHENYLATION,
 TYROSYLATION, TUMOR CELLS, MOUSE
 (3224)*
 BETA-NAPHTHYLAMINE, CARCINOGENESIS,
 DOG (5291)
 FORSSMAN, TUMORS, HUMAN (5994)*
 HEAD
 NECK, ADENOID CYSTIC CARCINOMA, HUMAN
 (3410)*
 HEAD AND NECK
 TUMOR, CLONAL ORIGIN, HUMAN (3942)
 HEART
 CARDIAC TUMORS, 1-PYRIDYL-3,3-DIETHYL-
 TRIAZENE, RAT (5108), (5162)
 PRIMARY OSTEOSARCOMA, CASE REPORT
 (5466)*
 RHABDOMYOSARCOMA, CASE REPORT (4050)*
 TUMOR, MORPHOLOGY, RAT (1594)
 TUMOR INDUCTION, METHYLNITROSUREA,
 RAT (5765)
 HELA CELLS
 INTERSTRAND DNA CROSS-LINKING, MUSTARD
 GAS ALKYLATION (4397)
 MITOCHONDRIAL RNA (2183)*
 RIBONUCLEOPROTEIN, MITOCHONDRIA
 (2189)*
 SENDAI VIRUS INFECTION, 4-NITROQUINO-
 LINE 1-OXIDE TREATMENT, REPAIR
 MECHANISM (4395)
 HEMAGGLUTINATION
 AVIAN MYELOBLASTOSIS VIRUS,
 NEURAMINIDASE (0134)*
 HEMANGIOBLASTOMA
 MENINGIOMA, ELECTRON MICROSCOPY,
 HUMAN (2081)*
 HEMANGIOENDOTHELIOMA
 HISTOLOGY, CASE REPORT (6208)*
 LEG, METALLIC FIXATION OF TIBIA,
 CASE REPORT (4488)*
 MALIGNANT, SPLEEN, ULTRASTRUCTURE,
 CASE REPORT (6071)*
 THOROTRAST, LEUKEMIA, PORTUGAL (4490)
 HEMANGIOMA
 CAVERNOUS, PLASMA CELL PROLIFERATION,
 CASE REPORT (6359)*
 DIMETHYLNITROSAMINE, RETICULOENDO-
 THELIAL SYSTEM, MOUSE (3701)
 PULMONARY SCLEROSING, ULTRASTRUCTURE,
 CASE REPORT (5406)*
 HEMANGIOMATOSIS
 SMALL AND LARGE BOWEL, HISTOLOGY,
 CASE REPORT (4906)*
 HEMANGIOPERICYTOMA
 NASAL CAVITY, CASE REPORT, NIGERIA
 (4876)*
 VULVA, METASTASIS TO BONE, CASE REPORT
 (5542)*
 HEMATOLOGY
 FIBRIN POLYMERIZATION, GLOBULIN, HUMAN
 (3394)*
 MYELOPREOLIFERATIVE DISORDER, SERUM
 LYSOZYME, B12, BINDING CAPACITY
 (1966)
 HEMATOPOIESIS
 ENZYMES, LEUKEMIA, RATS (2191)*
 PRECURSOR, CYTOSINE ARABINOSIDE,
 1,3-BIS(2-CHLOROETHYL)-1-NITROSUREA
 MOUSE (1298)*
 RAUSCHER-LEUKEMIA, HYPERTRANSFUSION
 EFFECT, MOUSE (3145)*
 HEMATOPOIETIC CELL
 COLONIES, ALKYLATING AGENTS, MOUSE
 (3466)*
 HERPES SIMPLEX VIRUS, CHROMOSOME,
 HUMAN (3812)
 PROLIFERATION, LETHALLY IRRADIATED
 MICE (4501)*
 PROLIFERATIVE KINETICS, HUMAN (1447)*
 HEMATOPOIETIC TUMOR

LYMPHOSARCOMA, FELINE LEUKEMIA VIRUS, CAT (3805)
 MOCYANIN
 RAUSCHER LEUKEMIA VIRUS, INFECTED CELL DIFFERENTIATION, MOUSE (4680)
 MOCYTOBLASTOSIS
 RNA SYNTHESIS, HUMAN DIPLOID CELLS (3760)
 MOGLOBIN
 LEVEL, CIGARETTE SMOKING, HUMAN (1637)*
 MYELOID LEUKEMIA, FETAL ERYTHROPOIESIS CHILD (4098)*
 SYNTHESIS
 BONE MARROW AND SPLEEN CELL SUSPENSION ACUTE MYELOGENOUS LEUKEMIA, RAT (3541)*
 CELL MULTIPLICATION, FRIEND LEUKEMIA VIRUS, DIMETHYL-SULFOXIDE, MOUSE (0412)
 MOPOIESIS
 EARLY PROLIFERATING CELLS, ULTRA-STRUCTURE, MOUSE (1903)*
 HETEROTOPIC RENAL, LEUKOERYTHROBLASTIC BLOOD REACTION, ACUTE LEUKEMIA, CASE REPORT (6133)*
 PATIC
 METASTASES, REGRESSION, HUMAN (2162)*
 MITOCHONDRIA, X-RAY, THERAPY, RAT (2156)*
 PATITIS
 ASSOCIATED ANTIGEN, LIVER CELL CARCINOMA, TAIWAN (1797)
 PATITIS-ASSOCIATED
 ANTIGEN, IMMUNOLOGY (1953)
 PATOCARCINOGENESIS
 DIMETHYLNITROSAMINE, NEWT (4467)*
 HYPOPHYSECTOMY, HISTOPATHOLOGICAL STUDY, RAT (4361)
 KARYOKINESIS AND NUCLEAR STRUCTURE, NITROSOMORPHOLINE, HEPATOCYTES, RAT (4472)*
 SYNGENETIC TRANSPLANT OF SKIN, MOUSE (3463)*
 PATOCARCINOMA
 CIRRHOSIS, COINCIDENCE, CHILD (1084)
 PATOCELLULAR CARCINOMA
 AUTOPSY STUDY, NIGERIANS, REVIEW (4351)*
 PORPHYRIA CUTANEA TARDA, FREQUENCY, HUMAN (4042)
 PATOMA
 AFLATOXIN B1, MOUSE (5152)
 AFLATOXIN-INDUCED, SOCKEYE SALMON (5827)*
 ALBUMIN CONTENT, LIVER, RAT (5512)*
 ALBUMIN SYNTHESIS, FREE POLYRIBOSOMES, RAT (5607)*
 ALDOLASE, HYBRID CELL, RAT (4849)
 ALDOLASE A, IMMUNOLOGY, RAT (1949)
 ALKALINE PHOSPHATASE VARIANT, NEURAMINIC ACID REMOVAL (5505)*
 ALPHA1-GLOBULIN, FETUS, TERATOMA, MOUSE (0449)
 AMINOAZO DYE, ANTIGENS, RAT (3170)
 ASCITES
 CELL NUCLEI, ISOLATION, RAT (4174)*
 CHEMICAL CHARACTERIZATION, CELL SURFACE, RAT (2731)*
 ENZYME TREATMENT, ELECTROPHORETIC MOBILITY, RAT (0297)*
 GLYCOGEN STORAGE, MECHANISM, RAT (5490)*

GLYCOPEPTIDES, ISOLATION, ANALYSIS MICROSOMES, RAT (5534)*
 HETERO-ORGANIC ANTIGEN, RAT (5366)*
 INVASION, LUNG METASTASIS, PROTEASE, RAT (1142)*
 PLASMA MEMBRANE, SURFACE STRUCTURE RAT (2016)
 SURFACE MEMBRANE, RAT (3404)*
 ASCITES 109A, SERUM GLYCOPROTEIN LEVEL RAT (5385)*
 ASCITES FLUID, DRUG METABOLIZING ENZYMES, LIVER MICROSOMES, RAT (3460)*
 AUSTRALIA ANTIGEN, ASIA (5297)
 BENZENE HEXACHLORIDE, MOUSE (4462)*
 BIOCHEMISTRY, CYTOGENETICS, CELL LINES RAT (5456)
 1-CARBON GROUP METABOLISM, WALKER'S CARCINOMA, RAT (4210)*
 CARCINOMA, TRANSPLANTATION, ALPHA-FETOPROTEIN, HUMAN (0759)
 CELL CULTURE, LIVER TISSUE BREAKDOWN TECHNIQUES (4206)*
 CELL HYBRIDS, LIVER ALCOHOL DEHYDROGENASE, RAT (4190)*
 CELL NUCLEI, ATPASE, HISTOCHEMISTRY, MOUSE (6236)*
 CELL SURFACE, ANTIBODY TREATMENT, ELECTROPHORESIS, RAT (4711)*
 CHEMICAL, INDUCTION OF TYROSINE AMINOTRANSFERASE, RAT (1964)
 CHEMICAL ACTIVITY, RAT, MOUSE (2127)*
 CHEMICAL INDUCTION, C-TYPE VIRUS, RAT (5810)
 CHOLINE TRANSPORT, RAT (1357)*
 CHRYSOIDINE, GROWTH, SPLENECTOMY, MOUSE (6027)*
 CIRRHOSIS, INCIDENCE, HUMAN (2195)*
 CYTOPLASM, INCLUSION, ULTRASTRUCTURE, MOUSE (0889)*
 DIETHYLNITROSAMINE, CARCINOEMBRYONAL ANTIGEN, SERUM, RAT (0488)*
 DIETHYLNITROSAMINE-INDUCED, 4-HYDROXYPENTENAL, OXYGEN UPTAKE, SH CONTENT, LIVER, RAT (5190)*
 4-DIMETHYLAMINOAZOBENZENE, CYTO-SKELETON ALTERATIONS, LIVER CELLS, RAT (5131)
 DNA, HISTONES, HISTONE PHOSPHATE TURNOVER, TISSUE CULTURE CELLS (5504)*
 DNA SYNTHESIS
 FERRITIN, HEPATECTOMY, RAT (1472)*
 GROWTH RATE (2014)
 DNA/PROTEIN RATIO, DNP, MOUSE (2128)*
 ENDOPLASMIC RETICULUM, LIPID, GLYCOGEN RAT (1986)
 ENZYME, RAT (4845)
 FAMILIAL INCIDENCE, U.S. (2859)
 FEEDBACK, CHOLESTEROL, RAT (1968)
 FEEDBACK CONTROL, CHOLESTEROL SYNTHESIS, HUMAN (3401)*
 FETAL MOLECULAR ENZYME FORMS, LIVER, RAT, HUMAN, REVIEW (5716)
 N-2-FLUORENYLACETAMIDE INDUCED, POLYNUCLEOTIDE LIGASE ACTIVITY, RAT (2945)
 GLUTATHIONASE, MOUSE, RAT (3682)
 GLYCEROLPHOSPHATE DEHYDROGENASE, THYROID HORMONE, RAT (0980)*
 GLYCOGEN PHOSPHORYLASE, FETAL LIVER, RAT (5339)
 GROWTH, GLYCOGEN UTILIZATION, LIVER,

RAT (4894)*
 GROWTH RATE, ULTRASTRUCTURE, MOUSE (6088)*
 GUANYLATE-SPECIFIC TRANSFER RNA METHYLASE, RAT LIVER (4248)*
 HEPATOMA - CONTINUED
 HEMOCHROMATOSIS, HUMAN (0580)*
 HORMONE, GLUCOCORTICOID, RECEPTOR, RAT (0287)*
 HYDROXYMETHYLGLUTARYL COENZYME, FEEDBACK CONTROL, CHOLESTEROL, RAT (0536)
 HYPERPLASTIC LESION, HEPATECTOMY, RAT (0945)
 INCIDENCE, AFLATOXIN CONTAMINATION, STORED FOOD, UGANDA (0511)
 INDUCTION
 CHICK EMBRYO LETHAL ORPHAN VIRUS, HAMSTER (0703)
 LIVER TOXICITY, LUTEOSKYRIN CYCLOCHLOROTINE, RICE, MOUSE (2354)
 INDUCTION RESISTANCE, 4-DIMETHYLAMINO-AZOBENZENE, BLOOD TRANSFUSION, RAT (2931)
 INHIBITION, GLUCOSE AND GLUCOSAMINE TRANSPORT, RAT (3510)*
 ISOZYME PATTERNS, BRANCHED-CHAIN AMINO ACID TRANSAMINASE, RAT (5474)*
 KARYOTYPE, RAT (2056)*
 LIVER, ANOMALOUS SERUM PROTEIN, HUMAN (0473)
 LUNG CARCINOGENESIS, DIMETHYLNITRO-AMINE, PHORBOL, MOUSE (4392)
 METABOLISM, LIVER, ISCHEMIA, RAT (4857)
 MITOCHONDRIA, ADENOSINE TRIPHOSPHATE, DEFICIENCY, RAT (0280)*
 MORRIS
 AMINO ACID TRANSPORT, TYROSINE AMINOTRANSFERASE, RAT (4271)*
 COMPARATIVE STUDY, CELLULAR ORGANELLES, RAT (3403)*
 CYCLIC AMP, ENDOCRINE CONTROL, RAT (4178)*
 DNA SYNTHESIS, RAT (3504)*
 ELECTRON TRANSPORT, RAT (3321)*
 ENZYME, REGULATION, CHOLESTEROL, RAT (4851)
 ERYTHROCYTIC PHOSPHORUS COMPOUND, RAT (4128)*
 GRAFTING, BLOOD ISLANDS, CHROMOSOMAL CHANGES, CHICK (2894)*
 GROWTH, PLASMA COPPER LEVELS, RAT (6243)*
 HEXOKINASE ACTIVITY, PLASMA MEMBRANE, MOUSE (1137)*
 LIVER, REGENERATION, DIHYDROURACIL DEHYDROGENASE, RAT (0578)*
 LIVER CELL NUCLEI, DNA SYNTHESIS, SUCROSE (1484)*
 LYSOSOMAL AND NONLYSOSOMAL ENZYMES, RAT (4092)*
 PHYTOSTEROL, RAT (3301)
 SINGLE-CELL SUSPENSION PREPARATION LIVER, RAT, MOUSE (6179)*
 TRANSPLANTATION
 ERYTHROCYTIC GLYCOLYSIS, RAT (4126)*
 TYROSINE AMINOTRANSFERASE, AMINO ACID TRANSPORT, LIVER, RAT (4072)*
 MORRIS 5123TC, CATALASE SYNTHESIS,

TRANSLATION REGULATION (3511)*
 NOVIKOFF
 ENDORIBONUCLEASE ACTIVITY, RAT (2813)
 EXOGENOUS RNA UPTAKE, IN VITRO (4070)*
 LIVER INVASION, ULTRASTRUCTURE, RAT (6281)*
 NUCLEOSIDE TRANSPORT, KINETIC ANALYSIS, RAT (0550)
 RNA, LIVER, RAT (6379)*
 NOVIKOFF ASCITES
 ANTIBODY, GOAT (1064)
 LYMPHOSARCOMA, LYSINE-RICH HISTONE DISTRIBUTION, RAT, CALF (1113)
 NOVIKOFF ASCITES CELL, SURFACE 3'-EXONUCLEASE (4084)*
 NOVIKOFF CELL NUCLEI, RNA NUCLEOTIDE SEQUENCE (2875)
 NOVIKOFF CELLS, GLUCOSE INCORPORATION, METABOLISM, RAT (4900)*
 NUCLEAR ALTERATIONS, URETHAN INJECTION ULTRASTRUCTURE, MOUSE (2327)
 L-ORNITHINE CARBAMYL TRANSFERASE ACTIVITY, ORNITHINE METABOLISM, LIVER, RAT (4989)*
 PHOSPHODIESTERASE ACTIVITY, RAT (6114)
 PHOSPHOENOLPYRUVATE CARBOXYKINASE DIBUTYRYL CYCLIC AMP (4011)
 HEPATOMA - CONTINUED
 PLASMA MEMBRANE
 HORMONE, ADENYL CYCLASE, RAT (1128)
 LIPID COMPOSITION, RAT, MOUSE (6115)
 POLYAMINE CONTENT, RAT (5620)*
 PRIMARY
 ELECTRON MICROSCOPE, HUMAN (2186)*
 HEPATITIS-ASSOCIATED ANTIGEN, CASE REPORT (5386)*
 HYPOGLYCEMIA, CASE REPORT (5689)*
 PROTEIN ACETYLATION, CHROMATIN, RAT (0588)*
 PROTEIN METHYLASE, RAT (3988)
 PROTEINS, IMMUNOELECTROPHORESIS, RAT (4732)*
 REGENERATING LIVER, METABOLISM, MOUSE (0981)*
 REGIONAL VARIATION, REVIEW (2223)*
 RIBOSOMAL PROTEINS, GEL ELECTROPHORESIS, RAT (2175)*
 RIBOSOMES
 FERRITIN, IRON, HUMAN (2043)*
 TYROSINE AMINOTRANSFERASE SYNTHESIS (0294)*
 RNA ACTIVITY, MONKEY, METHYLATION, N-NITROSODIETHYLAMINE (0631)
 RNA CODING, RAT (1957)
 RNA-DEPENDENT DNA POLYMERASE, LIVER, RAT (4017)
 RNA POLYMERASE, CHROMATIN, RAT (0589)*
 SPONTANEOUS, INCIDENCE, HEPATIC MALIC ENZYME CAPACITY, MOUSE (5514)*
 STEROL SYNTHESIS REGULATION, BETA-HYDROXY-BETA-METHYLGLUTARYL REDUCTASE, LIVER, MOUSE (1483)*
 SURFACE MEMBRANE ANTIGEN DELETION, 4-DIMETHYLAMINOAZOBENZENE, RAT (4678)
 SYNTHESIS OF BLOOD COAGULATION FACTOR, ACTINOMYCIN D INHIBITION, RAT (3296)
 TERATOMA, ALPHA FETOPROTEIN, CANCER PATIENT, CHILDREN, (BLOOD TEST) (0551)

THOROTRAST-INDUCED, CASE REPORT
 (4500)*
 3924A, MAMMARY TUMOR, CATION MOVEMENT
 (3423)*
 TISSUE CULTURE, MOUSE (2006)
 TRANSFER RNA, RAT (1971)
 TRANSPLANT
 CELL LINES, MORPHOLOGY, MODEL
 (4205)*
 RAT (2194)*
 TRANSPLANTABLE CELL LINE, MOUSE
 (5693)*
 TUMOR-SPECIFIC ANTIGEN, SOLUBILIZATION
 POTASSIUM CHLORIDE, GUINEA PIG
 (1074)*
 TYROSINE AMINOTRANSFERASE, D-GLUCOSE
 SUPPRESSION, RAT (1963)
 YOSHIDA, COLD-ANTIBODIES, CYTOTOXIC
 REACTION, RAT SERUM (4696)
 YOSHIDA ASCITES
 IMMUNIZATION, MOUSE (0172)*
 MITOTIC PROCESSES, RAT (4120)*
 TUMOR CELL ANTIGEN, CELL ELECTRO-
 PHORESIS (1822)
 YOSHIDA ASCITES CELLS, IMMUNE RESPONSE
 RAT (5364)
 EPATOMA CELL
 PERMEABILITY, JUNCTIONS (1985)
 EPATOMA CELL LINE
 PROTEIN KINASE, BINDING ACTIVITY
 (2168)*
 EPATOTOXICITY
 DIMETHYLNITROSAMINE, VENOCCLUSION,
 RAT (2411)*
 EPTACHLOR
 ADMINISTRATION, TUMOR INCIDENCE,
 SUCKLING RATS (5814)*
 ERBICIDES
 2,4-D, 2,4,5-T, EHRLICH ASCITES TUMOR
 CELLS, MOUSE (2363)
 HEREDITY
 MAMMARY CARCINOMA, FAMILY (0557)*
 OSTEOSARCOMA, IRRADIATION,
 TRANSMISSION, REVIEW (1518)*
 TUMOR INCIDENCE, BRITISH, CHILDREN
 (0816)*
 HERPES ZOSTER
 HODGKIN'S DISEASE, CLINICAL, HISTO-
 LOGIC AND IMMUNOLOGIC, CORRELATION
 (3763)
 HERPES ZOSTER-VARICELLA
 LYMPHOMA, HODGKIN'S DISEASE, ANALYSIS
 (3208)
 HETEROKARYONS
 ONCOGENIC POTENTIAL, MOUSE, HAMSTER
 (5398)
 HETEROPLIIDY
 DNA CONSTANCY, TUMOR (1439)
 HETEROTRANSPLANTATION
 HUMAN PROSTATIC ADENOMA CELLS
 NONIMMUNOSUPPRESSED HAMSTERS (4724)*
 HEXADECANE
 EPIDERMIS, ULTRASTRUCTURAL
 ABNORMALITIES, GUINEA PIG (0034)
 HEXAMETHYLENETETRAAMINE
 TRANSPLACENTAL TREATMENT, RAT (0040)
 ILAR CELL
 TUMOR, OVARY, ULTRASTRUCTURE, HUMAN
 (1134)*
 HISTAMINE
 CONTENT, BLOOD PLASMA, MYELOGENOUS
 LEUKEMIA, HUMAN (0582)*
 X-RAY, HELA CELL (1675)*
 HISTIOCYTOMA
 FIBROXANTHSARCOMA, SOFT TISSUES,
 HISTOLOGY, HUMAN (3355)*
 HISTIOCYTOSIS
 MALIGNANT, CUTANEOUS INVOLVEMENT,
 EOSINOPHILIA, CASE REPORT (4990)*
 HISTOCHEMISTRY
 ACANTHOMA, ICHTHYOSIS, LOWER LIMBS,
 CASE REPORTS (4215)*
 ATPASE, PLASMATIC CELL MEMBRANE,
 HEPATOMA, MOUSE (4123)*
 CHONDROBLASTOMA, ULTRASTRUCTURE, CASE
 REPORT (4216)*
 ENZYMES, NERVE TUMOR, RAT (4141)*
 GIANT CELL, TUMORS, HAMSTERS, VIRUS
 (0418)
 GLYCOGEN, UTERINE CERVIX CARCINOMA,
 HUMAN (4078)*
 HISTOCOMPATIBILITY
 CHORIOCARCINOMA, TROPHOBLASTIC
 NEOPLASIA, REVIEW (1228)*
 HISTOGENESIS
 BRAIN TUMOR, EXPERIMENTAL INDUCTION,
 RAT (1888)
 CARCINOMA IN SITU, INFILTRATIVE
 CARCINOMA, MAMMARY GLAND, REVIEW
 (1515)
 CERVICAL CARCINOMA, GLYCOLYSIS, HUMAN
 (4030)
 GRANULAR CELL TUMOR, VULVA, ULTRA-
 STRUCTURE, REVIEW (3626)*
 INSULIN-SECRETING PANCREATIC TUMOR,
 AMYLOID STROMA, A CELL ADENOMAS,
 CASE REPORT (4295)*
 MEDULLOBLASTOMA, REVIEW (1523)*
 METHYLCHOLANTHRENE-INDUCED CERVICAL
 CANCER, CERVICAL CANCER (0060)
 HISTOLOGY
 ACANTHOMA, NAEVUS-SEBACEOUS-LIKE
 FORMATIONS, CASE REPORTS (4111)*
 CANCER, GASTRIC, PROGNOSIS, HUMAN
 (2105)*
 CELL MEMBRANE, ALLOANTIGENS,
 LYMPHOID LOCI, REVIEW (1516)
 FIBROUS HISTIOCYTOMA, SOFT TISSUES,
 HUMAN (4058)*
 GASTRIC CARCINOMA, JAPAN, U.S.A.
 (0879)*
 LEIOMYOSARCOMA, UTERUS, HUMAN (4220)*
 MALIGNANT FIBROUS HISTIOCYTOMA, SOFT
 TISSUES, HUMAN (4053)*
 OVARIAN CYSTOADENOFIBROMA, CASE REPORT
 (4287)*
 RECTAL CANCER, CYTOLOGY, HUMAN (4124)*
 URETER CARCINOMA, CASE REPORT (4104)*
 TUMOR, GLOMUS CAROTICUM, HUMAN (0234)
 HISTONE
 DNA SYNTHESIS, INHIBITION,
 DIMETHYLNITROSAMINE, LIVER, RAT
 (0643)
 F1, MOLECULAR NATURE, PHOSPHORYLATION,
 CULTURED HEPATOMA CELLS (5506)*
 INHIBITORY EFFECTS, ENHANCING EFFECTS,
 TUMOR GROWTH, MOUSE (2938)
 LYSINE-RICH, DISTRIBUTION, NOVIKOFF
 HEPATOMA, LYMPHOSARCOMA, RAT, CALF
 (1113)
 PHOSPHORYLATION, LYMPHOCYTE,
 PHYTOHEMAGGLUTININ, PIG (1129)
 TRANSFORMATION, MAMMALIAN CELL,
 HAMSTER (1537)
 TURNOVER, HEPATOMA TISSUE, CULTURED
 CELLS (5504)*
 HISTOPATHOLOGY
 BARTHOLIN GLAND CARCINOMA, CASE REPORT

(6253)*
 BILATERAL BRENNER TUMOR, CASE REPORT
 (4131)*
 CANCER
 BLADDER, HUMAN (6227)*
 UTERINE CERVIX, HUMAN (6237)*
 CANCER TO CANCER METASTASES, CASE
 REPORT (6274)*
 CARCINOMA, ADRENAL GLAND CORTEX, CASE
 REPORTS (4112)*
 CARCINOMA LOBULARE IN SITU, BREAST,
 HUMAN (6241)*
 CEREBELLAR HEMANGIOBLASTOMA, TWO
 CONSECUTIVE GENERATIONS, CASE REPORT
 (6255)*
 CHONDROCARCINOMA OF THE BREAST, CASE
 REPORT (6268)*
 CLEAR CELL CARCINOMA, KIDNEY, HUMAN
 (6266)*
 GASTRIC MELANOMA, CASE REPORT (6229)*
 HEMANGIOMA, SYNOVIOMA, MONKEY (6270)*
 HODGKIN'S DISEASE, HUMAN
 (0900)*, (6383)*, (6392)*, (6393)*
 KIDNEY, PYRROLIZIDINE ALKALOIDS,
 ALPHA, BETA-UNSATURATED ALDEHYDES,
 RAT (1542)
 LEIOMYOSARCOMA OF THE CECUM, CASE
 REPORT (6261)*
 MALIGNANT LYMPHOGRANULOMA, CASE REPORT
 (4114)*
 MALIGNANT MELANOCYTIC NEVUS, CASE
 REPORT (6247)*
 MELANOMA, CHEEK, HUMAN (6222)*
 MUCOEPIDERMOID TUMOR, PAROTID, MOUTH,
 HUMAN (6228)*
 MYOBLASTOMYOMA, TONGUE, CASE REPORT
 (6265)*
 NEPHROBLASTOMA, ENZYME HISTOCHEMISTRY,
 COMPARISON WITH FETAL KIDNEY,
 CHILDREN (6232)*
 OVARIAN TUMOR STROMA, HUMAN (4121)*
 PRIMARY BONE TUMORS, HUMAN (6378)*
 PRIMARY CARCINOMA OF THE GREATER
 OMENTUM, CASE REPORT (6260)*
 RETICULUM CELL SARCOMA, OVARY, CASE
 REPORT (6252)*
 SEBACEOUS EPITHELIOMA, CASE REPORT
 (6210)*
 SPONTANEOUS MELANOBLASTOMA, RABBIT
 (6248)*
 STOMATITIS NICOTINA, HUMAN (2381)*
 HODGKIN'S DISEASE
 ANERGY, RECOVERY, CASE REPORT (1068)*
 ANTIGEN PATTERN, SURVIVAL, HUMAN
 (2706)*
 BIOSTATISTICAL AND EPIDEMIOLOGICAL
 FACTORS, REVIEW (4359)*
 BLASTIC TRANSFORMATION, LYMPH NODE
 CELLS, PHYTOHEMAGGLUTININ (6030)*
 BOWEN'S DISEASE OF THE PALM
 ASSOCIATED, CASE REPORT (4926)*
 BURKITT'S LYMPHOMA, MULTIPLE MYELOMA,
 AFRICA, REVIEW (0005)
 CHRONIC LYMPHOCYTIC LEUKEMIA,
 PERIPHERAL LYMPHOCYTES, ZINC
 STIMULATION IN VITRO, HUMAN (3917)*
 CHRONIC LYMPHOID LEUKEMIA, MYELOMA,
 IMMUNOLOGY, HUMAN, REVIEW (2202)
 CLINICOPATHOLOGIC STUDY (3523)*
 CYTOGENETICS, CASE REPORTS (3317)
 DELAYED SENSITIVITY (6033)*
 EPIDEMIC TRANSMISSION, INCIDENCE,
 GEORGIA (1100)
 EPIDEMIOLOGY, REVIEW (6078)

ETIOLOGY, REVIEW (3625)*
 EXTRANODAL SITE, CASE REPORT (6276)*
 FOAMY MACROPHAGES, CLINICAL STUDY
 (6205)*
 GRANULOCYTE ALKALINE PHOSPHATE,
 ACTIVITY (2856)
 HERPES ZOSTER, CLINICAL, HISTOLOGIC
 AND IMMUNOLOGIC CORRELATIONS (3763)
 HERPES ZOSTER-VARICELLA INFECTION,
 LYMPHOMA, ANALYSIS (3208)
 HISTOPATHOLOGY
 HUMAN (0900)*, (6383)*, (6392)*,
 (6393)*
 SURVIVAL, HUMAN (0796)*
 HL-A ANTIGEN
 GROUP FIVE SYSTEM, HUMAN (1789)
 HUMAN (0957), (1053), (1060)
 HL-A ANTIGEN TYPES (2677)*
 HL-A MEMBRANE ANTIGEN, MAN (0480)
 HL-A PHENOTYPES (2678)*
 IDIOPATHIC THROMBOCYTOPENIC PURPURA,
 PATHOLOGY, HUMAN (4061)*
 INBREEDING, HUMAN (2137)*
 INCIDENCE, NEW YORK (6074)
 KAPOSI'S SARCOMA, MALIGNANT MELANOMA,
 COINCIDENCE, HUMAN (0585)*
 LEUKEMIA, ASSOCIATION, CASE REPORTS
 (4213)*
 LEUKOCYTE
 CYTOPLASMIC IMMUNOFLUORESCENCE,
 HUMAN (3856)
 INTERFERON PRODUCTION, HUMAN
 (1172)*
 LIVER, PARENCHYMAL DAMAGE, HUMAN
 (6388)*
 LIVER BIOPSY, HUMAN (3994)
 LUNG PATHOLOGY, HUMAN (6385)*
 LYMPH, COMPOSITION, HUMAN (0883)*
 LYMPHATIC TISSUE, HUMAN, ULTRA-
 STRUCTURE (1438)
 LYMPHOCYTE, LYMPHOTOXIN PRODUCTION,
 HUMAN (0548)
 LYMPHOCYTE SURFACE IMMUNOGLOBULINS,
 HUMAN (4712)*
 MALIGNANT SKIN GRANULOMA, MORPHOLOGY,
 PATHOGENESIS (1902)*
 MULTIPLE MYELOMA, HL-A ANTIGEN,
 ANALYSIS (3222)*
 PATHOGENESIS, HYPOTHESIS, VIRAL
 INFECTION, HOST IMMUNITY (3237)
 PATHOLOGY, CLINICAL STUDY (5577)*
 PHA-STIMULATED LYMPHOCYTE RESPONSE,
 SERUM EFFECT, HUMAN (3165)
 POST-MORTEM FINDINGS, UGANDANS (4988)*
 PREGNANCY, HUMAN (6387)*
 PURINE AND PYRIMIDINE EXCRETION,
 CLINICAL-HISTOLOGICAL STUDY (4166)*
 SARCOIDOSIS, ETIOLOGY, IMMUNOLOGY,
 HUMAN (4209)*
 SERUM PROTEINS, IMMUNOELECTROPHORETIC
 INVESTIGATIONS, PATIENTS (5378)*
 SKELETON PATHOLOGY, HUMAN (6386)*
 SPREAD, LYMPHATIC SYSTEM, BLOOD
 STREAM, MAN (0899)*
 STAGING, EPIDEMIOLOGICAL CONSIDERA-
 TIONS, REVIEW (3638)*, (3639)*
 SYSTEMIC SPREAD, SPINAL CORD INVOLVE-
 MENT, CASE REPORT (4056)*
 TOTAL URINE HYDROXYPROLINE EXCRETION,
 PATIENTS (5591)*
 TUMOR-ASSOCIATED ANTIGEN, HUMAN
 (0749)

HORMONE
 ACTH

SECRETION, BRONCHIAL CARCINOID TUMORS, CASE REPORTS (6366)*
TUMOR CONCENTRATIONS, PLASMA CONCENTRATIONS, ECTOPIC ACTH SYNDROME, CLINICAL STUDY (6365)*
ADRENOCORTICOTROPIC
ADRENAL TUMOR, ADENYL CYCLASE (6119)
CUSHING'S SYNDROME, BRONCHIAL CARCINOID ADENOMA, HUMAN (4292)*
ANDROGEN, NUCLEAR PROTEIN, CHANGE, PROSTATE (1299)*
ANDROGEN BIOSYNTHESIS, ADRENAL GLAND TUMORS, HUMAN (3294)
ANDROGENIC STEROIDS, HEPATOCELLULAR CARCINOMA, HUMAN (5839)*
ANDROGENIC-ANABOLIC STEROID THERAPY, HEPATOCELLULAR CARCINOMA, CASE REPORTS (5843)*
BLOOD ESTROGENS, BREAST CANCER, HUMAN (4277)*
CARCINOGENESIS
COCARCINOGENIC ROLE (0314)*
MAMMARY TUMOR, ESTROGEN, PROGESTERONE, PROLACTIN, PITUITARY, MOUSE (2950)
TSH, LH, PROLACTIN, MOUSE (2942)
CHORIONIC GONADOTROPIN, TROPHOBLASTOMA TUMOR DOUBLING TIME, HUMAN (0815)*
CONTRACEPTIVES, MAMMARY CARCINOMA, MORPHOLOGY, HUMAN (2973)
DEPENDENCY
ENDOCRINE TUMORS, MOUSE (5633)*
ESTRADIOL, TESTOSTERONE, MAMMARY CARCINOMA, RODENT, HUMAN (0838)
DIETHYLSTILBESTEROL, PITUITARY TUMOR, GRAFT, RAT (2344)
ALPHA-DIHYDROTESTOSTERONE, METABOLISM, PROSTATE CARCINOMA, ESTROGEN, HUMAN (4854)
DISTURBANCES, PRECANCEROUS DISEASES, BREAST CANCER, WOMEN (3236)
ECTOPIC PRODUCTION, TUMORS, HUMAN (3400)*
ENDOCRINE TUMOR, ADENYL CYCLASE RESPONSE, HUMAN (4853)
EPIDERMAL GROWTH FACTOR, PRECURSOR UPTAKE, HELA CELL, KB CELL (5444)
ESTRADIOL
BINDING, THIOLS, MALIGNANT BREAST TUMORS, HUMAN (6339)*
7,12-DIMETHYLBENZ(A)ANTHRACENE, ADRENOCORTICAL NECROSIS, RAT (0976)*
PRODUCTION, INTESTINAL BACTERIA (5182)
ESTRADIOL-BINDING CHROMATIN, FRACTIONATION, MAMMARY TUMOR, RAT (1263)*
ESTRADIOL BINDING SITE, MAMMARY TUMOR, MOUSE (4406)
ESTRADIOL RECEPTOR, BREAST CARCINOMA, HUMAN (2948)
ESTRADIOL UPTAKE, MAMMARY TUMOR, STEROID EXCRETION, HUMAN (1183)*
H-ESTRADIOL ACCUMULATION, TESTES AND PITUITARY GLAND, MOUSE (4373)
ESTROGEN
CHORIOCARCINOMA, GYNECOMASTASIA (1185)
C-TYPE RNA VIRUS ACTIVATION
UTERUS, MOUSE (5250)
INHIBITORY EFFECT, MAMMARY TUMORS, PITUITARY ISOGRAFT,
7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT (2305)
LONG-TERM ADMINISTRATION, MAMMARY CANCER, WOMEN (4449)*
MAMMARY CARCINOMA, HUMAN (1250)
MAMMARY FIBROADENOMA, RAT (4420)
MAMMARY GLAND CARCINOMA, VAGINAL CYTOLOGY, HUMAN (4145)*
PROLACTIN, EFFECT ON DNA SYNTHESIS INDUCED MAMMARY TUMOR, RAT (2306)
UTERUS, BINDING SITE, MOUSE (0337)
VAGINAL CANCER, VAGINAL DEVELOPMENT, WOMEN (4464)*
ESTROGEN-BINDING CAPACITY, CYTOPLASMIC RECEPTOR, NORMAL, NEOPLASTIC BREAST TISSUES, HUMAN (5513)*
ESTROGEN-DEPENDENT TUMOR, ADRENOCORTICAL CARCINOMA, GROWTH, RAT (0229)
ESTROGEN EXCRETION, BREAST CANCER, ANDROGEN-TREATED PATIENTS (5501)*
ESTROGEN PRODUCTION, TROPHOBLASTIC TUMOR, TISSUE CULTURE (3307)
ESTROGEN-RECEPTOR
LACTATING MAMMARY GLAND, MAMMARY ADENOCARCINOMA, RAT (6116)
MAMMARY CANCER, HUMAN (1485)*
ESTROGEN REPLACEMENT THERAPY, BREAST CARCINOMA, WOMEN (4450)*
HORMONE - CONTINUED
FACTORS, UTERINE MYOMA, PATHOGENESIS, HUMAN (5648)*
GLUCOCORTICOID, RECEPTOR, HEPATOMA, RAT (0287)*
GROWTH
IMMUNOREACTIVE, LUNG AND STOMACH CANCER, HUMAN (3927)*
LUNG CARCINOMA, HUMAN (3023)*
PITUITARY TUMOR, HUMAN (1135)*
RNA POLYMERASE, DNA DEPENDENT, LIVER, RAT (1294)*
SYNTHESIS, LUNG CARCINOMA, CELL CULTURE (2839)
GROWTH HORMONE, INSULIN, CARCINOGENESIS, DIMETHYLBENZANTHRACENE, GENITAL TRACT, RAT (3007)
GS ANTIGENICITY EXPRESSION, CONTROL, C-TYPE RNA VIRUS, MOUSE (1007)
HETEROPHYLLY, PHYTOHORMONE, INVERTEBRATE ENDOCRINOLOGY (3350)*
HUMORAL REGULATOR, LEUKEMIA, REVIEW (0910)
6-HYDROXYTESTOSTERON,
DELTA 3,5-CHOLESTADIENE-7-ONE,
DELTA 4-CHOLESTENE-3,6-DIONE,
FAILURE OF ONCOGENESIS, MOUSE (1545)
INSULIN, ALDOSTERONE, PROGESTERONE, MAMMARY GLAND TISSUE GROWTH, IN VITRO (4173)*
JUVENILE, MELANOTIC PSEUDOTUMOR, DROSOPHILA (6118)
MAMMARY CARCINOMA (0284)*
PROTECTION, HUMAN (1616)*
MAMMARY TUMOR
ESTRADIOL BINDING, RAT (1242)
REVIEW (2243)*
MAMMARY TUMOR VIRUS REPLICATION, MOUSE (0714)
MAMMOTROPIC
SOMATOTROPIC
PITUITARY TUMOR, RAT (0586)*
SERUM, PITUITARY TUMOR, RAT

- (0587)*
 NEONATAL ADMINISTRATION, RNA
 METABOLISM, LIVER, RAT (2347)
 NEUROSECRETION, EHRlich ASCITES
 TUMOR CELLS, MOUSE (5551)*
 ORAL CONTRACEPTIVES, HYPERPLASIA,
 UTERINE CERVIX, HUMAN (0365)*
 OVARIAN
 MAMMARY CARCINOMA GROWTH, RAT
 (1144)*
 MAMMARY TUMORIGENESIS, N-NITROSO-
 BUTYLUREA, RAT (4382)
 PARATHYROID, ECTOPIC PRODUCTION,
 MAMMARY CARCINOMA, HUMAN (0596)*
 PRODUCTION, TUMORS, HUMAN, REVIEW
 (5701)
 PROGESTERONE, MAMMARY FIBROADENOMA,
 RAT (4420)
 PROGESTIN SECRETION, DECIDUOMATA
 MAINTENANCE MECHANISM, 3-METHYL-
 CHOLANTHRENE TREATMENT, RAT (3006)
 PROGESTOGENS, MAMMARY NEOPLASM, DOG
 (4193)*
 PROLACTIN, BREAST TUMOR, REVIEW
 (5034)*
 PROLACTIN DEPENDENCE, MAMMARY
 CARCINOMA, DEHYDROGENASE, HUMAN
 (5129)
 REACTIVITY, TRANSPLANTABLE, UTERINE
 CERVIX CANCER, MOUSE (6250)*
 RECEPTOR, ADENYL CYCLASE, ADRENO-
 CORTICAL CARCINOMA, RAT (1486)*
 SECRETION, CANCER CELL, HUMAN, REVIEW
 (4319)
 STEROID
 BENZO(A)PYRENE, MITOCHONDRIA,
 LIVER, RAT (2314)
 SKIN TUMORIGENESIS INHIBITION,
 CROTON OIL, MOUSE (4368)
 VIRILIZING LUTEOMA OF PREGNANCY,
 HUMAN (1140)*
 STEROID CONTENT, VIRILIZING LUTEOMA,
 HUMAN (1177)*
 STEROID TREATMENT, PLACENTAL GROWTH,
 RAT (5847)*
 STILBESTEROL, CANCER, REVIEW (0927)*
 TESTOSTERONE, MAMMARY GLAND CANCER,
 ETIOLOGY, HUMAN (4858)
 TESTOSTERONE METABOLISM, PROSTATIC
 ADENOMA, CARCINOMA TISSUE (6169)*
 THYMIDINE KINASE, ADRENAL CARCINOMA,
 RAT (1437)
 THYMOSIN, PURIFICATION, BIOLOGICAL
 ACTIVITY, THYMUS GLAND, MOUSE
 (5549)*
 THYROID, GLYCEROLPHOSPHATE
 DEHYDROGENASE, HEPATOMA, RAT (0980)*
 THYROID GLAND, GASTRIC CANCER INDUC-
 TION, RAT (5187)*
 THYROXINE, INSULIN, TUMOR CELL,
 MITOTIC ACTIVITY, IN VITRO (0231)
 HOST
 RNA VIRUS, CELL MEMBRANE, PHOSPHOLIPID
 CHICK (1342)
 HUMAN
 LEUKOCYTE, COMPLEMENT-FIXING ANTIGEN,
 EPSTEIN-BARR VIRUS, HUMAN (0694)
 HYALINOSIS
 PELVIC LYMPH NODES, CERVICAL CARCINOMA
 CLINICAL STUDY (6171)*
 HYALURONIC ACID
 INTERFERON PRODUCTION, ROUS SARCOMA
 VIRUS, CHICKEN CELL (1983)
 HYBRID
 HEPATOMA CELL, ALDOLASE, RAT (4849)
 MAMMARY CARCINOMA CELL, H-2 ANTI-
 GENICITY, MOUSE (3858)
 SV40-TRANSFORMED CELL, ANTIGENICITY,
 CHROMOSOME, MOUSE, RAT (4510)
 TUMOR CELL, CHROMOSOME, MORPHOLOGIC
 DIFFERENTIATION (4027)
 HYBRID CELL
 MOLONEY LYMPHOMA CELL, FIBROBLAST,
 SURFACE ANTIGEN, VIRUS RELEASE,
 MOUSE (1784)
 MONKEY-MOUSE, NEWCASTLE DISEASE VIRUS,
 HERPESVIRUS, INTERFERON PRODUCTION
 (1777)*
 SARCOMA VIRUS, LEUKEMIA VIRUS,
 PRODUCTION, ANTIGENS, HAMSTER, MOUSE
 (4565)
 HYBRIDIZATION
 ADENOVIRUS RNA AND DNA, CHROMOSOMES,
 HUMAN (3108)
 DNA, VIRUS, REVIEW (4311)
 INTRASPECIFIC SOMATIC, MALIGNANT
 CELLULAR TRANSFORMATION, KARYOLOGIC
 MODIFICATIONS, HAMSTER (5299)
 NUCLEIC ACID, ONCOGENIC VIRUS
 GENOMES, RODENT (2491)
 RNA
 DNA SEQUENCES, L CELL (0851)
 LEUKEMIA, MOUSE (0256)*
 RNA-DNA
 LEUKOCYTES, RAUSCHER LEUKEMIA
 VIRUS, MOUSE, HUMAN (3131)
 MURINE SARCOMA VIRUS, MURINE
 LEUKEMIA VIRUS, GENETIC
 DIFFERENCES (3135)
 ROUS SARCOMA VIRUS, CELL INFECTION
 RAT, CHICK (3040)
 HYDRADENOMA
 CLEAR-CELL, SKIN, CLINICAL STUDY,
 REVIEW (5730)*
 HYDRAZINE
 LUNG TUMORIGENESIS, MOUSE (3692)
 HYDRAZINE SULFATE
 LUNG AND MAMMARY GLAND TUMORS,
 PREGNANT AND PSEUDOPREGNANT MICE
 (4476)*
 LUNG TUMORS, C-TYPE PARTICLES, ULTRA-
 STRUCTURE, MOUSE (4371)
 TUMORIGENESIS, HAMSTER (2349)
 HYDROCARBON
 ACRIDINE, ACRIDONE DERIVATIVES,
 IMMUNOSUPPRESSIVE PROPERTIES (2615)
 AROMATIC POLYCYCLIC, BINDING, DNA,
 RNA AND PROTEIN, TRANSFORMED CELLS,
 HAMSTER (3672)
 CARCINOGENIC, WATER RESERVOIR
 CONTAMINATION, ENVIRONMENTAL HAZARD
 (2441)*
 CONTENT IN TAR OINTMENT (2388)*
 HETEROCYCLIC ANALOGUES, CARCINOGENS
 (2400)*
 HYDROCORTISONE
 H102 HAMSTER TUMOR (2146)*
 TYROSINE AMINOTRANSFERASE ACTIVITY,
 YOSHIDA SARCOMA, RAT (4986)*
 HYDROQUINONE
 CIGARETTE SMOKE CONDENSATE, CUTANEOUS
 CARCINOGENESIS, MOUSE (2432)*
 N-HYDROXY-N-ACETYLAMINOFLUORENE
 MITOCHONDRIA, ATP, SHOWDOMYCIN, RAT
 (0933)
 N-HYDROXY-N-1-ACETYLAMINOFLUORENE
 GUANINE BINDING, LIVER, RAT (5804)
 N-HYDROXY-N-2-ACETYLAMINOFLUORENE

OXIDATION, CARCINOGEN, METABOLISM (0343)
 N-HYDROXY-2-AMINOFLUORENE
 N-ACETYLATION, LIVER, MAMMALIAN SPECIES (0372)*
 4-HYDROXYAMINOQUINOLINE-1-OXIDE
 DNA BREAKAGE, REPAIR, MAMMALIAN CELL (4494)
 DNA REPAIR SYNTHESIS REDUCTION, XERODERMA PIGMENTOSUM (1596)
 DNA TRANSFORMATION, DIFFERENTIAL INACTIVATION, BACILLUS SUBTILIS (3666)
 ENZYMATIC ACTIVATION, CELLULAR INTERACTION, RAT (2341)
 MUTATION SUPPRESSOR, E. COLI (4482)*
 5-HYDROXYANTHRANILIC ACID
 METABOLISM, LIVER, GUINEA PIG, RAT, MOUSE, HUMAN (5165)
 URINARY EXCRETION, GLUCURONIDE, SULFURIC ESTER, HUMAN, RAT, GUINEA PIG (4388)
 5-HYDROXY-3,4-BENZOPYRENE
 SKIN FIBROSARCOMA, MOUSE (5141)
 N-HYDROXY COMPOUNDS
 N-HYDROXY-SUCCINIMIDE, NON-CARCINOGENIC, RAT (2407)*
 N-HYDROXY-2-FLUORENYLACETAMIDE
 CONVERSION TO O-AMIDOPHENOLS, STEREO-CHEMISTRY, MECHANISM, RAT LIVER (3712)
 MACROMOLECULE SYNTHESIS, LIVER, INHIBITION, RAT (1251)*
 RNA POLYMERASE INHIBITION, LIVER, RAT (4380)
 HYDROXYLAMINE
 METHOXYAMINE, MUTAGENESIS, CHEMICAL BASIS (2449)*
 7-HYDROXYMETHYL-12-METHYLBENZ(A)-ANTHRACENE
 ADRENAL, FETAL RAT (1569)
 4-HYDROXYPENTENAL
 OXYGEN UPTAKE, SH CONTENT, HEPATOMA, LIVER, RAT (5190)*
 8-HYDROXYQUINOLINE
 N-2-FLUORENYLACETAMIDE, CARCINOGEN INHIBITION, RAT (0969)
 SIDEROSIS, IRON, NEOPLASTIC AND PRENEOPLASTIC LESIONS, LIVER, RAT (4389)
 N-HYDROXY-SUCCINIMIDE
 N-HYDROXY COMPOUNDS, NON-CARCINOGENIC, RAT (2407)*
 HYDROXYUREA
 ULTRAVIOLET, DNA SYNTHESIS INDUCTION, HELA CELL (1676)*
 3-HYDROXYURIC ACID
 ONCOGENICITY, SYNTHESIS, RAT (2972)
 HYPERCALCEMIA
 TUMOR-INDUCED, CASE REPORT (6321)*
 UNDIFFERENTIATED LEUKEMIA, CASE REPORT (5610)*
 HYPERGLYCEMIA
 TUMOR GROWTH, RAT (4000)
 HYPERIMMUNIZATION
 CHRONIC, ASSOCIATED PERTUSSIS-DIPHThERIA-TETANUS VACCINE, LEUKEMIA MOUSE (3916)*
 HYPERNEPHROMA
 METASTASIS, NASAL SINUS, HUMAN (4135)*
 HYPERPLASIA
 ENDOMETRIAL, PRE-MALIGNANT LESION, HUMAN (6063)*
 ENDOMETRIUM, CHROMOSOME PATTERN, HUMAN (3546)*
 GLANDULAR EPITHELIUM, UTERINE CERVIX, ORAL CONTRACEPTIVES, HUMANS (0365)*
 N-HEXADECANE, ULTRASTRUCTURAL ABNORMALITIES, GUINEA PIG (0034)
 HYPERPLASTIC MAMMARY NODULE, PITUITARY ISOGRAFT, ADRENO-OVARIETOMY, MOUSE (0154)
 INDUCTION, SALIVARY GLAND ISOGRAFTS, MOUSE (4463)*
 ISLETS OF LANGERHANS, CONGENITAL NEUROBLASTOMA, INFANT, CASE REPORT (4959)*
 ISOGRAFTS, MOUSE (1993)
 LARYNGEAL EPITHELIUM, TUMOR, SH-GROUPS (4108)*
 LEAD ACETATE, PORPHYRIN CONTENT, KIDNEY, RAT (5085)
 LEYDIG CELL, BRENNER TUMOR OF OVARY, CASE REPORT (5611)*
 TUMOR, SKIN, UREA ANTIGEN, MOUSE (4692)
 HYPERPLASTIC GROWTH
 ENDOTOXIN, INDUCTION, BACTERIA (1548)
 HYPERSENSITIVITY
 DELAYED
 CHEMICAL CARCINOGEN, CELL-FREE TRANSFER, GUINEA PIG (1393)
 DEPRESSION, FREUND'S ADJUVANT, GUINEA PIG (1370)
 LUNG DISEASE (1861)*
 MACROPHAGE, REVIEW (1231)*
 SV40, MOUSE (3882)
 DEPRESSION, FREUND'S ADJUVANT, GUINEA PIG (1371)
 HYPERTENSION
 7,12-DIMETHYL(A)ANTHRACENE, RAT (1645)*
 HORMONE SECRETING TUMORS, RAT (3500)*
 HYPERTRICHOSIS LANUGINOSA
 ACQUIRED, MALIGNANCY, CASE REPORTS (5665)*
 HYPOGAMMAGLOBULINEMIA
 BURSECTOMY, ROUS SARCOMA VIRUS, TUMOR GROWTH, CHICKEN (5239)
 HYPOGLYCEMIA
 LYMPHOSARCOMA, METASTASIS TO GLUCOSE CONTROL CENTER, CASE REPORT (4911)*
 PRIMARY HEPATOMA, CASE REPORT (5689)*
 TUMOR INDUCED (2027)*
 HYPOPHARYNGEAL
 CARCINOMA, HUMAN CELL LINE (2117)*
 HYPOSENSITIVITY
 MULTIPLE MYELOMA, HUMAN (3520)*
 HYPOTHALAMUS
 PITUITARY, LESIONS, MICE (2004)
 8-HYPOXANTHINE
 NORMAL CELL, MALIGNANT CELL, SENSITIVITY, HUMAN (1473)*
 HYPOXIA
 MAMMARY GLAND NEOPLASMS, PATHOGENESIS, CLINICAL STUDY (6053)
 HYSTERECTOMY
 ENDOMETRIAL CARCINOMA, RECURRING (1954)
 IGG MEMORY
 DEFECT, GENETICS, MOUSE (1782)
 IMMUNE DEFENSE
 ANIMAL TUMORS (1787)
 IMMUNE MECHANISM
 ANTISERUM, LYMPHOID MEMBRANE COMPONENT HUMAN (1819)
 HOST, CELLULAR IMMUNITY, SQUAMOUS CERVICAL CARCINOMA, HUMAN (1820)

TARGET CELL CULTURE, CANCER PATIENT (1864)*

IMMUNE REACTION

CYTOLYSIS, LIPOSARCOMA, OSTEOSARCOMA, IMMUNE LYMPHOCYTE, GUINEA PIG (3898)

GRAFT-VERSUS-HOST, IMPAIRMENT, SPLEEN CELL, TUMOR, RAT (3855)

UVEAL MELANOMA, AUTOCHTHONOUS SERA, HUMAN (3889)

IMMUNE RESPONSE

ANTIBODY, FORMALINIZATION, TUMOR CELL, MOUSE (5306)

ASSESSMENT, IMMUNOSUPPRESSION, ACUTE VIRUS INFECTION (1854)*

AUTOLOGOUS TUMOR, HUMAN (1796)

COLON CARCINOMA, HUMAN (1868)*

DEPRESSION, SPLEEN CELL, 4-NITRO-QUINOLINE 1-OXIDE, MOUSE (3679)

GENETIC CONTROL, H-2 ANTIGEN, IGA, MOUSE (1813)

HUMORAL, GENETIC CONTROL, LEUKEMIA, MOUSE (5338)

IMMUNOSUPPRESSION, ANTIGEN CHALLENGE LYMPHOSARCOMA, MOUSE (5341)

SKIN CARCINOMA, HUMAN (1867)*

SPLEEN CELL, FRIEND VIRUS INFECTION, MOUSE (1801)

SUPPRESSION, PHYTOHEMAGGLUTININ, GUINEA PIG (3907)

TRANSIENT, TUMOR ANTIGEN, HUMAN (1794)

IMMUNITY

ADOPTIVE TRANSFER, BESNOITIA JELLISONI RADIATION, HAMSTER (3729)

ALLOGRAFT

THYMOCYTE, BONE MARROW CELL, CYTOTOXICITY, LYMPHOMA, MOUSE (3873)

TUMOR, T CELL, MOUSE (5310)

ALLOGRAFT SURVIVAL, 3-METHYL-CHOLANTHRENE, PAPILLOMA, MOUSE (0459)

ANTIBODY, ANTITUMOR, CYTOTOXIC, MOUSE, RAT, ADENOVIRUS (0479)

H-2 ANTIGEN, TUMOR GROWTH, TISSUE IMMUNOGENICITY, MOUSE (0492)*

H-7 ANTIGEN, TOLERANCE, MOUSE (0754)

ANTISERUM, RADIATION LEUKEMIA VIRUS, MOUSE (0768)

AUTOCHTHONOUS CANCER CELLS, LEUKOCYTE MIGRATION TEST, HUMAN (3214)

BRAIN TUMORS, CELL MEDIATED, HUMAN (3841)

BREAST CARCINOMA, TUMOR-ASSOCIATED ANTIGEN, HUMAN (4675)

BURKITT LYMPHOMA, COLONY INHIBITION, EFFECTOR CELL, HUMAN (4685)

CANCER, HUMAN, REVIEW (3634)*

CARCINOMA

FREUND-NEUBERG REACTION, REVIEW (1218)*

LYMPHOCYTE (0016)*

CELL, WILM'S TUMOR, NEUROBLASTOMA, HUMAN (4731)*

T CELL, B CELL, FUNCTIONAL ONTOGENY, THYMUS, MOUSE (3188)

CELL-MEDIATED

BLOCKING ACTIVITY, BCG THERAPY, MELANOMA, HUMAN (5330)

MACROPHAGE MIGRATION INHIBITION, PLASMACYTOMA, MOUSE (3893)

ROUS SARCOMA, QUAIL (5923)

ROUS SARCOMA VIRUS, THYMECTOMY, RAT (5324)

CELL-MEDIATED ANTITUMOR, TUMOR GROWTH,

TUMOR RESECTION, IRRADIATED TUMOR CELL, MOUSE (4642)

CELL-MEDIATED RESPONSE, CERVIX, OVARY, CARCINOMA, HUMAN (1401)

CELL-MEDIATED TUMOR, LEUKOCYTE ADHERENCE INHIBITION, SERUM BLOCKING FACTORS, MOUSE (2662)*

CELL-MEDIATED TUMOR ALLOGRAFT, TRANSFER WITH RNA, MOUSE (2636)

CELLULAR

ANTIBODY, TUMOR (0011)*

BACILLUS CALMETTE-GUERIN, MAMMARY CARCINOGENESIS, 7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT (0637)

BLOCKING ACTIVITY, MAMMARY TUMOR, MOUSE (3879)

HEPATOMA, MACROPHAGE MIGRATION, GUINEA PIG (4650)

IMMUNE CYTOLYSIS, GUINEA PIG (4774)*

URETHANE-INDUCED LUNG ADENOMA, MOUSE (2326)

CONCOMITANT, TUMOR GROWTH, MOUSE (0745)

CONCOMITANT TUMOR, IMMUNOSELECTION, METASTASES, MAMMARY FIBROSARCOMA, RAT (0757)

CROSS PROTECTION, AVIAN SARCOMA VIRUS, CHICKEN (4531)

CUTANEOUS HYPERSENSITIVITY, TUMOR ANTIGEN, VIRUS, HAMSTER (0705)

CYTOTOXICITY

BLOCKING SERUM, TUMOR ELUATE, POLYOMA VIRUS, RAT (4649)

LYMPHOCYTE, HL-A COMPATIBILITY, HUMAN (3861)

CYTOTOXICITY REACTION, LYMPHOID CELL, LYMPHOMA, GROSS VIRUS, RAT (4621)

CYTOTOXICITY SUPPRESSION, SPLEEN CELL, LYMPH NODE CELL, ASCITES TUMOR, MOUSE (4752)*

DEFICIENCY

THYMUS, AMES DWARF MOUSE (3229)*

TUMOR, VACCINE (0013)*

VIRUS INFECTION, HUMAN (1700)

DELAYED CUTANEOUS HYPERSENSITIVITY, MALIGNANT MELANOMA, AUTOLOGOUS TUMOR EXTRACT, HUMAN (4657)

DELAYED HYPERSENSITIVITY, LYMPHOMA, RETICULUM CELL, CASE REPORT (0772)*

DEPRESSION ACTIVITY, GRAFT-VS-HOST REACTION, HOMOGRAFT REJECTION, 7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT (2308)

EFFECTOR CELL ACTIVITY, BURKITT LYMPHOMA, LEUKOCYTE, HUMAN (4623)

EHRlich ASCITES CARCINOMA, RESISTANCE INDUCTION, RABBIT IMMUNE SERUM, MOUSE (4661)

GAMMA-RAY EXPOSURE, DOG (2663)*

GRAFT REJECTION, MAMMARY TUMOR, DNA TREATMENT, CELL DEBRIS TREATMENT, RAT (4695)

GRAFT RESISTANCE, EHRlich ASCITES TUMOR, ADENOVIRUS, MOUSE (1037)*

GRAFT VS HOST REACTION, MIXED LYMPHOCYTE REACTION, LEUKEMIA VIRUS ACTIVATION, MOUSE (2515)

GRAFT VS HOST REACTIVITY, ANAPHYLAXIS, LEUKEMIA, AKR MOUSE (3866)

H-2, METHYLCHOLANTHRENE-INDUCED SARCOMA, GUINEA PIG (4703)

H-2 RESISTANCE

AUTOCHTHONOUS TUMOR CELL, SIMIAN

ADENOVIRUS, HAMSTER (0471)
 MAMMARY TUMOR GROWTH, MOUSE (1396)
 HOST-TRANSPLANT REACTION, SARCOMA,
 MOUSE (1080)*
 HUMAN TUMORS, MOUSE, TUMOR SPECIFIC
 ANTIGENS, BLOCKING ANTIBODY (0460)
 HUMORAL, 3-METHYLCHOLANTHRENE, MOUSE
 (4363)
 IMMUNITY - CONTINUED
 IMMUNE REACTIVITY, AUTOLOGOUS BLAST
 CELLS, LEUKEMIA PATIENTS (4643)
 IMMUNE RESPONSE
 HISTOCOMPATIBILITY, TUMOR
 INDUCTION, REVIEW (1202)
 RADIATION, BONE MARROW, MOUSE
 (0780)*
 TUMOR ANTIGEN, REVIEW (0627)*
 IMMUNE RESPONSE TO TUMORS, REVIEW
 (0601)
 IMMUNOCOMPETENCE, MAMMARY CARCINOMA,
 MALIGNANCY, TUMOR GROWTH, MOUSE
 (0457)
 IMMUNOGENICITY
 CANCER (0007)*
 MURINE SARCOMA, ANTIGEN (0164)
 IMMUNOSUPPRESSION, LEUKEMIA, MOUSE
 (0167)*
 IMMUNOSURVEILLANCE, TUMOR GROWTH
 (0025)*
 INDUCTION, LEUKEMIA, GUINEA PIG (1055)
 INFLUENZA VIRUS, EHRLICH ASCITES
 TUMOR, MOUSE (0150)
 LEUKEMIA SUSCEPTIBILITY, DOWN'S
 SYNDROME, HUMAN (1834)
 LYMPHATIC LEUKEMIA, LEUKOCYTES, MOUSE,
 PIG (3906)
 LYMPHOCYTE
 DNA SYNTHESIS, INHIBITION,
 SARCOMA, HUMAN (0168)*
 TUMOR, HUMAN (0155)
 LYMPHOCYTE CYTOTOXICITY, COLON
 CARCINOMA, HUMAN (4698)
 LYMPHOCYTE REACTIVITY, SERUM, HUMAN
 (1408)*
 LYMPHOMA, TUMOR RESECTION, HAMSTER
 (0452)
 MACROPHAGE MIGRATION, ALLOGENEIC TUMOR
 ISOGENEIC TUMOR, MOUSE (4700)
 MALIGNANCY, MAN, REVIEW (2212)
 MALIGNANT BRAIN TUMORS, ANTIGENIC
 STIMULATION, HUMAN (5962)
 MALIGNANT TUMORS, REVIEW (2294)*
 MAMMARY ADENOCARCINOMA, TUMOR CELL,
 MOUSE (0490)*
 MUTATION, NEOPLASM, CHEMOTHERAPY,
 REVIEW (1522)*
 MYELOMA PROTEIN, CELL SURFACE, MOUSE
 (4702)
 MYELOMA TUMOR, BALB/C MICE (4751)*
 NEOPLASIA, HUMAN, REVIEW (2290)*
 NEUROBLASTOMA
 HUMAN, REVIEW (0902)
 LYMPHOCYTE, HUMAN (0010)*
 NONSPECIFIC, RAUSCHER LEUKEMIA VIRUS,
 GUINEA PIG (1875)*
 PATHOGENESIS, PRECANCEROUS CHANGES,
 HUMAN, REVIEW (2267)*
 PLAQUE-FORMING CELL, SPLEEN, LYMPH
 NODE, MAMMARY ADENOCARCINOMA, MOUSE
 (0758)
 RAUSCHER LEUKEMIA VIRUS, TUMOR
 RESISTANCE INDUCTION, ADULT MOUSE,
 NEWBORN MOUSE (4687)
 RECOGNITION, MAMMARY TUMOR, ENDOTOXIN,
 MOUSE (5303)
 RENAL CARCINOMA, CELLULAR, MAN (3905)
 RESPONSE, LYMPHOCYTE, LEUKEMIA, HUMAN
 (1083)*
 RNA TUMOR VIRUS ANTIGEN, MOUSE (4618)
 ROUS SARCOMA VIRUS, ONCOGENICITY,
 THYMECTOMY, QUAIL (0135)*
 SARCOMA, MELANOMA, TUMOR ANTIBODY,
 CLINICAL COURSE, HUMAN, REVIEW
 (0307)
 SKIN-GRAFT REJECTION, URETHAN,
 LYMPHOMAGENESIS, MOUSE (0755)
 SPLEEN CELL-MEDIATED CELLULAR,
 CENTRAL INHIBITION, LEUKEMIA,
 ISOANTIBODY, MOUSE (3159)
 STIMULATION, BACILLUS CALMETTE-GUERIN,
 SPONTANEOUS LEUKEMIA, POLYOMA TUMOR,
 MOUSE (1824)
 SV40, INFLUENZA VIRUS, TUMOR, MOUSE
 (0151)
 IMMUNITY - CONTINUED
 TOLERANCE
 LEUKEMIA, NEWBORN MOUSE (0325)*
 SV40, ADENO (0312)*
 TRANSPLANT RESISTANCE, LEUKEMIA, VIRUS
 INFECTION, MOUSE (5309)
 TRANSPLANTATION
 BLOCKING FACTOR, REVIEW (1509)
 ENHANCEMENT, MYCOBACTERIUM
 BUTYRICUM, MOUSE (3904)
 RAT ASCITIC TUMOR, MOUSE (5995)*
 TRANSPLANTATION ANTIGEN, TUMOR
 (0008)*
 TUMOR
 ADENOSINE 3',5'-PHOSPHATE, MOUSE
 (3836)
 ANIMAL, HUMAN, REVIEW (0612)
 BLOCKING EFFECT, COUNTERACTION,
 POLYOMA VIRUS, RAT (4612)
 CELL-MEDIATED
 MEASUREMENT, SOLUBLE TUMOR
 SPECIFIC ANTIGENS (4619)
 ONCORNAVIRUS, MOUSE (5920)
 COLON CARCINOMA ANTIGEN, SALT
 EXTRACTED, EVALUATION, HUMAN
 (4749)*
 CYTOSTATIC ANTIBODY, SV40, RAT
 (1042)
 HUMAN, REVIEW (0908)
 RESISTANCE, CORYNEBACTERIUM PARVUM
 TREATMENT, MOUSE (6015)*
 REVIEW (2297)*
 RNA-MEDIATED TRANSFER, RAT (1389)
 TRANSPLANTATION ANTIGEN (0030)*
 TUMOR-ASSOCIATED, ENHANCEMENT,
 MYCOBACTERIUM BUTYRICUM, RAT (3156)
 TUMOR-ASSOCIATED ANTIGEN, VIRUS,
 REVIEW (0626)*
 TUMOR CELL, DISRUPTION, VACCINE,
 ADENOVIRUS, HAMSTER (0415)
 TUMOR GROWTH, ALLOGRAFT, RADIATION,
 MOUSE (0463)
 TUMOR GROWTH STIMULATION, REVIEW
 (5711)
 TUMOR INHIBITION, MATERNAL IMMUNIZA-
 TION, ADENOVIRUS 12, PROTEINS,
 HAMSTER (1805)
 TUMOR SPECIFIC
 FETAL TISSUE, HAMSTER (1063)
 GROWTH SUPPRESSION, MYCOBACTERIUM
 BOVIS INOCULATION, MOUSE (4746)*
 3-METHYLCHOLANTHRENE, TUMOR CELL,
 MOUSE (0854)
 NONTUMORIGENIC TUMOR CELL, ASCITES

- TUMOR, MOUSE (3885)
TUMOR-SPECIFIC TRANSPLANTATION
ANTIGEN
REVIEW (0608)
SCHMIDT-RUPPIN ROUS SARCOMA VIRUS,
RAT (0474)
TUMOR SUPPRESSION, BACILLUS CALMETTE-
GUERIN, CELL WALL, OIL DROPLET,
HEPATOMA, GUINEA PIG (3877)
VACCINE BACILLUS CALMETTE-GUERIN,
HEPATOCELLULAR CARCINOMA, GUINEA PIG
(4655)
VIRUS, MACROPHAGE, REVIEW (1230)*
IMMUNIZATION
AUTOLOGOUS TUMOR CELLS, CANCER PATIENT
(5983)*
BACILLUS CALMETTE-GUERIN, LEUKEMIA,
HUMAN (1781)
DOUBLE, ADENOVIRUS TYPES 1,3, RABBIT
(6002)*
IN VITRO, THYMOCYTE, CYTOTOXICITY,
TUMOR PROTECTION, MOUSE (4667)
LYMPHOMA CELL, CHEMICAL MODIFICATION,
MOUSE (1816)
MASTOCYTOMA CELL, CYTOLYTIC LYMPHOID
CELL, INDUCTION, MOUSE (1811)
PASSIVE, LYMPHOMA, ANTISERA, MOUSE
(4701)
RADIATION, MALIGNANT MELANOMA, CYTO-
TOXIC REACTION, LYMPHOCYTE, HUMAN
(0168)*
SALMONELLA, RESISTANCE, EHRlich
ASCITES TUMOR, MOUSE (1081)*
SV40 VIRUS, ROUTE OF INOCULATION,
HAMSTER (3886)
YOSHIDA ASCITES, HEPATOMA, MOUSE
(0172)*
IMMUNOCOMPETENCE
AMYLOIDOSIS, REOVIRUS, MOUSE (1368)*
IMMUNOSUPPRESSION
ACUTE LEUKEMIA, HUMAN (1395)*
LEUKEMIA INDUCTION, VIRUS, MOUSE
(1785)
LYMPH NODE, MAMMARY CARCINOMA, HUMAN
(1788)
IMMUNOCYTOLOGY
MYELOMA, PHAGOCYTTIC CELL FACTOR,
GROWTH REQUIREMENT, MOUSE (5302)
IMMUNOCYTOMA
MONOCLONAL PROTEINS, RAT (6012)*
IMMUNODEFICIENCY
CARCINOMA, INCIDENCE, HUMAN (0024)*
IMMUNODEPRESSION
ANTINUCLEAR ANTIBODY, INHIBITION,
RAUSCHER LEUKEMIA VIRUS, MOUSE
(4559)
FRIEND AND RILEY VIRUSES, CONTACT
SENSITIVITY, MOUSE (5375)*
GRAFFI LEUKEMIA VIRUS, MOUSE (5322)
LEUKEMOGENESIS, URETHAN, N-NITROSO-
METHYLUREA, MOUSE (1610)*
IMMUNOELECTROPHORESIS
PROTEINS, LIVER AND HEPATOMA, RAT
(4732)*
IMMUNOFLOUORESCENCE
ADENOVIRUS TYPE 12, ARGININE
DEPRIVED CELLS (2587)*
AUTOANTIBODIES, ANTIGENS, LEUKEMIA,
CHILDREN (2682)*
COLONIC POLYP, HUMAN (4624)
CONCAVALIN A BINDING, TRANSFORMED
CELL, MOUSE (1830)
DETECTION OF HERPESVIRUS ANTIGENS,
LUCKE RENAL ADENOCARCINOMA, FROG
(3035)
ALPHA-FETOPROTEIN, PRIMARY LIVER
NEOPLASM, HUMAN (4713)*
FRIEND VIRUS, INFECTED CELL, TUMOR,
RAT (1321)*
INDIRECT, HERPES SIMPLEX, TYPE
DIFFERENTIATION, HAMSTER (0711)
INTRACELLULAR MACROGLOBULIN, CHRONIC
LYMPHOCYTIC LEUKEMIA, HUMAN (4716)*
LYMPH NODES, LEUKEMIA, CATTLE (4717)*
SERUM, MAMMARY CARCINOMA, HUMAN (1802)
IMMUNOGENICITY
ANTIGENS BOUND TO MACROPHAGES,
LYMPHOCYTES, THYMOCYTES AND
HEPATOMA CELLS (4744)*
EHRlich ASCITES CELL, HEAT TREATMENT,
MOUSE (5987)*
LEUKEMIA, NEURAMINIDASE, MOUSE (4653)
LEUKEMIA ISOTRANSPLANT SYSTEM,
CELLULAR AND CELL-FREE PREPARATIONS,
MOUSE (3923)*
LEUKEMIA VIRUS, MOUSE (1047)
MECHANISM, IMMUNOLOGICAL TEMPLATE,
ANTIBODY RNA (1858)*
OSTEOSARCOMA, RADIATION, MOUSE (3896)
SYNGENEIC TUMOR CELLS, MOUSE (1817)
TUMOR CELL HOMEGENATES, INFLUENZA
VIRUS, MOUSE (2655)*
IMMUNOGLOBULIN
ACUTE LEUKEMIA, CLINICAL FACTOR, CHILD
(1399)*
ALPHA GLOBULIN
EMBRYO SPECIFIC, RETROPERITONEAL
TERATOBLASTOMA (2659)*
SERUM, TUMOR-BEARING HOST, HUMAN
(1402)
H-2 ANTIGEN, MODULATION, MOUSE (1845)*
ANTIGENIC REACTION, GROUP-SPECIFIC,
INTERSPECIES SPECIFIC, C-TYPE VIRUS
(3875)
BIOSYNTHESIS, MYELOMA, MOUSE (0783)*
CARCINOMA, CERVIX, HUMAN (3932)*
CONTACT REGIONS, DINITROPHENYL AND
MENADION HAPTENS, ANTIBODY HETERO-
GENEITY, MOUSE (2664)*
CONTENT, PLASMOCYTOMA (2661)*
CONTROL MECHANISMS, PLASMOCYTOMA,
CLINICAL STUDY (6044)*
DETERMINATION, PARAPROTEINEMIA,
LYMPHOGRANULOMATOSIS,
LYMPHORETICULOSARCOMA, HUMAN (1857)*
DISTRIBUTION, LYMPHOCYTE, HYPERGAMMA-
GLOBULINEMIA, IMMUNE DEFICIENCY,
CHRONIC LYMPHATIC LEUKEMIA, HUMAN
(1376)*
G, ANTIBODY ACTIVITY, IGM, LEUKEMIA,
HUMAN (5311)
G, FREE KAPPA-CHAIN SYNTHESIS,
LYMPHOMA CELLS, MYELOMA CELLS, MOUSE
(3168)
GAMMA A1, DISULPHIDE BRIDGE, HUMAN
(0171)*
GAMMA FRACTION, BLOOD SERUM, LYMPHATIC
LEUKEMIA, LYMPHOSARCOMA, HUMAN
(5290)
GAMMA G, CATABOLISM, MYELOMA PROTEIN,
HUMAN, MONKEY (4699)
GAMMA G SUBFRACTION, MYELOMA, HUMAN
(0174)*
GAMMAGLOBULIN, ALTERATIONS, LEUKEMIA,
SERUM, CHILDREN (5999)*
GAMMA GLOBULIN-CARRYING CELLS,
AUTOIMMUNE DISEASE, NZB MICE (3185)
HEAVY CHAIN IGA VARIANT, MYELOMA,

MOUSE (6023)*
 HEAVY CHAINS, SEQUENCE RELATIONSHIPS,
 VARIOUS MAMMALIAN SPECIES (4754)*
 HYPERGAMMAGLOBULINEMIA, ALEUTIAN
 DISEASE, MINK (1432)
 HYPERIMMUNE 7S, KINETIC STUDY, TUMOR
 BEARING RATS (2708)*
 IGA
 IMMUNE RESPONSE, H-2 ANTIGEN,
 GENETIC CONTROL, MOUSE (1813)
 INTERCHAIN DISULFIDE BOND FORMA-
 TION, MYELOMAS, MOUSE (5374)*
 MYELOMA, CASE REPORT (0778)*
 PEPSIN FRAGMENTS, HAPTEN BINDING,
 X-RAY CRYSTALLOGRAPHY, MOUSE
 (6021)*
 IGA DISEASE, FACIAL CUTANEOUS TUMOR,
 HUMAN (0177)*
 IGA MYELOMA PROTEIN, STRUCTURAL
 CHARACTERISTICS, MOUSE (1866)*
 IGA PROTEIN, 2,4-DINITROPHENYL-LYSINE,
 OPTICAL ACTIVITY, MYELOMA, MOUSE
 (0178)*
 IGE
 CANCER PATIENT, SERUM (5334)
 MYELOMA, PROTEIN, HUMAN (0748)
 SYNTHESIS, SECRETION, MYELOMA
 CELL, HUMAN (1809)
 IGG, NONSPECIFIC MYELOMA PROTEIN,
 SPECIFIC ANTIGENIC DETERMINANT,
 HUMAN (2611)
 IGG DETECTION, LYMPHOCYTES, SPLEEN AND
 LYMPH NODES, MOUSE (5365)
 IGG MYELOMA, PAPAIN SUSCEPTIBILITY
 (2668)*
 IGG MYELOMA PROTEIN, ANTIBODY
 SPECIFICITY, HUMAN (1838)
 IGG2, TUMOR ELUATE, TUMOR TRANSPLANTA-
 TION, MOUSE (3862)
 IGG2 FC REGION, TUMOR ENHANCEMENT,
 MOUSE (4668)
 IGM, KAPPA CHAIN, ISOLATION, BURKITT
 LYMPHOMA, HUMAN (1380)
 IGM HEAVY CHAIN, WALDENSTROM'S
 MACROGLOBULINEMIA, LEUKEMIA, CASE
 REPORT (0773)*
 IGM-KAPPA, BURKITT LYMPHOMA, CELL
 SURFACE (1058)
 KAPPA CHAIN, PURIFICATION, CHEMICAL
 CHARACTERIZATION, RAT (6010)*
 KREBS II ASCITES, MESSENGER RNA TRANS-
 LATION, CELL-FREE SYSTEM (4189)*
 LEUKEMIA, CHILDREN (5960)
 LEUKEMIC PATIENTS, CLINICAL STUDY
 (4708)*
 LYMPHOCYTE, HUMAN (1407)*
 LYMPHOCYTE SURFACE
 CHARACTERISTICS, PLASMACYTOMA,
 MOUSE (4765)*
 HODGKIN'S DISEASE, HUMAN (4712)*
 MALIGNANT DYSGAMMAGLOBULINEMIA,
 MYELOMA, REVIEW (1222)*
 MALIGNANT LYMPHOGRANULOMATOSIS,
 THYMOMA, HUMAN (5326)
 MELANOMA, CELL MEMBRANE, IMMUNO-
 FLUORESCENCE, HUMAN (6036)*
 MEMBRANE, PERIPHERAL BLOOD LYMPHOCYTE,
 HODGKIN'S DISEASE PATIENTS (6031)*
 MEMBRANE-BOUND MONOCLONAL, CHRONIC
 LYMPHOCYTIC LEUKEMIA (3900)
 MEMORY, IMMUNOSUPPRESSION, RAUSCHER
 LEUKEMIA VIRUS, MOUSE (0700)
 MONOCLONAL, MYELOMA, WALDENSTROM'S
 MACROGLOBULINEMIA, ABSENCE (1873)*
 MONOCLONAL IGA PROTEIN, CHEMICAL
 STRUCTURE, HUMAN (0176)*
 MU, KAPPA, CELL SURFACE, CHRONIC
 LYMPHOCYTIC LEUKEMIA, HUMAN
 (0464)
 MUTATION, MYELOMA, MOUSE (0180)*
 MYELOMA, KAHLER'S DISEASE, REVIEW
 (2233)*
 IMMUNOGLOBULIN - CONTINUED
 NASOPHARYNGEAL CARCINOMA, BURKITT
 LYMPHOMA (1052)
 PAPAIN FRAGMENT, VH REGION, IGG3
 MYELOMA PROTEIN, HUMAN (4738)*
 PARAPROTEIN, PHYSICAL ABNORMALITIES,
 CHEMICAL ABNORMALITIES, CASE REPORTS
 (6020)*
 PRODUCTION
 LYMPHOID TISSUE, NORMAL, MALIGNANT
 CELL LINE ESTABLISHMENT, HUMAN
 (2613)
 MOLONEY LEUKEMIA VIRUS PRODUCTION,
 INFECTED CELL, RAT (1771)*
 RECEPTOR
 B LYMPHOCYTE, PLASMACYTOMA, MOUSE
 (3853)
 LEUKEMIA, LYMPHOMA, MOUSE (3184)
 MASTOCYTOMA CELL, MOUSE (3180)
 SERUM LEVELS, PROSTATE CARCINOMA,
 HUMAN (2626)
 SPONTANEOUS LYMPHOMAS, MOUSE (5991)*
 A-STRUCTURE, INTERCHAIN DISULFIDE
 BRIDGES, MYELOMA PROTEIN (2674)*
 SURFACE, BLOOD LYMPHOCYTE, CHRONIC
 LYMPHOCYTIC LEUKEMIA, HUMAN (1829)
 SYNTHESIS
 BURKITT'S LYMPHOMA, HUMAN (4690)
 ZONAL CENTRIFUGATION, ASCITES
 MYELOMA CELLS, MOUSE (6343)*
 X-IRRADIATION, HUMAN MYELOMA (2656)*
 IMMUNOLOGIC DISORDER
 GASTRIC, CARCINOMA, HUMAN (2024)*
 IMMUNOLOGY
 ACUTE LEUKEMIA, CHILDREN (5391)*
 ALTERATION, LYMPHOGRANULOMATOSIS,
 REVIEW (2260)*
 ANTIBODY RESPONSE, MURINE LEUKEMIA
 VIRUS, SPONTANEOUS INFECTION, MOUSE
 (3852)
 ANTIGEN, HEPATITIS-ASSOCIATED (1953)
 ASTROCYTOMA, ANTIGEN SPECIFICITY,
 IN VITRO (3929)*
 BETA 1 A/C CONCENTRATION, MALIGNANT
 LYMPHOMA, MYELOMA, WALDENSTROM'S
 DISEASE, SERUM, HUMAN (5354)
 CANCER
 IMMUNOTHERAPY, HUMAN, REVIEW
 (5063)*
 LYMPHOCYTE TRANSFORMATION, IN
 VITRO, HUMAN (3925)*
 MOUSE, REVIEW (2914)*
 REVIEW (2254)*, (2262)*
 CARCINOEMBRYONIC ANTIGEN, FECES, HUMAN
 (2621)
 CELL MEDIATED, TUMOR, REVIEW (2245)*
 CIRCULAR DICHROISM STUDY, HAPTEN
 INTERACTION, MYELOMA PROTEINS,
 ANTIBODIES, MOUSE (4753)*
 CROSS-IMMUNITY, MALIGNANCIES, HUMAN
 (2619)
 CROSS-REACTIVITY OF ANTIGENS, TUMOR
 AND FETAL CELLS, MOUSE (5388)*
 CYTOMEGALOVIRUS INFECTION, LEUKEMIA,
 CHILDREN (4063)*
 DIGESTIVE TRACT TUMORS, CLINICAL STUDY

(6042)*
 ENHANCED TUMOR CELL ANTIGENICITY,
 PAPAN TREATMENT (2666)*
 EYE CANCER, HUMANS (3914)*
 FLOCCULATION REACTION, ANTIGEN,
 LEUKEMIA (2713)*
 GASTRIC CARCINOMA, GLYCOPROTEIN,
 ELECTROPHORESIS (2711)*
 GESTATIONAL CHORIOCARCINOMA, INVASIVE
 MOLE, REVIEW (5759)*
 GLOBULIN LEVELS
 LYMPHOBLASTIC, LEUKEMIA, CHILDREN
 (2714)*
 LYMPHOGRANULOMA, CHILDREN (2715)*
 GROSS VIRUS LEUKEMIA, DNA SYNTHESIS,
 MOUSE (3919)*
 HAMSTER-SPECIFIC SARCOMA VIRUS,
 HARVEY MURINE SARCOMA, GROUP
 SPECIFIC ANTIGEN (0767)
 HAPTEN ISOLATION, NEOPLASM, RABBIT
 (3850)
 HEPATOMA, ALDOLASE A, RAT (1949)
 HERPES SIMPLEX VIRUS, TYPES 1 AND 2
 DIFFERENTIATION, IN VITRO (4581)*
 HISTOCOMPATIBILITY SYSTEMS, CANCER,
 REVIEW (5727)*
 HODGKIN'S DISEASE
 CHRONIC LYMPHOID LEUKEMIA, MYELOMA
 HUMAN, REVIEW (2202)
 MAN, ANTIGEN (0480)
 HOST RESISTANCE, FREUND'S ADJUVANT,
 PRETREATMENT, NEOPLASM, MOUSE (3839)
 HOST-ALLOGRAFT RELATIONSHIPS, TUMORS,
 LYMPHOID CELLS, MOUSE (5989)*
 HYBRID RESISTANCE, HEMATOPOIETIC CELLS
 MOUSE (2665)*
 HYPERSENSITIVITY RESPONSE, CANCER,
 COLON, HUMAN (3933)*
 IMMUNE CYTOLYSIS, X-RAY CYTOLYSIS,
 HAMSTER CELL (5864)
 IMMUNE DEFENSE AGAINST CANCER, TUMOR
 STUDIES, HUMAN (4638)
 IMMUNE MACROPHAGES, SARCOMA I CELLS,
 INTERACTION IN PERITONEAL CAVITY,
 ULTRASTRUCTURE, MOUSE (2673)*
 IMMUNE MECHANISM, DIETARY STIMULATION
 (2689)*
 IMMUNE RESPONSE
 ANTIBODY-MEDIATED SUPPRESSION,
 MOUSE (2690)*
 CELL-TO-CELL INTERACTION, THYMUS-
 DERIVED CELLS (2629)
 EFFECT OF DRUGS, CYTOTOXICITY,
 TEST, MOUSE (4759)*
 EHRlich ASCITES TUMOR, CLOSTRIDIUM
 BUTYRICUM, MOUSE (3220)*
 GENETIC CONTROL, ANTIBODY RESPONSE
 THYMECTOMY, MOUSE (4670)
 HISTOCOMPATIBILITY ANTIGENS,
 RELATIONSHIP, MOUSE, GUINEA PIG
 (2686)*
 IMMUNOLOGICAL MEMORY, ALKYLATING
 AGENTS, RADIATION, MOUSE (5968)
 LEUKEMIA, CAT (5292)
 MORPHOLOGICAL EVIDENCE, BREAST
 CANCER, REVIEW (2211)
 NEOPLASMS, HUMAN, REVIEW (5049)*
 POLYINOSINIC POLYCYTIDYLIC ACID,
 MOUSE (2637)
 PRIMARY, ACUTE BOVINE LYMPHOCYTIC
 LEUKEMIA, ANTIBODY, E. COLI, COW
 (3197)
 RADIATION-RESISTANT A CELL, SHEEP
 ERYTHROCYTES, MOUSE (3176)

SPONTANEOUS AND CHEMICALLY INDUCED
 TUMORS, MOUSE (5293)
 TUMOR-BEARING MICE (4747)*
 TUMOR CELL KILLING, KINETICS,
 MOUSE (4741)*
 TUMOR CELLS, HUMAN, REVIEW (5066)*
 VIRUS, DISEASE, HUMAN (6013)*
 YOSHIDA HEPATOMA ASCITES TRANS-
 PLANT, RAT (5364)
 IMMUNE RESPONSE DEPRESSION,
 PRECANCEROUS CONDITIONS, REVIEW
 (2907)
 IMMUNOCOMPETENT CELL SEPARATION,
 HEMOPOIETIC CELL SUSPENSIONS,
 VELOCITY SEDIMENTATION, HUMAN AND
 MOUSE (4726)*
 IMMUNOCYTES, TUMOR CELLS, REACTION,
 RABBIT (2707)*
 IMMUNODEPRESSION, TUMOR GROWTH, MOUSE
 (3213)
 IMMUNOGLOBULIN CONTROL MECHANISMS,
 PLASMOCYTOMA, CLINICAL STUDY (6044)*
 IMMUNOLOGIC MECHANISMS, HUMAN
 ONCOGENESIS, REVIEW (3608)
 IMMUNOLOGIC SURVEILLANCE, IATROGENIC
 ALTERATIONS, MALIGNANCY, HUMAN,
 REVIEW (5728)*
 IMMUNOPROLIFERATIVE DISORDERS,
 LYMPHOCYTE TRANSFORMATION, PHYTO-
 HEMAGGLUTININ, HUMAN (4641)
 IMMUNOREGULATION, MALIGNANT LYMPHOMAS,
 ONCOGENIC VIRUSES, HUMAN, REVIEW
 (5745)*
 IMMUNOSUPPRESSION, TUMOR GROWTH,
 TUMORIGENESIS, REVIEW (5761)*
 IMMUNOTHERAPY, CANCERS (4725)*
 INTERFERENCE, ROUS SARCOMA VIRUS,
 TUMORIGENESIS, RAT (2625)
 IMMUNOLOGY - CONTINUED
 LEUKEMIA
 CANDIDIASIS, HUMAN (4086)*
 EFFECT OF VIBRIO CHOLERAE
 NEURAMINIDASE, IN VITRO (4719)*
 MOUSE (4718)*
 LYMPHOBLASTIC LEUKEMIA, HYDROCORTISONE
 IN VITRO (4736)*
 LYMPHOCYTES, CYTOTOXIC, MELANOMA,
 HUMAN (2710)*
 LYMPHOGRANULOMATOSIS, HUMAN (6050)*
 LYMPHOID CELL LINES, IMMUNOGLOBULIN
 BIOSYNTHESIS, HUMAN (2695)*
 MALIGNANT MELANOMA, IMMUNOFLOUORESCENCE
 (5392)*
 MAMMARY GLAND CANCER, MOUSE, REVIEW
 (3606)
 MAMMARY GLAND TUMOR, ASCITES TUMOR,
 ANTIGEN CROSS-REACTIVITY, MOUSE
 (3930)*
 MIXED LYMPHOCYTE TUMOR REACTION,
 ANTIGEN DETECTION IN VITRO, NORMAL
 CELLS, NEOPLASTIC CELLS, RAT (6043)*
 MOLONEY SARCOMA, STRESS, MOUSE (3920)
 MYELOMA (0489)*
 NASOPHARYNGEAL CARCINOMA, HUMAN,
 REVIEW (3609)
 NEOPLASIA, HUMAN, EXPERIMENTAL,
 REVIEW (0606)
 NEOPLASTIC DISEASES, BLASTIC TRANS-
 FORMATION, LYMPHOCYTES, HUMAN,
 REVIEW (5044)*
 ONCOGENESIS, METHYLCHOLANTHRENE, MOUSE
 (2622)
 PERITONEAL CELLS, MIGRATION INHIBITION
 GUINEA PIG (2660)*

*INDICATES A PLAIN CITATION WITHOUT ACCOMPANYING ABSTRACT

POST-BIOPSY BREAST CARCINOMA, HUMAN (2649)
 PRECANCEROUS CELL, MORPHOLOGY, REVIEW (1512)
 PRIMARY IMMUNE RESPONSE, STIMULATION FACTOR, IN VITRO (4656)
 RECENT ADVANCES, REVIEW, CANCER (0612)
 REGIONAL LYMPH NODES, SIMULATED COLON CARCINOMA, RABBIT (4742)*
 REVERSE TRANSCRIPTASE, IMMUNOLOGICAL MARKER, MONKEY (5970)
 RICINUS COMMUNIS, AGGLUTINATION (2651)*
 RNA TUMOR VIRUS, EMBRYOGENESIS, TUMORIGENESIS (0308)
 ROUS VIRUS, MOUSE (1840)
 TRANSPLANTED MELANOMA, MOUSE (0487)*
 TROPHOBLASTIC TUMOR, HAMSTER (1390)
 TUMOR
 CELL MEMBRANE CHANGES, PROTEOLYTIC ENZYMES, REVIEW (5029)
 HUMAN
 ESCAPE MECHANISMS (0020)*
 REVIEW (5712)
 PROSPECTIVES, REVIEW (2296)*
 REVIEW (2244)*
 TUMOR CELL, ANTIGENICITY, RAT (6004)*
 TUMOR CELL DETECTION, DEXTRAN, SHEEP RED BLOOD CELLS (4758)*
 TUMOR PATHOLOGY, REVIEW (2295)*
 TUMOR SPECIFIC ANTIGENS, CARCINO-EMBRYONIC ANTIGEN, ALPHA-FETOPROTEIN (4730)*
 TUMOR TISSUE, MOUSE (3931)*
 TUMORIGENESIS, REVIEW (5068)*
 UTERINE CERVIX, CARCINOMA, PROTEIN STRUCTURE, HUMAN (5295)
 VIRAL, ANTIBODY, ANTIGEN, TRANSFORMED SV40, HAMSTER (2712)*
 IMMUNOPROTECTION
 LEUKEMIA, FREUND'S ADJUVANT, GUINEA PIG (1852)*
 IMMUNOSUPPRESSION
 ACRIDINE, ACRIDONE DERIVATIVES (2615)
 ACUTE VIRUS INFECTION, IMMUNE RESPONSE ASSESSMENT (1854)*
 ANTIBODY
 MALIGNANT MELANOMA, HUMAN (0179)*
 MAMMARY TUMOR VIRUS, MOUSE (3857)
 ANTIGEN CHALLENGE, LYMPHOSARCOMA, MOUSE (5341)
 ANTILYMPHOCYTE GLOBULIN, CARCINOMA CELL TUMORIGENICITY, MONKEY, HUMAN (3872)
 ANTILYMPHOCYTE SERUM, PROCARBAZINE, RETICULUM CELL SARCOMA, MOUSE (0169)*
 ANTITUMOR AGENTS, CARCINOGENICITY, EXPERIMENTAL STUDIES (2440)*
 BISDIOXOPIPERAZINE, MOUSE (3901)
 CARCINOGENESIS
 REVIEW (2272)*
 VIRAL, CHEMICAL, ORGAN TRANSPLANT (0001)
 CELL-MEDIATED, SPLEEN CELLS, MOUSE (4752)*
 CHROMATIN FRACTION, NUCLEI, EHRLICH ASCITES TUMOR CELLS, MOUSE (5368)*
 CYCLOPHOSPHAMINE, ANTIBODY PLAQUE-FORMING SPLEEN CELLS, HEMOLYTIC ANTIBODIES, MOUSE (6019)*
 FRIEND LEUKEMIA VIRUS
 ANTIBODY FORMATION, MOUSE (1375)
 RESISTANCE, MOUSE (5352)
 GRANULOMA DEVELOPMENT ADJUVANT-INDUCED, MOUSE (4636)
 GROSS LEUKEMIA VIRUS, POLYINOSINIC-POLYCYTIDYLIC ACID, MOUSE (1853)*
 IGG2 FC REGION, TUMOR ENHANCEMENT, MOUSE (4668)
 IMMUNOCOMPETENCE
 ACUTE LEUKEMIA, HUMAN (1395)
 LEUKEMIA INDUCTION, VIRUS, MOUSE (1785)
 IMMUNOGLOBULIN MEMORY, RAUSCHER LEUKEMIA VIRUS, MOUSE (0700)
 INTERFERON, VIRUS, REVIEW (2208)
 LEUKEMIA, CAT (5292)
 LEUKEMIA, MOUSE (0167)*
 LEUKOCYTE MIGRATION, FRIEND LEUKEMIA VIRUS, MOUSE (4574)
 3-METHYLCHOLANTHRENE, SKIN CARCINOMA, MOUSE (1388)
 MURINE LEUKEMIA VIRUS, INFECTION, MECHANISM (0478)
 ORGAN TRANSPLANT, CANCER, REVIEW (0914)*
 PLAQUE-FORMING CELL, RADIATION LEUKEMIA VIRUS, LEUKEMIA, MOUSE (0751)
 RENAL MALIGNANCY, RENAL TRANSPLANTATION, HUMAN (4276)*
 SKIN CANCER, HUMAN (2642)
 SPONTANEOUS MAMMARY TUMORS, MOUSE (0747)
 TUMOR TRANSPLANTATION, HUMAN RECIPIENT, REVIEW (0904)
 URETHANE, RAT (3921)*
 VIRUS INFECTION, REVIEW (1379)
 IMMUNOSUSCEPTIBILITY
 MAMMARY CARCINOMA CELL, SUBLINE, TRANSPLANTABILITY, MORPHOLOGY, KARYOTYPE, MOUSE (3851)
 IMMUNOTHERAPY
 BCG, FRIEND DISEASE, MOUSE (3161)
 CANCER, IMMUNOLOGY, HUMAN, REVIEW (5063)*
 CANCER TREATMENT, HUMAN, REVIEW (4336)*
 HUMAN CANCER (0020)*
 IMMUNOLOGY, CANCERS (4725)*
 LEUKEMIA, ROUTE OF ADMINISTRATION, IMMUNOLOGICAL STIMULANTS, MOUSE (2680)*
 TUMOR, BREAST CANCER, ANTIGEN (0016)*
 INDENOINDOLES
 PENTA-AND HEXACYCLIC, CARCINOGENIC NITROGEN COMPOUNDS (2444)*
 INDOLE
 5-OXO-5H-BENZO(E)ISOCROMENO(4,3-B), STRUCTURE-ACTIVITY RELATIONSHIPS, MOUSE (0338)
 URINARY BLADDER TUMORIGENESIS, HAMSTER (4376)
 INDUCTION
 ADENOCARCINOMA, MAMMARY, INTESTINAL, GENETIC FACTOR, HAMSTER (2318)
 BLADDER CANCER, N-METHYL-N-NITROSOUREA HISTOLOGY, RAT (4431)
 C-TYPE VIRUS, BROMODEOXYURIDINE, CLONAL CELL LINES, MOUSE (4523)
 DNA SYNTHESIS, MAREK'S DISEASE VIRUS, ONCOGENICITY, BIRD (4586)*
 FOCUS-FORMING VIRUS, 5-BROMODEOXY-URIDINE, MURINE SARCOMA VIRUS-INDUCED (3665)
 HEPATOMA, N-2-FLUORENYLACETAMIDE, CELL LOSS AND PROLIFERATION, LIVER,

- RAT (4434)
HYPERPLASIA, SALIVARY GLAND ISOGRAFTS,
MOUSE (4463)*
IMMUNOLOGIC, MALIGNANT LYMPHOMA,
GENETIC FACTORS, GRAFT-VS-HOST MODEL
(4628)
INTERFERON, TILORONE HYDROCHLORIDE,
NORMAL, LEUKEMIC LYMPHOCYTE CULTURES
HUMAN (6308)*
INTERSTITIAL CELL TUMORS, CADMIUM
CHLORIDE, TESTES, RAT (5132)
LIVER TUMOR, NITROSAMINES, FISH
(2324)
LUNG CANCER, N-NITROSOHEPTAMETHYLENE-
IMINE, RAT (5113)
LUNG CARCINOMA, DIETHYLNITROSAMINE,
INFLUENZA VIRUSES, MOUSE (5079)
MALIGNANT TUMOR
7,12-DIMETHYLBENZ(A)ANTHRACENE,
OVARY, RAT (5858)*
N-ISOPROPYL-ALPHA-2-(METHYL-
HYDRAZINE)-P-TOLUAMIDE HYDRO-
CHLORIDE, RAT (5812)*
NERVOUS SYSTEM TUMORS, PHENYL-
DIMETHYL-TRIAZENE, RAT (5111)
ORNITHINE DECARBOXYLASE
CULTURED HEPATOMA CELLS, RAT
(6293)*
PHYTOHEMAGGLUTININ, CULTURED
LYMPHOCYTES, HUMAN (6294)*
OSTEOSARCOMAS, MOUSE (3765)
OVARIAN TUMOR, 7,12-DIMETHYLBENZ(A)
ANTHRACENE, HAMSTER (2307)
PHAGE, BENZO(A)PYRENE, STREPTOCOCCUS
PYOGENES (2390)*
RENAL STRUCTURE, CONGENITAL NEPHROMA,
HUMAN (1885)
SPECIFIC TUMOR IMMUNITY, TUMOR GROWTH
SUPPRESSION, MYCOBACTERIUM BOVIS
INOCULATION, MOUSE (4746)*
THYROID TUMOR, METHYLCHOLANTHRENE,
C-CELLS, RAT (5090)
TUMOR
BOVINE ADENOVIRUS TYPE 3
BIOLOGICAL PROPERTIES,
MORPHOLOGY, HAMSTER (5945)*
HAMSTER (5939)*
BRAIN, KIDNEY, N-NITROSOBUTYLUREA,
RAT (4422)
CELO VIRUS, TUMOR TISSUE, TUMOR
CELLS, MORPHOLOGY, HAMSTER
(3130)
FELINE SARCOMA VIRUS, MONKEY
(4524)
MURINE SARCOMA VIRUS, POLYRIBINO-
SINIC-POLYRIBOCYTIDYLIC ACID,
MOUSE (3764)
SIMIAN ADENOVIRUS SA7(C8), HAMSTER
(5938)*
TYROSINE AMINOTRANSFERASE, HEPATOMA
CHEMICAL, RAT (1964)
URINARY BLADDER TUMOR,
BUTYL(3-CARBOXYPROPYL)NITROSOAMINE,
RAT (4470)*
INFANT
EMBRYONAL DEVELOPMENT, CARCINOGENESIS,
REVIEW (0618)*
INFECTION
BESNOITIA JELLISONI, TOXOPLASMA
GONDII, TUMOR RESISTANCE, MOUSE
(1799)
EPSTEIN-BARR VIRUS, LYMPHOBLASTOID
CELL, HUMAN (4575)
HERPES SIMPLEX VIRUS, HERPES GENITALIS
VIRUS, CYTOLOGICAL CHANGES, HUMAN
CELL (1024)
INHIBITION, RIFAMPIN, ROUS SARCOMA
VIRUS, CHICK CELL (0422)
MURINE LEUKEMIA VIRUS, FRIEND VIRUS,
FRACTION, MOUSE CELL (4521)
NATURAL, MURINE LEUKEMIA VIRUS,
QUANTITATION, MOUSE (1711)
OCULAR HERPES SIMPLEX VIRUS,
INHIBITION, BURKITT'S LYMPHOMA CELLS
HUMAN (1725)
POLYOMA VIRUS
DNA, HOST DNA, HIGH TEMPERATURE,
MOUSE (1760)
VIRUS PRODUCTION TIME COURSE,
MOUSE (5261)
REQUIREMENT, MURINE LEUKEMIA VIRUS,
MURINE SARCOMA VIRUS, MOUSE EMBRYO
CELL (1329)
RESISTANCE, SV40, MONKEY CELL (5879)
ROUS SARCOMA VIRUS, RNA-SENSITIVE DNA
POLYMERASE, RAT CELL (1745)
SV40
DNA SYNTHESIS REINITIATION,
HAMSTER (1751)
NUCLEOPROTEIN COMPLEX, MONKEY
(1348)
PROTEIN SYNTHESIS, MONKEY (5263)
TEMPERATURE-SENSITIVE MUTANT,
MONKEY CELL (4542)
SV40-RELATED, HUMAN, REVIEW (3612)
INFECTIOUS BOVINE RHINOTRACHEITIS
HERPESVIRUS, ANTIGENIC RELATIONSHIPS,
MAREK'S DISEASE, BURKITT'S LYMPHOMA
(4611)
INFECTIOUS MONONUCLEOSIS
ACUTE LEUKEMIA, SIMULTANEOUS
OCCURRENCE, CASE REPORT (4545)
ACUTE LYMPHOCYTIC LEUKEMIA,
EPSTEIN-BARR VIRUS ANTIGEN, HUMAN
(5402)
EPSTEIN-BARR VIRUS
CAPSID ANTIGEN, ANTIBODY, HUMAN
(3042)
HUMAN, REVIEW (5738)*
IGM (5977)
VIRAL CAPSID ANTIGEN, EARLY VIRAL
ANTIGEN, ANTIBODY, HUMAN (0456)
IGM ANTIBODIES, EPSTEIN-BARR VIRUS
(6025)*
LYMPHOPROLIFERATIVE DISEASE,
RELATIONSHIP, REVIEW (2232)*
INFECTIVITY
ADENOVIRUS, HUMAN (0734)*
IN VITRO, CHICKEN EMBRYO LETHAL ORPHAN
VIRUS, MONKEY, HAMSTER (0111)
INFILTRATION
LIVER, SPLEEN, LEUKEMIC CELL, HUMAN
(0271)*
INFLUENZA
PREGNANCY, LYMPHATIC CANCERS,
INCIDENCE, ENGLAND (6083)
INSECTICIDE
ALDRIN, DIELDRIN, BLOOD, HUMAN (0647)*
ODT, ANTITUMORIGENIC EFFECT, MOUSE
(0648)*
ENDRIN, HYPERPLASIA, TROUT (0668)*
INSULIN
DEPRIVATION, EFFECT ON GROWTH,
MAMMARY CARCINOMA, ALLOXAN DIABETES,
RAT (2993)
ENERGY METABOLISM, GRANULOMA TISSUE,
RAT (5495)*
MAMMARY CARCINOMA GROWTH,

7,12-DIMETHYLBENZ(A)ANTHRACENE,
OOPHORECTOMY, HYPOPHYSECTOMY, RAT
(1563)

INTERFERON
ADENOVIRUS TYPE 2, INHIBITION, HUMAN,
MONKEY (1054)
ANTIBODY PRODUCTION, RAUSCHER VIRUS-
INFECTED, MOUSE (2639)
BROWN-PIERCE CARCINOMA, METASTASIS
INHIBITION, RABBIT (1164)*
CYTOTOXICITY, LYMPHOCYTES, MOUSE
(3995)
DEPRESSION OF PRODUCTION, LEUKEMIA,
MOUSE (3834)*
ENHANCEMENT OF SARCOMA AND LEUKEMIA
INDUCTION, MOUSE, RAT (4553)
IMMUNOSUPPRESSION, VIRUS, REVIEW
(2208)
INDUCERS, TUMOR GROWTH RATE ENHANCE-
MENT (4599)*
INDUCTION
CARCINOMA, POLYINOSINIC-
POLYCYTIDYLIC ACID (0021)*
F2 BACTERIOPHAGE RNA (1765)*
HERPES SIMPLEX VIRUS (3753)
TILORONE HYDROCHLORIDE, NORMAL,
LEUKEMIC LYMPHOCYTE CULTURES,
HUMAN (6308)*
INHIBITION, SOLID MALIGNANT TUMOR,
PULMONARY METASTASES, MOUSE (3341)*
LEUKOCYTE FUNCTION, LEUKEMIA, REVIEW
(0932)*
MACROMOLECULE, VIRUS (3444)*
MURINE SARCOMA VIRUS, CELL SENSITIVITY
LOSS, MOUSE (3091)
POLY I:C-INDUCED, HERPESVIRUS HOMINIS
INFECTION, MOUSE (3149)*
POLYRIBOINOSINIC ACID, POLYRIBO-
CYTIDYLIC ACID, TUMOR PROTECTION,
MOLONEY SARCOMA VIRUS, MOUSE (2497)
PRODUCTION
HERPES VIRUS, IMMUNOLOGICAL
REACTIVITY, LEUKOCYTES,
MACROPHAGES, RABBIT (5997)*
LEUKOCYTE, HODGKIN'S DISEASE,
HUMAN (1172)*
MURINE SARCOMA, NEWCASTLE DISEASE,
MOUSE (2488)
NEWCASTLE DISEASE VIRUS, HERPES-
VIRUS, MONKEY-MOUSE HYBRID CELL
(1777)*
ROUS SARCOMA VIRUS, HYALURONIC
ACID, CHICKEN CELL (1983)
RELEASE INCREASE, MORPHOLOGICAL
ALTERATION, DOUBLE-STRANDED RNA,
HUMAN CELL (1872)*
SV40, RNA TRANSCRIPTION, MONKEY
(0130)
VIRAL INHIBITOR, CHICK EMBRYO (2415)*
INTERSTITIAL
TUMOR, EXPERIMENTS, MICE (2068)*
TESTINE
ADENOMA, N,N'-2,7-FLUORENYLENEBIS-
ACETAMIDE, RAT (5089)
ANTIGEN, CANCER, CARCINOEMBRYONIC
ANTIGEN, HUMAN (4697)
ANTIGENICITY, MUCINOUS CYSTADENOMA,
OVARY, HUMAN (1846)*
BACTERIA, ESTRADIOL PRODUCTION (5182)
BENZO(A)PYRENE HYDROXYLASE, RAT
(0369)*
CARCINOMA, COLITIS, ASSOCIATION, HUMAN
(0583)*
CHRON'S DISEASE, ADENOCARCINOMA, CASE
REPORT (1149)*
CYCASIN, TARGET ORGAN SHIFT, MAMMARY
GLAND, RAT (5781)
INDUCED ADENOCARCINOMA, GENETIC
FACTORS, HAMSTER (2318)
INFLAMMATORY DISEASE, CARCINOMA
(0196)*
LARGE
CANCER, HEMMORRHAGE, ULCERATION,
HUMAN (2744)*
METACHRONOUS CANCER, HUMAN, REVIEW
(4355)*
LYMPHOMA, SPRUE (1449)*
LYMPHORETICULAR SARCOMA, CASE REPORT
(3369)*
MUCOSA, RADIATION, REGENERATION,
CELL LOSS MECHANISM (0106)*
PEYER'S PATCHES, MALIGNANT LYMPHOMA,
PATHOLOGY, MOUSE (5498)*
REGENERATION (0289)*
SMALL
ADENOCARCINOMA, METHYLNITROSOUREA,
RABBIT (5767)
CARCINOMA, HISTOLOGY, HISTOGENESIS
HUMAN (6069)*
LYMPHOSARCOMA, CLINICOPATHOLOGIC
STUDY, HUMAN (3381)*
PRIMARY TUMOR, HISTOLOGY, HUMAN
(6206)*
TUMOR, 3-2'DIMETHYLAMINOBIIPHENYL, RAT,
HUMAN (5074)
INTRAHEPATIC
TUMOR, CIRCULATORY DYNAMICS, RAT
(1970)
INVASIVE CERVICAL CARCINOMA
CHROMOSOMES, PREINVASIVE (1950)
INVASIVE MOLE
IMMUNOLOGICAL ASPECTS, REVIEW (5759)*
INVERTEBRATES
CANCEROGENESIS, EXPERIMENTAL ANIMAL,
SNAIL (1956)
IODINE
BENZO(A)PYRENE CARCINOGENICITY, MOUSE
(1577)
METHYLTHIOURACIL, THYROID TUMOR,
HAMSTER (5170)
RADIOACTIVE, RNA, MOLECULAR HYBRIDIZA-
TION EXPERIMENTS (6375)*
THYROID CARCINOGENESIS, HAMSTER
(3735)*
IODODEOXYURIDINE
BURKITT LYMPHOBLASTOID CELLS,
HYBRIDIZATION, INACTIVATED SENDAI
VIRUS, CHROMOSOME ANALYSIS,
MOUSE AND HUMAN CELL LINES (3053)
5-IODODEOXYURIDINE
C-TYPE VIRUS ACTIVATION, HUMAN (2483)
MURINE LEUKEMIA VIRUS, ACTIVATION,
5-BROMODEOXYURIDINE, MOUSE (1031)
VIRUS ACTIVATION, HUMAN (2493)
IPRONIAZID
NEUROBLASTOMA, GROWTH STIMULATION,
DOPAMINE EFFECT REVERSAL, MOUSE
(1631)*
IRON
NEOPLASTIC AND PRENEOPLASTIC LESIONS,
8-HYDROXYQUINOLINE-INDUCED SIDEROSIS
LIVER, RAT (4389)
IRRADIATION
N,N'-2,7-FLUORENYLENEBISACETAMIDE,
COCARCINOGENESIS, RAT (0941)
LYMPH NODE, BARRIER, RABBIT (2061)*
MYELOMA, ULTRASTRUCTURE, HUMAN (2028)*
OSTEOSARCOMA, HEREDITY, TRANSMISSION,

REVIEW (1518)*
 ISLET CELL
 CARCINOMA, STAINING TECHNIQUES, HUMAN (2199)*
 TUMOR
 DOPAMINE BINDING, HAMSTER (1196)*
 ULTRASTRUCTURE, HAMSTER (0868)*
 ISLET CELL TUMOR
 ADENOSINE MONOPHOSPHATE, FORMATION, DEGRADATION, HAMSTER (1459)*
 PANCREAS, CUSHING'S SYNDROME, AVASCULAR NECROSIS OF BONE, CASE REPORT (4893)*
 ISOENZYMES
 LACTATE DEHYDROGENASE, BLOOD SERUM, TUMOR TISSUE, HUMAN (2094)*
 NEOPLASMS, HEMOBLASTOSIS, HUMAN (2155)*
 ISOGRAFTS
 HYPERPLASIA, MOUSE (1993)
 ISONIASIDE
 BRONCHI, SKIN, CARCINOMA, TUBERCULOSIS HUMAN (0985)*
 ISONICOTINIC ACID HYDRAZIDE
 TUMORIGENESIS, RAT, MOUSE (0069)
 N-ISOPROPYL-ALPHA-2-METHYL-HYDRAZINE
 TUMOR TISSUE, PTERIDINE, RIBOFLAVIN, RAT (3991)
 ISOZYME
 ENZYME REGULATION, CANCER (0624)*
 ESTERASE,
 7,12-DIMETHYLBENZ(A)ANTHRACENE, SKIN, MOUSE (0960)
 LIVER, LIVER TUMOR,
 N,N'-2,7-FLUORENYLENEBIASACETAMIDE, MOUSE (1551)
 LYMPHOGRANULOMATOSIS, HUMAN (2118)*
 PYRUVATE KINASE, 3'-METHYL-4-AMINO-AZO BENZENE, LIVER, RAT (1562)
 JAAGSIEKTE
 LYMPH NODE, SERUM PROTEIN, SHEEP (4634)
 JAW
 GRANULOMA, PERIPHERAL GIANT CELL, CASE REPORTS (5405)*
 LYMPHOSARCOMA, BURKITT'S TUMOR, CASE REPORTS (6317)*
 SYNOVIAL CHONDROMATOSIS, TEMPORO-MANDIBULAR JOINT, CASE REPORTS (4889)*
 TUMORIGENESIS, TRAUMA, HUMAN (5875)*
 TUMORS, HUMAN (4873)*
 JENSON'S SARCOMA
 CARDOLIPINS, MITOCHONDRIA, MICROSOMES (5671)*
 KAHLER'S DISEASE
 MYELOMA, IMMUNOGLOBULINS, REVIEW (2233)*
 KAPOSI'S SARCOMA
 IMMUNOLOGY, PATHOLOGY, CHILDREN (4199)*
 LYMPHOCYTE TRANSFORMATION (6279)*
 MALIGNANT MELANOMA, HODGKIN'S DISEASE, COINCIDENCE, HUMAN (0585)*
 POSTMORTEM FINDINGS, DISEASE PATTERNS, WOMEN (4890)*
 SYMPTOMATOLOGY, UGANDA (0891)*
 TISSUE CULTURE (5696)*
 KARYOTYPE
 ABERRATION, EUPLOID SARCOMA, SPINAL CORD, N-METHYLNITROSOUREA, RAT (1268)
 H-2 ANTIGEN, ASCITES TUMOR, MOUSE (0753)

CHLOROMA, TRANSPLANTATION, RAT (6215)*
 E16 CHROMOSOME, MALIGNANCY, DATA PROCESSING METHOD, HUMAN (4019)
 CHRONIC MYELOGENOUS LEUKEMIA, CYTOLOGY, HUMAN (4842)
 HEPATOMA, RAT (2056)*
 LEUKEMIA, HUMAN (1179)*
 LEUKEMIA, MULTIPLE HEMOPATHIES, PARAPROTEINEMIA, CASE REPORT (4275)*
 LYMPHOID CELL LINE, VIRUS, MOUSE (5308)
 MALIGNANT CELL, HYBRID, MOUSE (0848)
 MAMMARY CARCINOMA CELL, SUBLINE, IMMUNOSUSCEPTIBILITY, MOUSE (3851)
 GUINACRINE FLUORESCENT AND GIEMSA BANDING, CHROMOSOME ANALYSIS, TRANSFORMED AND MALIGNANT CELL LINES, LIVER, RAT (5599)*
 STEMLINE ALTERATIONS, AGING, TUMOR CELLS, RAT (6295)*
 KERATINISATION
 BASAL CELL CARCINOMA, CULTURE, HUMAN (3234)
 EPITHELIOMA, RESPIRATORY METABOLISM, DMBA, MICE, REVIEW (2247)*
 KERATOACANTHOMA
 EPITHELIOMA, CASE REPORT (1906)*
 HISTOPATHOLOGY, ULTRASTRUCTURE, HUMAN (3533)*
 TUMOR, MALIGNANT TRANSFORMATION, CASE REPORT (1911)*
 VITAMIN A, ACTINOMYCIN D, SKIN, RABBIT (0869)*
 VITAMIN A, GLYCOPROTEIN SYNTHESIS, HUMAN (4378)
 KETONE
 TOSYL PHENYLALANINE CHLOROMETHYL, CARCINOGENESIS, SKIN, MOUSE (5844)*
 KIDNEY
 ADENOCARCINOMA
 HERPESVIRUS, FROG, REVIEW (5737)*
 HERPESVIRUS CONTENT, FROG (3061)
 HERPES TYPE VIRUS, FROG (5218)
 ADENOVIRUS TYPE 2 AND 4, INTERFERENCE WITH ADENOVIRUS TYPE 12, GUINEA PIG (3826)*
 BASIC LEAD ACETATE, N-NITROSODIMETHYL-AMINE, N-BUTYL-N-(4-HYDROXYBUTYL)-NITROAMINE, 3-METHYLCHOLANTHRENE, 4-NITROQUINOLINE 1-OXIDE, RAT (5183)
 CARCINOMA, PHENACETIN ABUSE, HUMAN (0973)*
 CARCINOSARCOMA, GLYCOLYSIS, OXYGEN UPTAKE, RAT, IN VIVO (4115)*
 CELL CARCINOMA, AUTOANTIBODIES, HUMAN (3203)
 CELL PROLIFERATION, LEAD ACETATE INDUCED, EFFECTS OF UNINEPHRECTOMY, RAT (2446)*
 CLEAR CELL TUMOR, HISTOPATHOLOGY, HUMAN (6266)*
 CONGENITAL NEPHROMA, RENAL STRUCTURE INDUCTION, HUMAN (1885)
 CYSTOPAPILLARY ADENOMA, SIDEROSIS, CASE REPORT (6136)*
 CYTOMORPHOLOGICAL CHANGE, MYCOTOXIN, RAT (1282)*
 EMBRYO GRAFT, TERATOCARCINOGENESIS, MOUSE (0263)*
 EPITHELIAL TUMOR, MORPHOGENESIS, DEIMTHYLNITROSAMINE, RAT (1266)
 FIBROBLAST ALTERATIONS, DIMETHYL-NITROSAMINE, RAT (4398)
 GLOMUS TUMOR, CIRCULATION, HISTOLOGY

(1912)*
GRAFTS, DONOR-CANCER DEVELOPMENT,
CASE REPORTS (6360)*
GRAWITZ TUMOR, BLOOD GROUPS, HUMAN
(4848)
HISTOLOGICAL AND HISTOCHEMICAL
CHANGES, X-IRRADIATION (2474)*
HORNING-MITCHELY TUMOR, HARDING-
PASSEY MELANOMA, NUCLEIC ACID,
PROTEIN, CYTOCHEMISTRY (1470)*
HYPERNEPHROID CANCER, GASTRIC
CARCINOMA METASTASE, CASE REPORT
(3554)*
HYPERNEPHROID CARCINOMA, IMMUNOLOGICAL
TESTS, SERUM, URINE, HUMAN (6047)*
INCIDENCE, JAPAN (1426)*
INFECTION, MOLONEY LEUKEMIA VIRUS,
MURINE SARCOMA VIRUS, PATHOLOGIC
CHANGE, MOUSE (1776)*
LUCKE RENAL ADENOCARCINOMA, VERTICAL
TRANSMISSION, FROG (3759)
LUCKE RENAL CARCINOMA, INCIDENCE, FROG
(2781)*
LYMPHANGIOMA, CYSTIC STRUCTURES, CASE
REPORT (6259)*
MORPHOLOGY, MULTIPLE MYELOMA, HUMAN
(6234)*
MULTIPLE MYELOMA, LIPOID NEPHROSIS,
HISTOCHEMICAL GLOMERULAR STUDIES,
HUMAN (3453)*
NEPHROBLASTIC NEPHROBLASTOMA, AVIAN
LEUKOSIS GROUP VIRUS, SEQUENCE
OF DEVELOPMENT, ULTRASTRUCTURE,
CHICKEN (3100)
NEPHROBLASTOMA, HISTOLOGY, HUMAN
(3454)*
NEPHROTIC SYNDROME, MALIGNANT DISEASE
(1500)*
NON-DIFFERENTIATED NEURAL TUMORS,
CASE REPORTS (5691)*
NUCLEIC ACID SYNTHESIS, DIMETHYL-
NITROSAMINE, RAT (1587)
PARENCHYMA, CARCINOMA, MORPHOLOGY,
HUMAN (4143)*
PORPHYRIN CONTENT, LEAD ACETATE,
HYPERPLASIA, RAT (5085)
PRIMARY CARCINOMA, RENAL PELVIS AND
URETER, URINE CYTOLOGY, HUMAN
(5553)*
PRIMARY LEIOMYOSARCOMA, CASE REPORT,
REVIEW (4338)*
RENAL ADENOCARCINOMA
METASTASIS, HUMAN (2899)*
VIRAL ETIOLOGY, FROG, REVIEW
(4343)*
RENAL CARCINOMA
CELLULAR IMMUNITY, MAN (3905)
HEPATIC DYSFUNCTION, CASE REPORTS
(3331)*
SIBLINGS, CASE REPORT (6113)
DNEY - CONTINUED
RENAL CELL CARCINOMA, ULTRASTRUCTURE,
ULTRACYTOCHEMISTRY, HUMAN (3318)
RENAL DAMAGE, RADIATION, DOG (5868)*
RENAL FUNCTION, SERUM AND URINARY
PROTEINS, CHRONIC MYELOGENOUS
LEUKEMIA PATIENTS (4905)*
RENAL METABOLISM, EHRlich ASCITES
TUMORS, MOUSE (3431)*
RENAL TUMOR, ESTROGEN-INDUCED, MAST
CELLS, HAMSTER (2393)*
SARCOMA, POLYOMA VIRUS-INDUCED,
PROLIFERATION KINETICS, RAT (5955)*
SV40 DNA OLIGOMER INFECTION,
RECOMBINANT ISOLATION, MONKEY (3060)
SV40 TRANSFORMATION, AMINO ACID
DEPRIVATION, DNA SYNTHESIS, HAMSTER
(3063)
TRACE ELEMENT LEVELS, METHYLCHOL-
ANTHRENE SENSITIZATION, MOUSE (5809)
TRANSFORMATION, 3-METHYLCHOLANTHRENE,
MOUSE (1582)
TRANSPLANTATION
TESTICULAR CARCINOMA, CASE REPORT
(1404)*
WILM'S TUMOR, IMMUNOSUPPRESSION,
HUMAN (4276)*
TRNA METHYLASE, DIMETHYLNITROSAMINE,
RAT (5123)
TUMOR
ANTIGENS, HUMANS (3924)*
DAUNOMYCIN, RAT (1532)
DIETHYLSTILBESTROL, HAMSTER
(0942)
DIMETHYLNITROSAMINE, ANGIOGRAPHY,
RAT (1286)*
HYDROLYTIC ENZYMES, CYTOCHEMISTRY,
HAMSTER (5458)*
KARYOMETRICAL STUDY, MITOTIC INDEX
HAMSTER (5459)*
NUCLEIC ACIDS, PROTEINS, CYTO-
CHEMISTRY, HAMSTER (5457)*
RENAL TUBULAR ANTIGEN, HUMAN
(2617)
STILBESTROL-INDUCED, GROWTH
CHARACTERISTICS, HAMSTER (2358)
TRNA N2-GUANINE DIMETHYLASE, RAT
(4862)
ULTRASTRUCTURE, HUMAN, REVIEW
(0928)*
TUMOR INDUCTION, N-NITROSOBUTYLUREA,
RAT (4422)
WILM'S TUMOR, 2-MUTATION MODEL (3238)
KUPFFER CELL
LIVER, PHAGOCYTOSIS, HUMORAL
RECOGNITION FACTOR, LEUKEMIA, RAT
(5298)
LACRIMAL GLAND
ADENOID CYSTIC CARCINOMA, CASE REPORT
(6194)*
LACTATE DEHYDROGENASE
ISOENZYMES, BLOOD SERUM, TUMOR TISSUE,
HUMAN (2094)*
NEOPLASTIC, HEMOBLASTOSIS, HUMAN
(2042)*
LACTATION
MAMMARY TUMORIGENESIS, MOUSE (4846)
LACTIC ACID
LUNG CANCER, GLYCOLYTIC ENZYMES, HUMAN
(4442)
LANTHANUM
CELLULAR ELECTROLYTE ALTERATIONS,
EHRlich ASCITES TUMOR CELLS, MOUSE
(6300)*
CELLULAR ELECTROLYTE AND MEMBRANE
POTENTIAL ALTERATIONS, EHRlich
ASCITES TUMOR CELLS (4484)*
LARYNGOPHARYNX
MULTIPLE PRIMARY TUMORS, CLINICAL
STUDY (4795)*
LARYNX
CANCER
CLINICAL STUDY (4904)*
HISTOENZYMATIC CHARACTERISTICS,
HUMAN (3989)
LEUKEMIA-LIKE VIRUSES, HUMAN
(5883)
RECURRENCE, CASE REPORTS (3373)*

- CANCER SPREAD, HUMAN (4945)*
 CARCINOMA
 CIGARETTE, INCIDENCE, HUMAN (2962)
 CIGARETTE SMOKING, HUMAN (1272)
 RADIATION, HUMAN (1308)*
 CERVIX, PRECANCEROUS CONDITION, HUMAN (1889)
 CHEMODECTOMA, HISTOPATHOLOGY, CASE REPORT (6212)*
 CHEMODECTOMATA, CASE REPORTS (5481)*
 EPITHELIOMA, MAST CELLS, HUMAN (5647)*
 FIBROSARCOMA, CASE REPORT (4957)*
 GIANT CELL TUMOR, CASE REPORT (4875)*
 GRANULOMA, INTUBATION ANESTHESIA, HUMAN (1311)*
 MALIGNANT TUMOR, METASTASES, HUMAN (4296)*
 NEOPLASIA, EPIDEMIOLOGY, UKRAINE (0531)*
 OROPHARYNX, EPITHELIOMA WITH SARCOMATOUS STROMA, HUMAN (4138)*
 PAPILLOMA, VIRUS-LIKE PARTICLE, HUMAN (1497)*
 PHARYNX
 CARCINOMA, RADIATION, HUMAN (0027)*
 PRECANCEROUS CONDITION, HUMAN (0498)*
 POST-CRICOID CARCINOMA, PATERSON-KELLY SYNDROME, ASSOCIATION, HUMAN (0532)*
 PRECANCEROUS ALTERATIONS, HISTOLOGY, CLINICAL STUDY (6056)*
 PRECANCEROUS LESIONS
 CYTOLOGY, HUMAN, REVIEW (5061)*
 MORPHOLOGY, HISTOLOGY (1908)*
 VERRUCOUS CARCINOMA, CLINICAL STUDY, PATHOLOGICAL STUDY (5522)*
 VESTIBULAR CANCER, METASTASES, HUMAN (3552)*
 LASIOCARPINE
 AFLATOXIN B1, CARCINOGENICITY, LIVER, RAT (2351)
 DIMETHYLNITROSAMINE, ETHANOL, POLYSOMAL DISAGGREGATION, LIVER, MOUSE (1287)*
 LIVER POLYSOMAL DISAGGREGATION, 2-DIETHYLAMINOETHYL-2,2-DIPHENYL-VALERATE, MOUSE (1652)*
 MALIGNANT TUMOR, CARCINOGENESIS, RAT (2352)
 LATHYROGENIC COMPOUND
 INHIBITION, CARCINOGENESIS AND CIRRHOSIS, LIVER, RAT (5189)*
 LEAD ACETATE
 HYPERPLASIA, PORPHYRIN CONTENT, KIDNEY, RAT (5085)
 LEG
 HEMANGIOENDOTHELIOMA, METALLIC FIXATION OF TIBIA, CASE REPORT (4488)*
 LEIOMYOBlastoma
 GASTRIC, EXTRAGASTRIC, HUMAN (2181)*
 UTERUS, CASE REPORT (5595)*
 LEIOMYOMA
 ANAL CANAL, CASE REPORT (4955)*
 BIZARRE, VULVA, CASE REPORT (5682)*
 CELLULAR, UTERINE, LEIOMYOSARCOMA, ULTRASTRUCTURE (1462)*
 ESOPHAGUS, PATHOLOGY, CASE REPORT (6249)*
 LUNG, ULTRASTRUCTURE, HUMAN (0892)*
 MULTIPLE CUTANEOUS, HEREDITARY, CASE REPORT (1136)*
 STOMACH, CASE REPORT (3566)*
 LEIOMYOMATA
 UTERUS, ASCITES AND HYDROTHORAX-ASSOCIATED, CASE REPORT (5621)*
 LEIOMYOSARCOMA
 HUMAN, REVIEW (3637)*
 PRIMARY, KIDNEY, CASE REPORT, REVIEW (4338)*
 PRIMARY RENAL VEIN, CASE REPORT (3961)*
 SKIN, CASE REPORT (6363)*
 UTERINE LEIOMYOMA, CELLULAR LEIOMYOMA, ULTRASTRUCTURE (1462)*
 LEUCINE
 INCORPORATION
 3'-METHYL-4-DIMETHYLAMINOAZO-BENZENE, CALORAMPHENICOL, DIET, RAT (1559)
 PROTEIN, INHIBITION, TUMOR-BEARING BLOOD, RAT (5524)*
 LEUKEMIA
 ABELSON VIRUS, MOUSE, RAT (4794)
 ACUTE
 L-ASPARAGINASE, LYMPHOCYTE TRANSFORMATION, HUMAN (4049)*
 BACTERIA FLORA, PATIENTS (4181)*
 BENZENE, OCCUPATIONAL HAZARD, CASE REPORTS (2976)
 BENZENE-INDUCED HYPOPLASTIC ANEMIA, CASE REPORT (4473)*
 BLOOD CELL DEHYDROGENASE ACTIVITY, CIRCADIAN RHYTHM, CHILDREN (6183)*
 CELL, DNA SYNTHESIS (3449)*
 CELL PROLIFERATION, PRELEUKEMIC STATE, CYTOPHOTOMETRY, AUTO-RADIOGRAPHY, CASE REPORT (3964)*
 CHEMOTHERAPY
 CLINICAL STUDY, INFANTS (4958)*
 HUMAN (2129)*
 CHILDREN, DIURNAL ACTIVITY OF ADRENAL CORTEX (3590)*
 CLINICAL STUDY, AUSTRALIA, REVIEW (4325)*
 CYTOCHEMISTRY, REVIEW (3624)*
 CYTOGENETICALLY ABNORMAL CELLS, HUMAN (4172)*
 DNA, CHROMOSOMES, CLINICAL STUDY (6108)
 DOWN'S SYNDROME, LEUCOCYTE FUNCTION, CLINICAL STUDY (6301)*
 ENZYME ACTIVITY (2037)*
 ERYTHROCYTIC PYRUVATE KINASE, CHILDREN (6256)*
 FACTOR XIII, HUMAN (3506)*
 FUNGAL INFECTION, POSTMORTEM RECORD STUDY (5580)*
 GENETICS, HUMAN (4125)*
 IMMUNOCOMPETENCE, IMMUNOSUPPRESSION, HUMAN (1395)
 IMMUNOGLOBULIN, CLINICAL FACTOR, CHILD (1399)
 IMMUNOLOGY, CHILDREN (5391)*
 INFECTIOUS MONONUCLEOSIS, SIMULTANEOUS OCCURRENCE, CASE REPORT (4545)
 LEUKOERYTHROBLASTIC BLOOD REACTION
 HETEROTOPIC RENAL HEMOPOIESIS, CASE REPORT (6133)*
 LYMPHOBLASTIC VIRUS-LIKE PARTICLES
 LYMPHATIC CELL INCLUSIONS, BONE MARROW, PERIPHERAL BLOOD, HUMAN (4560)
 LYSOSOMES, ENZYMES, HUMAN (3493)*
 MICROBIAL AGENTS, ISOLATION AND

IDENTIFICATION, BLOOD, BONE MARROW, HUMAN (3538)*
 MICROBIAL FACTOR, PATHOGENESIS, RAT (6070)*
 MYELOFIBROSIS, HUMAN (4079)*
 MYELOGENOUS, LYMPHOSARCOMA, CASE REPORT (4937)*
 MYELOID, CRYPTOCOCCAL MENINGITIS DISSOCIATED LOSS OF CELLULAR IMMUNOLOGICAL FUNCTION, CASE REPORT (4777)*
 PHYTOHEMAGGLUTININ, CELL TYPE, HUMAN, REVIEW (4357)*
 PLATELET FUNCTION, CLINICAL STUDY (5582)*
 PNEUMATOSIS CYSTOIDES INTESTINALIS PATHOLOGY, CASE REPORTS (4060)*
 PROLIFERATION, CHARACTERISTICS, HUMAN (2860)
 PROLONGED REMISSION, CHILDREN (4183)*
 PROMYELOCYTIC, ULTRASTRUCTURE, HUMAN (4970)*
 PROTEOLYTIC ENZYME BRINASE, AUTOCYTOTOXICITY, IMMUNOTHERAPY, HUMAN (3205)
 RADIATION, PH1 CHROMOSOME, CASE REPORT (5867)*
 REMISSION, LYMPHOCYTE CULTURE, HUMAN (1391)
 RNA SYNTHESIS, BLOOD AND BONE MARROW, HUMAN (2841)
 SERUM AMINO ACIDS, HUMAN (4260)*
 STATISTICS, PATHOLOGY, HUMAN (4286)*
 VIRAL AND LEUKEMIA-ASSOCIATED ANTIGENS, IDENTICAL TWINS (5325)
 UTE ERYTHROCYTIC, POLYCYTHEMIA VERA, CASE REPORT (4148)*
 UTE GRANULOCYTIC
 COLONY GROWTH, NORMAL LEUKOCYTE, HUMAN (1106)
 GRANULOCYTE COLONY FORMATION, SERUM, HUMAN (5373)*
 UTE LYMPHOBLASTIC, CELL CYCLE, NUCLEIC ACID SYNTHESIS, L-ASPARAGINASE, HUMAN (4026)
 UTE LYMPHOBLASTIC HL-A ANTIGEN PHENOTYPE, HUMAN (1804)
 UTE LYMPHOBLASTIC LYMPHOCYTE TRANSFORMATION, HUMAN (1795)
 UTE LYMPHOCYTIC
 CYTOTOXIC ANTIBODY, HUMAN (5304)
 INFECTIOUS MONONUCLEOSIS, EPSTEIN-BARR VIRUS ANTIGENS, HUMAN (5402)
 PERIPHERAL BLOOD CELLS, COLONY GROWTH, PATIENTS (5493)*
 UTE MYELOGENOUS
 CHROMOSOME, HUMAN (1410)
 HEME SYNTHESIS, BONE MARROW AND SPLEEN CELL SUSPENSIONS, RAT (3541)*
 RADIATION THERAPY, HUMAN (1664)
 UTE MYELOID
 CYTOGENETIC STUDY (2809)
 SERUM PROTEINS, IMMUNOELECTROPHORETIC INVESTIGATIONS, PATIENT (5378)*
 UTE PROMYELOCYTIC, FIBRINOGEN, FACTOR XIII, DEFICIENCIES, HUMAN (3456)*
 UTE LEUKEMOGENICITY, URETHAN, -IRRADIATION, MOUSE (2328)
 AGGREGATION OF CELLS, CHITOSAN, MOUSE (0829)
 AGRICULTURE, REVIEW (1520)*
 AKR MOUSE, GRAFT VS HOST REACTIVITY, ANAPHYLAXIS (3866)
 ALKALINE PHOSPHATASE, KINETICS, MOUSE (4089)*
 ALKALINE PHOSPHATASE ACTIVITY, MOUSE (5272)
 AMINO ACID CELL REQUIREMENTS, HUMAN, IN VITRO (4091)*
 AMINOPEPTIDASE ACTIVITY, LEUKOCYTES, HUMAN (3550)*
 ANEMIA, OXYMETHOLONE, HUMAN (0082)*
 LEUKEMIA - CONTINUED
 ANTIBODY RECEPTOR, INHIBITION, MACROPHAGE, ISOANTIBODY, MOUSE (3854)
 ANTIGENIC DIFFERENCES, MOUSE (2671)*
 ANTILYMPHOCYTE SERUM, HL-A ANTIGEN, HUMAN (1871)*
 ARABINOSYL CYTOSINE TOLERANCE, CIRCADIAN RHYTHM, MOUSE (4863)
 AREGENERATIVE ANEMIA, BONE MARROW, HUMAN (4783)
 ASSOCIATED ANTIGEN DETECTION, RABBIT (3908)
 ATOMIC BOMB RADIATION, INCIDENCE, TUMOR, HUMAN, REVIEW (3027)
 ATOMIC BOMB SURVIVOR (1663)
 AUTOANTIBODIES, ANTIGENS, CHILDREN (2682)*
 AVIAN LEUKOSIS VIRUS, GROUP-SPECIFIC ANTIBODY, HUMAN (0175)*
 AVIAN MYELOBLASTOSIS VIRUS, REVIEW (2236)*
 BASOPHILIC AND EOSINOPHILIC GRANULOCYTES, QUANTITATIVE FEATURES, CHILDREN (4263)*
 BIOCHEMISTRY, ALTERATION, LEUKOCYTES, REVIEW (2240)*
 BLAST CELL, CELL SIZE, RNA SYNTHESIS, HUMAN (0545)
 BLOOD ANTICOAGULATION SYSTEM, HUMAN (3343)*
 BLOOD GROUP ISOANTIGEN, LEUKEMIA, NEURAMINIDASE, HUMAN (0477)
 BLOOD HAPTOGLOBIN, HUMAN (0558)*
 BONE MARROW
 CELL PROLIFERATION, REVIEW (2224)*
 DNA, STAINING, HUMAN (0652)*
 ERYTHROPOIETIN, HUMAN (4039)
 BONE MARROW BLAST, SERUM COPPER, HUMAN (5432)
 BURKITT LYMPHOMA
 DIMETHYLSULFOXIDE KINETICS, IN VITRO (4254)*
 EPSTEIN-BARR VIRUS, CELL LINE ESTABLISHMENT (4032)
 CANCER
 BACILLUS CALMETTE-GUERIN, HUMAN, REVIEW (2213)
 CHROMOSOME ABERRATION, COINCIDENCE (0798)*
 MORTALITY, FRANCE (3249)
 CANDIDIASIS IMMUNOLOGY, HUMAN (4086)*
 CELL
 ASCORBIC ACID ABSORPTION, RAT (0866)*
 DNA SYNTHESIS, HUMAN (1107)
 MAMMARY TUMOR VIRUS-ASSOCIATED ANTIGENICITY, MOUSE (3193)
 PROTEIN SYNTHESIS INHIBITION, PHENYLALANINE, TRYPTOPHAN

- E. COLI, MOUSE (1624)*
T CELL, B CELL, MOUSE (3179)
CELL CHARACTERIZATION, ACIDIC NUCLEAR
PROTEIN PROFILE, HUMAN (3999)
CELL CULTURE, GROWTH STIMULATING
FACTOR, HUMAN (4041)
CELL CULTURE MEDIUM, C-TYPE VIRUS
PARTICLE, COW (1008)
CELL CYCLE KINETICS, MOUSE
(4031), (5410)
CELL CYCLE PHASE PROGRESSION,
ACTINOMYCIN D, PUROMYCIN, MOUSE
(1630)*
CELL GRAFT, HUMAN (0500)*, (0501)*
CELL INJURY, HYPERTHERMIC STATE,
HYPOTONIC STATE, HUMAN (1434)
CENTRAL NERVOUS SYSTEM, CYTO-
CENTRIFUGATION, CASE REPORTS (4947)*
CHILDHOOD (2150)*
REMISSION, FATALITIES, CLINICAL
STUDY (5666)*
CHILDREN
CLINICAL STUDY (4960)*
INCIDENCE, TIME-SPACE CLUSTERING,
NEW ZEALAND (0811)
MATERNAL AGE FACTOR, RELATIONSHIP
(3275)
CHLOROLEUKEMIA, CYTOPLASMIC DNA,
STRONTIUM 90, RAT (0673)
CHROMOSOMAL ABERRATIONS, MULTIPLE
MYELOMA, LYMPHOPROLIFERATIVE DISEASE
REVIEW (3627)*
CHROMOSOMES (1525)*
DNA, HUMAN (0885)*
CHRONIC, T OR B LYMPHOCYTES, HUMAN
(2645)
CHRONIC GRANULOCYTIC
ACID PHOSPHATASE LEUKOCYTE, HUMAN
(4158)*
ACQUIRED LIPIDOSIS, GAUCHER-LIKE
AND BLUE CELLS, CLINICAL STUDY
(5668)*
BLASTIC TRANSFORMATION REMISSION,
HEMATOLOGIC AND CYTOGENETIC
STUDIES (4021)
POLYCYTHEMIA VERA, MEGAKARYOCYTES,
ULTRASTRUCTURE HUMAN (5478)*
SERUM RIBONUCLEASES, ISOLATION,
CHARACTERIZATION (6161)*
CHRONIC HYPERIMMUNIZATION, ASSOCIATED
PERTUSSIS-DIPHTHERIA-TETANUS VACCINE
MOUSE (3916)*
CHRONIC LYMPHATIC, T CELL ISOLATION,
HUMAN (6017)*
LEUKEMIA - CONTINUED
CHRONIC LYMPHOCYTIC
BLASTIC TRANSFORMATION, LYMPHOCYTE
CULTURES, HUMAN (4639)
BLOOD LYMPHOCYTE, SURFACE IMMUNO-
GLOBULIN, HUMAN (1829)
CHROMOSOME, HUMAN (5448)
CHRONIC MYELOCYTIC, EPSTEIN-BARR
VIRUS, ANTIBODY, HUMAN (0764)
HODGKIN'S DISEASE PERIPHERAL
LYMPHOCYTES, ZINC STIMULATION
IN VITRO (3917)*
INTRACELLULAR MACROGLOBULIN, HUMAN
(4716)*
T LYMPHOCYTE, B LYMPHOCYTE, HUMAN
(1855)*
LYMPHOCYTE STIMULATION, PLANT
MITOGEN, HUMAN (5811)
LYMPHOCYTES
ANTIGENIC PROPERTY, HUMAN
(5396)*
PROLIFERATION, CELL CYCLE
KINETICS, RAT (5958)
LYMPHOCYTIC LYMPHOMA, EPSTEIN-
BARR VIRUS, ANTIBODY, HUMAN
(2516)
LYMPHOSARCOMA, MORPHOLOGY, CASE
REPORT (4282)*
LYMPHOSARCOMA CELL, BLOOD LYMPHO-
CYTES, ULTRASTRUCTURE, HUMAN
(3339)*
MEMBRANE-BOUND MONOCLONAL IMMUNO-
GLOBULIN (3900)
MU IMMUNOGLOBULIN, KAPPA IMMUNO-
GLOBULIN, CELL SURFACE, HUMAN
(0464)
PROTEIN SYNTHESIS, RIBOSOMES,
BLOOD LYMPHOCYTES, HUMAN (6016)*
TRANSIENT LYMPHOTOXIC SERUM FACTOR
CASE REPORT (4706)*
WHITE BLOOD CELL, ANTIGENICITY,
HUMAN (4620)
CHRONIC LYMPHOID
DISSEMINATED CRYPTOCOCCOSIS, HUMAN
(3561)*
PRIMARY CANCER, LUNG, CASE REPORT
(4105)*
CHRONIC MYELOCYTIC
GENETIC MARKERS, HUMAN (4243)*
GRANULOCYTE KINETICS, PERIPHERAL
BLOOD, HUMAN (4197)*
INCIDENCE, CHILDREN, AFRICA
(1936)*
MITOSIS, BLOOD (0227)
CHRONIC MYELOGENOUS
GAUCHER CELLS (3545)*
KARYOTYPE, CYTOLOGY, HUMAN (4842)
PHILADELPHIA CHROMOSOME, BLASTIC
CRISIS, CASE REPORT (5473)*
SERUM AND URINARY PROTEINS,
RENAL FUNCTION, CLINICAL STUDY
(4905)*
CHRONIC MYELOID
ANEUPLOID CELL LINES, CASE REPORT
(4182)*
BONE MARROW LEUKOCYTE, METABOLISM,
HUMAN (4101)*
CHRONIC LYMPHOID, HL-A, HUMAN
(1048)
CYTOCHEMISTRY, CELL CLONES, HUMAN
(6144)*
DOWN'S SYNDROME, CHROMOSOME, HUMAN
(0836)
GRANULOCYTE COLONY, ORIGIN (1453)*
HEMATOLOGY, CASE REPORTS (4130)*
PHAGOCYTE ACTIVITY, ALKALINE
PHOSPHATASE, REVIEW (1213)*
PHILADELPHIA CHROMOSOME, CLONAL
ORIGIN, HUMAN (1441)
VITAMIN B12 BINDING, SERUM, HUMAN
(1960)
X-IRRADIATION, CASE REPORT (2472)*
CHRONIC MYELOLEUCOSIS, CELL STUDY,
HUMAN (3418)*
CLASSIFICATION, CYTOCHEMISTRY, ULTRA-
STRUCTURE (4153)*
CLINICAL TREATMENT, SURVIVAL, HUMAN
(2044)*
CONGENITAL, MONGOLISM, CASE REPORT
(4909)*
CRYPTOGENETIC, BLOOD DISEASES,
PATHOLOGY, NON-HEMOLYTIC CHEMICAL
AGENTS, REVIEW (5733)*
C-TYPE VIRUS PARTICLE, MOUSE (0727)*

*INDICATES A PLAIN CITATION WITHOUT ACCOMPANYING ABSTRACT

CYCLIC ACTIVITY, HUMAN (2140)*
 CYTOCHEMISTRY, ESTERASE, REVIEW
 (0912)*
 CYTOGENETIC MARKER, MOUSE (0994)
 CYTOMEGALOVIRUS, ASYMPTOMATIC
 INFECTION, CHILD (1317)
 CYTOMEGALOVIRUS INFECTION, IMMUNOLOGY,
 CHILDREN (4063)*
 CYTOTOXIC ANTIBODY, BURKITT'S LYMPHOMA
 INFECTIOUS MONONUCLEOSIS, HUMAN
 (0752)
 CYTOTOXICITY, FIBROBLASTS, CELL
 CULTURE (1998)
 DERMATOGLYPHICS, CHILDREN (0875)*
 DEVELOPMENT, 3-METHYLCHOLANTHRENE,
 AGE FACTOR, MOUSE (5149)
 DISORDERED LEUKOCYTE PROLIFERATION,
 HUMAN (4949)*
 DNA
 FRACTIONATION ANALYSIS, HUMAN
 (1479)*
 RNA, SYNTHESIS INHIBITION,
 LYMPHOCYTES, HUMAN (5957)
 DNA BIOSYNTHESIS, TETRAHYDROHOMOFOLATE
 MOUSE (1457)*
 DNASE ACTIVITY, LYSOSOMES, HUMAN
 (2120)*
 DOMESTIC ANIMAL, EPIDEMIOLOGY, HUMAN,
 REVIEW (5706)
 DRUG-RESISTANT SUBLINE, INCREASED
 ANTIGENICITY, MOUSE (4679)
 EGG-WHITE LYSOZYME, ANTIGENICITY,
 HUMAN, CHICKEN (1040)
 ELECTRON MICROSCOPE, BONE MARROW, RAT
 (1969)
 ENDOPLASMIC RETICULUM, ULTRASTRUCTURE,
 HUMAN (0586)*
 ENZYME
 PROTEOLYTIC, CATABOLISM, MOUSE
 (1989)
 SERINE BIOSYNTHESIS, LEUKOCYTE,
 HUMAN (3316)
 EOSINOPHILIC, THROMBOPLASTIC ACTIVITY,
 CASE REPORT (6304)*
 EPIDEMIOLOGY
 AFRICA (0520)*
 BUENOS AIRES PROVINCE (4819)
 EPSTEIN-BARR VIRUS, ANTIBODY, VIRAL
 ILLNESS, HUMAN (0403)
 ERYTHRO-, ERYTHROBLAST, ULTRASTRUCTURE
 HUMAN (2887)*
 ERYTHROBLASTIC, REGRESSION, HYPO-
 PHYSECTOMY, RAT (3375)*
 ERYTHROCYTE SENSITIVITY, LYSIS (1454)*
 ERYTHROLEUKEMIA, C-TYPE VIRUS
 PARTICLE, SPLEEN, MOUSE (0733)*
 EMIA - CONTINUED
 ETIOLOGY
 EPIDEMIOLOGY, PATHOLOGY, REVIEW
 (5746)*
 PATHOGENESIS, CHILDREN, REVIEW
 (2253)*
 EXOCRINE PANCREAS FUNCTION, HUMAN
 (4107)*
 FAMILIAL, PELGER-HUET ANOMALY,
 CHROMOSOME, ICELAND (6117)
 FIBRINOLYTIC ACTIVITY, BLOOD
 LEUKOCYTIC COUNT, CLINICAL STUDY
 (5675)*
 FRIEND LEUKEMIA VIRUS, RIBONUCLEOTIDE
 REDUCTASE, SPLEEN, MOUSE (0849)
 FRIEND VIRUS
 LYMPHATIC LEUKEMIA VIRUS, ISOLA-
 TION, PATHOGENICITY, MOUSE
 (0406)
 SPLEEN CELL CHROMOSOMES,
 SEQUENTIAL CHANGES, MOUSE
 (3791)
 GAMMA IRRADIATION, LONGEVITY, MOUSE
 (0674)
 GAMMAGLOBULIN, IMMUNOGLOBULIN
 ALTERATIONS, SERUM, CHILDREN (5999)*
 GANGLIOSIDES, LEUKOCYTES (1962)
 GLOBULINS, CHILDREN (2714)*
 GRAFFI VIRUS
 ALKALINE AND ACID PHOSPHATASE,
 HISTOCHEMISTRY, MOUSE (0116)
 CELL-FREE FILTRATES, PERIPHERAL
 BLOOD ALTERATIONS, MOUSE (0137)*
 SPLEEN, THYMUS, MOUSE (0115)
 GRAFFI AND GROSS, GROUP-SPECIFIC,
 MEMBRANE-BOUND ANTIGEN, MOUSE, RAT
 (5342)
 GRAFFI VIRUS-INDUCED, IDENTICAL
 ANTIGENS, RAT, MOUSE (5343)
 GRANULOCYTE
 ESTERASE DEFECT, HUMAN (1158)*
 PROLIFERATION, HUMAN (4033)
 GRANULOCYTIC, ABNORMAL CELL LINE,
 HUMAN (2847)
 GROSS, SKIN ALTERATION, TUMOR CELLS,
 MOUSE (5340)
 GROSS VIRUS
 CELL-SURFACE ANTIGEN, SUPPRESSION,
 MOUSE (4694)
 H-2 ANTIGEN, MOUSE (1316)
 PROTOZOAN INFECTION, MORTALITY,
 MOUSE (0698)
 RAUSCHER VIRUS, CELL SURFACE
 ANTIGENS, MOUSE, RAT (3880)
 SKIN GRAFT, MOUSE (0118)
 GROUP-SPECIFIC ANTIGEN, TYPE-SPECIFIC
 ANTIGEN, FRIEND VIRUS, MAZURENKO
 VIRUS, RAUSCHER VIRUS, MOUSE (4631)
 GROWTH, ANTIBODY PRODUCTION, MOUSE
 (0173)*
 GROWTH OF CELL LINE, PROTEIN-FREE
 MEDIUM, HUMAN (4963)*
 GROWTH ENHANCEMENT, LEUKEMIC CELL,
 MOUSE (1803)
 HEMATOPOIESIS, ENZYMES, RATS (2191)*
 HEMOCYTOBLASTIC, CHROMOSOMES, CASE
 REPORT (0577)*
 HEMOGLOBIN, VIRUS, DIMETHYLSULFOXIDE,
 MICE (0412)
 HERPESVIRUS, ISOLATION, GUINEA PIG
 (1338)
 HERPESVIRUS ANTIBODY, INCIDENCE,
 HUMAN (3747)
 HODGKIN'S DISEASE, ASSOCIATION, CASE
 REPORTS (4213)*
 HORMONE, HUMORAL REGULATOR, REVIEW
 (0910)
 HOUSEHOLD PET, EXPOSURE, INCIDENCE
 (6084)
 IMMUNE REACTIVITY, AUTOLOGOUS BLAST
 CELLS, PATIENTS (4643)
 IMMUNE SUPPRESSION, 4-NITROQUINOLINE-
 1-OXIDE INDUCED, MOUSE (2977)
 IMMUNITY
 IMMUNOSUPPRESSION, MOUSE (0167)*
 INDUCTION, GUINEA PIG (1055)
 LYMPHOCYTE CYTOLYSIS, MOUSE (4688)
 IMMUNITY STIMULATION, BACILLUS
 CALMETTE-GUERIN, MOUSE (1824)
 IMMUNIZATION, BACILLUS CALMETTE-GUERIN
 HUMAN (1781)
 IMMUNOCOMPETENT LYMPHOID CELLS,

- ALLOGENEIC TRANSFER, GUINEA PIG (3164)
IMMUNOFLUORESCENCE, LYMPH NODES, SPLEEN, CATTLE (4717)*
IMMUNOGENICITY
EFFECT OF VIBRIO CHOLERAE NEURAMINIDASE, IN VITRO (4719)*
MOUSE (4718)*
NEURAMINIDASE, MOUSE (4653)
IMMUNOGLOBULIN
CHILDREN (5960)
G, IGM, ANTIBODY ACTIVITY, HUMAN (5311)
IMMUNOGLOBULIN RECEPTOR, MOUSE (3184)
IMMUNOPROTECTION, FREUND'S ADJUVANT, GUINEA PIG (1852)*
INCIDENCE
ADRENALECTOMY, THYMUS, MOUSE (0872)*
CHILDREN, BULGARIA (6095)*
EPIDEMIOLOGY, U.S.S.R. (5425)
GONADECTOMY, MOUSE (0871)*
MORTALITY, RADIATION, REVIEW (2203)
POLAND (1099), (1914)
RADIO IODINE THERAPY, HUMAN (1667)
SCOTLAND, CHILD (1916)
SOUTHERN IRAN (6318)*
U.S.S.R. (6073)
WALES (0826)*
INCIDENCE PATTERN, HUMAN (1423)*
INDUCTION
3-METHYLCHOLANTHRENE, X-IRRADIATION, RAT (0068)
VIRUS, IMMUNOSUPPRESSION, IMMUNOCOMPETENCE, MOUSE (1785)
INFLUENZA, PREGNANCY, REVIEW (5743)*
ISOTRANSPLANT SYSTEM, IMMUNOGENICITY, CELLULAR AND CELL-FREE PREPARATIONS, MOUSE (3923)*
LEUKEMIA - CONTINUED
JUVENILE CHRONIC MYELOGENOUS, FETAL ERYTHROCYTE, CASE REPORT (6128)
KARYOTYPE
HUMAN (1179)*
MULTIPLE HEMOPATHIES, CASE REPORT (4275)*
L1210 AND L5178Y, COLLATERAL SENSITIVITY, MOUSE (4008)
L-4946, MOUSE (2581)*
LACTATE DEHYDROGENASE, HEPATOMA, HUMAN RAT (4845)
LACTATE DEHYDROGENASE ACTIVITY, MOUSE (2827)
LEUKEMIA-LIKE VIRUS, CYTOLOGY, HUMAN (5289)*
LEUKEMIC CELL, INFILTRATION, LIVER, SPLEEN, HUMAN (0271)*
LEUKEMOGENESIS
EFFECTS OF INOCULATION ROUTES, VIRAL PREPARATIONS, MOUSE (3120)
FACTORS, HUMAN, REVIEW (5053)*
LEUKOCYTE FUNCTION, INTERFERON, REVIEW (0932)*
LEUKOCYTE METABOLISM, RNA METABOLISM, HUMAN, RIBOSOMES, MESSENGER RNA (0839)
LEUKOCYTES
ADENOSINE, DEAMINASE, HUMAN (3302)
CHILDREN (2008)
CYTIDINE-5'-MONOPHOSPHATE-N-ACETYL NEURAMINATE SYNTHETASE, HUMAN (0563)*
DNA SYNTHESIS, PRECURSOR
METABOLISM, HUMAN, REVIEW (0609)
LEUKOCYTIC RNA METABOLISM, HUMAN (4198)*
LEUKOSIS, INCIDENCE, COW, HUMAN, DENMARK (0817)*
LIVER, KUPFFER CELL, PHAGOCYTOSIS, HUMORAL RECOGNITION FACTOR, RAT (5298)
LYMPHATIC
AUSTRALIA ANTIGEN, PERIARTERITIS NODOSA, HUMAN (2087)*
B CELLS, GUINEA PIG (2835)
CHRONIC, ACUTE, HUMAN (1843)*
IMMUNITY, LEUKOCYTES, MOUSE, PIG (3906)
IMMUNOSUPPRESSION, RADIATION LEUKEMIA VIRUS, MOUSE (0751)
INFLUENZA VIRUS, INTRA-ARTICULAR INOCULATION, MOUSE (4602)*
LUNG TUMOR, BRACKEN FERN, MOUSE (4387)
LYMPHOCYTES, ULTRASTRUCTURE, HUMAN (5491)*
LYMPHOSARCOMA, IMMUNOGLOBULINS, GAMMA FRACTION, HUMAN (5290)
LYMPHOBLASTIC
CELLULAR ANTIGENS, HYDROCORTISONE, IN VITRO (4736)*
HL-A ANTIGEN, PATIENTS' FAMILIES (1825)
LYMPHOBLASTOID CELL, LEUCOGENOL, HUMAN (1180)*
LYMPHOBLASTOID CELL CULTURE, CHROMOSOME ABERRATION, HUMAN (2831)
LYMPHOCYTE CHANGES, BIOCHEMISTRY (3518)*
LYMPHOCYTE CYTOTOXICITY
IDENTICAL TWIN, HUMAN (4674)
PERITONEAL CAVITY, MOUSE (5307)
LYMPHOCYTE TRANSFORMATION, IMMUNE REACTION, ANTILYMPHOCYTE SERA EFFECT
ANTIPARABLAST SERA EFFECT, CHILDREN (3847)
LYMPHOCYTES
HISTOLOGY (2045)*
IMMUNE RESPONSE, HUMAN (1083)*
IMMUNOGLOBULIN DISTRIBUTION, HUMAN (1376)
RIBOSOMAL RNA, CONTROL, HUMAN (1994)
LYMPHOCYTIC
ACUTE BOVINE, PRIMARY IMMUNE RESPONSE, ANTIBODY, E.COLI, COW (3197)
MALIGNANT LYMPHOMA, HERPESVIRUS SAIMIRI, MONKEY (1337)
LYMPHOCYTIC CHROMATIN ALTERATIONS, HUMAN (3505)*
LYMPHOCYTOTOXINS, CLINICAL STUDY (5653)*
LYMPHOID, DNA POLYMERASE, LYMPHOCYTES, OX (5940)*
LYMPHOID CELL, NORMAL, HUMAN, REVIEW (4306)
LYMPHOMA
EPIDEMIOLOGY, COLOMBIA (0461)
PATHOGENESIS, ATOMIC BOMB, REVIEW (5013)
LYMPHOSARCOMA CELL, CHRONIC LYMPHOCYTIC, CYTOLOGY, HUMAN (0556)*
LYSOZYME
ACUTE, CHRONIC (2017)
MURAMIDASE, HUMAN (0255)*
MALIC ACID, MALATE DEHYDROGENASE

DETECTION, HUMAN (6143)*
 MALIGNANT LYMPHOMA, MULTIPLE MYELOMA,
 MORTALITY, NEW ZEALAND (5411)
 MENINGOSIS, CYTOCHEMICAL FINDINGS,
 HUMAN (3508)*
 METHYLNITROSOUREA-INDUCED, VIRUS
 CODED ANTIGENS, MOUSE (2624)
 MIGRATION OF TUMORAL CELLS, SPECIFIC
 INHIBITION, SENSITIZED LYMPHOID CELL
 MOUSE (3201)
 MITOCHONDRIAL DNA, CHARACTERIZATION,
 CHICKEN (0815)
 MIXED LEUKOCYTE REACTION, TARGET CELL
 DEATH, HUMAN (5395)*
 MONOCYTIC
 HUMAN (3507)*
 IMMATURE CELLS, HUMAN (0574)*
 MURAMIDASE, SERUM, URINE, HUMAN
 (4274)*
 MORBIDITY, ENVIRONMENTAL FACTORS,
 POLAND (3977)*
 MORTALITY
 BCG VACCINATION
 CHICAGO (6007)*
 CHILDREN, QUEBEC, GLASGOW (0766)
 INCIDENCE, SCOTLAND (2633)
 CHILDREN, BIRTH WEIGHT (1098)
 GERMANY (6092)*
 LEUKEMIA - CONTINUED
 MULTIPLE MYELOMA, OCCUPATIONAL HAZARD,
 INCIDENCE, FARMER, UNITED STATES
 (1932)
 MURINE
 VIRUS, ROUS MOUSE CELL LINE
 (4589)*
 XENOGRAFT, KARYOLOGY, HAMSTER
 (3407)*
 MURINE MYELOID, COLONY, SPLEEN, MOUSE
 (4201)*
 MURINE SARCOMA VIRUS INDUCTION,
 ENHANCEMENT BY INTERFERON INDUCERS,
 MOUSE, RAT (4553)
 MURINE VIRUS ANTIGEN, CELLULAR ANTIGEN
 MYELOMA CELL, MOUSE (4555)
 MYELOBLAST, GENERATION TIME, HUMAN
 (4013)
 MYELOCYTIC, CHROMOSOMAL REPLICATION,
 HUMAN (0564)*
 MYELOGENOUS
 ABNORMAL CATALASE ANTIGEN,
 NORMAL ANTIGEN DELETION, LEUKO-
 CYTES, HUMAN (4768)*
 ANEMIA, MOUSE (5443)
 ANEMIC STRESS, X-RAY, RAT (1669)
 BASOPHILIA, CASE REPORT (0896)*
 BLOOD PLASMA, HISTAMINE CONTENT,
 HUMAN (0582)*
 CONTINUOUS LYMPHOBLASTOID CELL
 LINE, MONKEY (2882)
 SUBCLONES, DRUG SENSITIVITY,
 KARYOTYPES (3448)*
 MYELOIC, CYTOKINETICS, HUMAN (3346)*
 MYELOIC FIBROSIS, CHROMOSOMAL
 PATTERNS, POLYCYTHEMIA, HUMAN
 (0562)*
 MYELOID
 FETAL ERYTHROPOIESIS, HEMOGLOBIN
 LEVELS, CHILD (4098)*
 GAUCHER CELLS, ULTRASTRUCTURE,
 CYTOCHEMISTRY (6139)*
 ISOCHROMOSOME 17 IDENTIFICATION,
 HUMAN (4980)*
 PHILADELPHIA CHROMOSOME, ORIGIN,
 HUMAN (0273)*
 RABBIT, CASE REPORT, GENETICS
 (4067)*
 THYMIC LYMPHOMA, ETHYLNITROSOUREA-
 INDUCED, RAT (2996)
 MYELOID MONOCYTIC
 IMMUNOLOGY, CYTOLOGY, ULTRASTRUC-
 TURE, INFANTS (5397)*
 KARYOTYPE, CHROMOSOMAL ABERRATIONS
 CHILDREN (4177)*
 SIDEROBLASTIC ANEMIA, CASE REPORTS
 (6163)*
 SPLENOMEGALY, CHILDREN, CASE
 REPORT (4176)*
 MYELOMONOCYTIC
 CELLULAR DIFFERENTIATION, MOUSE
 (5667)*
 TRANSPLANTATION, BEAGLE (0101)
 MYELOPROLIFERATIVE DISEASE, SERUM
 MURAMIDASE, CASE REPORTS (3233)
 N-NITROSOBUTYLUREA
 BIOLOGICAL PROPERTIES, RAT (1628)*
 RAT (5136)
 RAT, VIRUS (4505)
 NONLYMPHATIC TUMORS, GLOMERULO-
 SCLEROSIS, INCIDENCE, MICE (5418)
 NUCLEIC ACID CONTENT, LIVER, SPLEEN,
 CELL NUCLEI, MOUSE (5439)
 NUCLEIC ACID CONTENT, LIVER, SPLEEN,
 HUMAN (3987)
 OVARIAN DYSGERMINOMA, SIMULTANEOUS
 OCCURRENCE, CASE REPORT (6230)*
 PATHOGENESIS, REGULATORY ABNORMALITY,
 REVIEW (1529)*
 PERINATAL, BLAST CELL PROLIFERATION,
 CHROMOSOMAL TRANSLOCATION, CASE
 REPORT (5477)*
 PESTICIDE, ENVIRONMENTAL HAZARD,
 POLAND (5417)
 PHAGOCYTE ACTIVITY, ALKALINE
 PHOSPHATASE, HUMAN (1495)*
 PHENYLBUTAZONE, CHROMOSOME DAMAGE,
 CASE REPORT (1292)*
 PLASMA AMINO ACID, HUMAN (0646)*
 PLASMA CELL, ULTRASTRUCTURE, CELL
 (0597)*
 PREGNANCY, SERUM PROTEIN RESPONSE,
 MOUSE (4046)
 PRELEUKEMIA, VIRUS, ANTIGEN (0014)*
 PRELEUKEMIC CHRONIC GRANULOCYTIC,
 LIGHT-CHAIN DISEASE, SIDEROBLASTIC
 ANEMIA, CASE REPORT (4796)*
 PRELEUKEMIC STATE, CHILDHOOD, MISSING
 BONE MARROW C CHROMOSOME, MYELOPRO-
 LIFERATIVE DISORDER, CASE REPORT
 (3232)
 PROCARBAZINE HYDROCHLORIDE, MONKEY
 (0035)
 PROLIFERATIVE PATTERNS, CHILDREN
 (3391)*
 PROMYELOCYTIC, INTRAVASCULAR
 COAGULATION, HUMAN (0599)*
 PROTECTION, GROSS LEUKEMIA VIRUS,
 MOUSE (1003)
 PURULENT DISEASES, TOTAL BLOOD
 PROTEASE ACTIVITY, HUMAN (6257)*
 LEUKEMIA - CONTINUED
 RADIATION, GUINEA PIG (5202)
 RADIO-LEUKOSIS VIRUS, MOUSE (5276)
 RAUSCHER
 HEMATOPOIESIS, HYPERTRANSFUSION
 EFFECT, MOUSE (3145)*
 SPONTANEOUS REGRESSION, MOUSE
 (3146)*
 RAUSCHER VIRUS

MULTIPLICATION, SUSCEPTIBILITY,
MOUSE (2509)
RNA, DNA FRACTIONS, SPLEEN, MOUSE
(5210)
RNA-DIRECTED DNA POLYMERASE
INHIBITION, CYTOSINE ARABINOSIDE
TRIPHOSPHATE (4585)*
TUMOR TRANSPLANTATION, MOUSE
(3070)
RAUSCHER-VIRUS-INDUCED, RIFAMPICIN,
INHIBITORY EFFECT, MOUSE (3136)
RECKLINGHAUSEN'S DISEASE, CASE REPORTS
CHILDREN (6142)*
REGRESSION, H-2 ANTIGEN, FRIEND VIRUS,
MOUSE (4645)
REMISSION INDUCTION, DEVELOPING IN
BURKITT'S LYMPHOMA, CASE REPORT
(3384)*
RESISTANCE, ALLOGENEIC LYMPHOID CELLS,
GUINEA PIGS (2620)
RESPONSE, CHROMOSOME, RADIATION, MOUSE
(1665)
RETICULOENDOTHELIOSIS, HISTOCHEMISTRY,
HUMAN (2091)*
RETICULUM CELL SARCOMA, CELLULAR
PROLIFERATION, HUMAN (1427)
RIBONUCLEASE, SERUM, URINE, HUMAN
(2167)*
RIBOSOMAL RNA METHYLATION, BLOOD CELL,
HUMAN (0834)
RICH VIRUS, ADENOSINE DEAMINASE, MOUSE
(1331)
RISK, DIAGNOSTIC IRRADIATION, HUMAN
(3968)
RNA, HYBRIDIZATION, MOUSE (0256)*
RNA METABOLISM, LEUKOCYTES, HUMAN
(4194)*
RNA SYNTHESIS
ACTINOMYCIN D, INHIBITION,
LEUKEMIA, HUMAN (0226)
MOUSE (0298)*
RNA TRANSFER, NUCLEUS, CYTOPLASM,
HUMAN, AUTORADIOGRAPHY (0843)
SERINE, ASPARTIC ACID, METABOLISM,
THERAPY, HUMAN (2890)*
SERUM, PROTEIN, HUMAN (0770)
SERUM INTERFERON PRODUCTION,
DEPRESSION, MOUSE (3834)*
SERUM LACTIC DEHYDROGENASE, MYELOMA,
ANEMIA, HUMAN (1191)*
SERUM PROTEIN, TRANSCOBALAMIN, HUMAN
(0878)*
SERUM PROTEIN FRACTIONS, HUMAN (3918)*
SKIN ALTERATION, ALLOGRAFT HYPOTHESIS,
MOUSE (4512)
SKIN GRAFT REJECTION, MOUSE, TUMOR
CELL (0769)
SPLEEN CELL-MEDIATED IMMUNITY,
INHIBITION, ISOANTIBODY, MOUSE
(3159)
SPONTANEOUS STEM CELL, RAT (3947)
SUB-ACUTE MYELO-MONOCYTIC
CASE REPORT, REVIEW (5062)*
PATHOLOGY, CLINICAL STUDY (6165)*
RESISTANT ANEMIA, BLOOD PLATELETS,
CLINICAL STUDY (6164)*
SURVIVAL, CERVICAL CARCINOMA,
RADIATION THERAPY, HUMAN (1304)
SUSCEPTIBILITY
HL-A ANTIGEN, HUMAN (0484)*
IMMUNOLOGICAL FACTOR, DOWN'S
SYNDROME, HUMAN (1834)
TOLERANCE, NEWBORN MOUSE (0325)*
LEUKEMIA - CONTINUED

TETRAHYDROFOLATE DEHYDROGENASE
PURIFICATION, CHROMATOGRAPHY, MOUSE
(3325)*
THERMORESISTANT ANTIGEN, FERRITIN,
HUMAN (0515)
THOROTRAST, HEMANGIOENDOTHELIOMA,
PORTUGAL (4490)
THROMBOPLASTIC LYMPHOCYTE ACTIVITY,
HUMAN (3519)*
THYMIDYLATE BIOSYNTHESIS,
5-FLUOROURACIL, MOUSE (4439)
THYMUS, 7,12-DIMETHYLBENZ(A)ANTHRACENE
MOUSE (5168)
TONSILLECTOMY, CHILDREN, REVIEW
(4328)*
TRANSFORMED CELLS, MICE (2035)*
TRANSPLANTABLE, GROWTH PATTERN,
MORPHOLOGY, RAT (5531)*
TRANSPLANTATION, THYMECTOMY, ANTI-
LYMPHOCYTE SERUM, HAMSTER, MOUSE
(5313)
7,8,12-TRIMETHYLBENZ(A)ANTHRACENE
LYMPHOID TISSUES, RAT (5799)
SPLEEN, THYMUS, RAT (7562)
7,8,12-TRIMETHYLBENZ(A)ANTHRACENE-
INDUCED, BONE MARROW CHANGES, RAT
(3691)
21 TRISOMY, INFANT (1199)*
TUBERCULIN ALLERGY, BACILLUS CALMETTE-
GUERIN, INCIDENCE, DENMARK (1923)
TUMOR ANTIGEN, LYMPHOCYTE STIMULATION,
HUMAN (5966)
TYPE C VIRUS, SEROLOGICAL DETECTION,
BOVINE CULTURES (4735)*
ULTRASTRUCTURE, HAIRY CELL, BONE
MARROW, HUMAN (2141)*
UNDIFFERENTIATED, HYPERCALCEMIA, CASE
REPORT (5610)*
URETHANE, N-NITROSOMETHYLUREA, IMMUNO-
DEPRESSION, MOUSE (1610)*
VIRAL ETIOLOGY, MOUSE, REVIEW (5724)*
VIRAL ORIGIN, H-POLYMERASE, HUMAN,
REVIEW (2205)
VIRUS
H-2 ANTIGENS, MOUSE (3870)
ETIOLOGY, REVIEW (1220)*
IMMUNOGENICITY, MOUSE (1047)
ISOLATION OF COMPONENTS, MOUSE
(2487)
VIRUS INFECTION, TRANSPLANT RESISTANCE
MOUSE (5309)
WALDENSTROM'S MACROGLOBULINEMIA,
IGM HEAVY CHAIN, CASE REPORT (0773)*
X-RAY INDUCED, INCIDENCE REDUCTION,
ANTI-LYMPHOCYTE SERUM, MOUSE (3727)
LEUKEMIC CELLS
IN VITRO, L-ASPARAGINE (2190)*
PLASMA MEMBRANES, ISOLATION,
CHARACTERIZATION (2172)*
LEUKEMOGENICITY
DI GUGLIELMO'S ERYTHREMIC MYELOSIS,
CELL-FREE FILTRATE, MOUSE (5943)*
LEUKOCYTE
ADHERENCE INHIBITION, CELL-MEDIATED
TUMOR IMMUNITY, SERUM BLOCKING,
FACTORS, MOUSE (2662)*
ALKALINE PHOSPHATASE, LYMPHOMA, HUMAN
(2851)
ALTERATION, BIOCHEMISTRY, LEUKEMIA,
REVIEW (2240)*
ARYL HYDROCARBON HYDROXYLASE,
3-METHYLCHOLANTHRENE, PHYTOHEMAGGLU-
TININ, HUMAN (5121)
BLASTIC TRANSFORMATION, CULTURE

(2657)*
 CARBOHYDRATE METABOLISM, CHRONIC
 LEUKOSIS, HUMAN (3485)*
 METABOLISM, PROTEINS, HUMAN (2124)*
 HEMOATTRACTANTS, LYMPHOCYTES (2688)*
 CHROMOSOME, ABNORMALITY, THERAPEUTIC
 DRUG, RADIATION, HUMAN (5454)*
 CHRONIC MYELOLEUCOSIS, CELL STUDY,
 HUMAN (3418)*
 COMPLEMENT-FIXING ANTIGEN,
 EPSTEIN-BARR VIRUS, HUMAN (0694)*
 CULTURE, UMBILICAL CORD, CHEMICAL
 CARCINOGEN, VIRUS, RADIATION, HUMAN
 (0719)*
 CYTIDINE-5'-MONOPHOSPHATE-N-ACETYL
 NEURAMINATE SYNTHETASE, LEUKEMIA,
 HUMAN (0563)*
 CYTOCHEMISTRY, MALIGNANCY, HUMAN
 (2850)*
 CYTOPLASMIC IMMUNOFLOUORESCENCE,
 LYMPHOSARCOMA, MULTIPLE MYELOMA,
 HODGKIN'S DISEASE, HUMAN (3856)*
 ORDERED PROLIFERATION, LEUKEMIA,
 HUMAN (4949)*
 ENZYMES, METABOLISM, REVIEW (1517)*
 ESTABLISHMENT OF CELL LINES, HUMAN
 (0852)*
 FUNCTION
 DOWN'S SYNDROME, ACUTE LEUKEMIA,
 CLINICAL STUDY (6301)*
 LEUKEMIA, INTERFERON, REVIEW
 (0932)*
 IMMUNITY, LYMPHATIC LEUKEMIA, MOUSE,
 PIG (3906)*
 INTERFERON PRODUCTION
 HERPESVIRUS, IMMUNOLOGICAL
 REACTIVITY, RABBIT (5997)*
 HODGKIN'S DISEASE, HUMAN (1172)*
 LEUKEMIA
 ADENOSINE DEAMINASE, HUMAN (3302)*
 CHILDREN (2008)*
 DNA SYNTHESIS, PRECURSOR
 METABOLISM, HUMAN, REVIEW (0609)*
 SERINE BIOSYNTHESIS, ENZYME, HUMAN
 (3316)*
 MALIGNANCY ASSOCIATED CHANGES, ULTRA-
 STRUCTURE & AIR DRYING, WRIGHT'S, PAS
 STAINING, HUMAN (6347)*
 MIGRATION, FRIEND LEUKEMIA VIRUS,
 MOUSE (1009)*
 MITOSIS, COLCEMID INHIBITION AND
 RECOVERY, HUMAN (2878)*
 NORMAL, LEUKEMIC, COLONY GROWTH, HUMAN
 (1106)*
 NORMAL AND LEUKEMIC STRAIN,
 COMPARATIVE STUDIES (3537)*
 PERIPHERAL, MUCOPOLYSACCHARIDES
 (2066)*
 POLYMORPHONUCLEAR, PROTEASES, HUMAN
 (3478)*
 ACTION, BURKITT LYMPHOMA TUMOR CELL,
 CELL STIMULATION, HUMAN (3888)*
 ACTIVITY, ANTINUCLEAR ANTIBODY,
 BLOOD MALIGNANCY, HUMAN (1405)*
 METABOLISM, LEUKEMIA, HUMAN,
 RIBOSOMES (0839)*
 SYNTHESIS, HUMAN (1464)*
 TRANSFORMATION
 CYTOPATHIC CHANGES, VIRAL ANTIGENS
 EPSTEIN-BARR VIRUS, MONKEY
 (3118)*
 PROLIFERATION, HUMAN (3843)*
 UMBILICAL CORD, TRANSFORMED, LYMPHOID
 CELL FILTRATE, HUMAN (2869)*
 X-IRRADIATION, CHROMOSOME ABERRATIONS,
 HUMAN, MARMOSSET (2477)*
 LEUKOCYTOSIS
 HEMATOLOGIC EFFECT, COLONY STIMULATING
 FACTOR, MOUSE (2097)*
 LEUKOPLAKIA
 EPIDEMIOLOGIC STUDY, INDIA (3264)*
 ORAL, HISTOPATHOLOGY, HUMAN (2729)*
 LEUKOSIS
 ACUTE
 ANTINUCLEAR FACTORS (2675)*
 NUCLEIC ACIDS, COPPER LEVELS,
 MANGANESE LEVELS, RAT (5873)*
 ALDOLASE POLYMORPHISM, HENS (5639)*
 AVIAN COMPLEX, ZINC CONTENT, TISSUES,
 FOWL (5527)*
 BENZENE INDUCED, PROTEIN LEVELS,
 CORTICOSTEROID TREATMENT, HUMAN
 (3367)*
 CARCINOMA, COINCIDENCE, HUMAN (0923)*
 LEUKEMIA, INCIDENCE, COW, HUMAN,
 DENMARK (0817)*
 LEUKOTIC TUMOR, SERUM ANTIGEN, CATTLE
 (1384)*
 TRANSPLANTED RAT ERYTHROMYELOSIS,
 CELL-FREE FILTRATES, MOUSE (5943)*
 LEYDIG CELL
 HYPERPLASIA, BRENNER TUMOR OF OVARY,
 CASE REPORT (5611)*
 TUMORS
 CADMIUM, ENZYME, RAT (0952)*
 MICROBODIES, TESTIS, RAT (5543)*
 LIGAND
 METAL, CARCINOGENESIS, REVIEW (1504)*
 LIMBUS
 CARCINOMA, ULTRASTRUCTURE, HUMAN
 (0569)*
 LIP
 CANCER
 HUMAN, REVIEW (4358)*
 METASTASES, CLINICAL STUDY (6311)*
 RISK, HUMAN, REVIEW (4350)*
 EPIDERMAL CARCINOMA, KIDNEY
 TRANSPLANT, CASE REPORT (1078)*
 PIGMENTED TUMOR, ULTRASTRUCTURE, HUMAN
 (6177)*
 PRECANCEROUS, PREVENTION, HUMAN
 (2738)*
 SQUAMOUS-CELL CARCINOMA, DISTANT
 CUTANEOUS METASTASES, CASE REPORT
 (6296)*
 LIPID
 ACCUMULATION, EHRlich ASCITES TUMOR,
 CYTOPLASM, GROWTH (0267)*
 CARCINOGENESIS, ESR SIGNAL OF FERRUM-
 COMPLEXES, FREE RADICAL PROCESSES
 (3721)*
 COMPOSITION, EHRlich ASCITES TUMOR
 CELLS, NACE CONTENT OF MEDIA (5552)*
 EMBRYONIC, TUMOR, BRAIN, HEART, LIVER,
 CHICK (4918)*
 FLUCTUATION, GROWTH PERIOD, EHRlich
 CARCINOMA, LIVER, MOUSE (6356)*
 GLYCOSPHINGOLIPID, BIOSYNTHESIS,
 NEUROBLASTOMA (0237)*
 GRANULOMAS, BONE MARROW, CLINICAL
 STUDY (4961)*
 METABOLISM, LIVER, 4-DIMETHYLAMINOAZO-
 BENZENE, RAT (4440)*
 MOBILIZATION, OBESITY, TUMOR, MOUSE
 (1456)*
 PANCREATIC EXOCRINE CELLS, WALKER
 TUMOR, RAT (5635)*
 PLASMA MEMBRANE, HEPATOMA, RAT, MOUSE.

(6115)
 LIPIDOSIS
 ACQUIRED, CHRONIC GRANULOCYTIC
 LEUKEMIA, GAUCHER-LIKE AND BLUE
 CELLS, CLINICAL STUDY (5668)*
 LIPOFUSCIN
 MALIGNANT AND NON-MALIGNANT PROSTATE
 TISSUE, HUMAN (3476)*
 LIPOMAS
 MICROTHROMBI, HUMAN (2154)*
 PAROTID, CASE REPORT (3564)*
 LIPOPROTEIN
 SARCOMA 180, NK-LYMPHOMA ASCITES TUMOR
 CELLS, CHEMICAL COMPOSITION, ULTRA-
 STRUCTURE (3389)*
 SERUM, CANCER PATIENTS (4069)*
 LIPOSARCOMA
 HUMAN, REVIEW (3637)*
 HUMAN NERVE-GROWTH FACTOR, CASE REPORT
 (6329)*
 LITHOCHOLIC ACID
 DL-ETHIONINE CARCINOGENESIS, LIVER,
 RAT (1554)
 LIVER
 2-ACETYLAMINOFLUORENE, CHOLANGIO-
 CARCINOMA, HAMSTER (0087)*
 ACID PHOSPHATASE CHANGE, AZO DYE
 CARCINOGENESIS, RAT (3714)
 ADENOMA, ULTRASTRUCTURE, HUMAN (0894)*
 ADENOSINE 3',5'-MONOPHOSPHATE ADENYL
 CYCLASE, RAT (4161)*
 ADENYL CYCLASE, ADRENALIN RESPONSE,
 2-ACETYLAMINOFLUORENE, RAT (5125)
 AFLATOXIN, TOXICITY, ULTRASTRUCTURE,
 RAT (0954)
 AFLATOXIN B1 ACTIVITY, SALMONELLA
 TYPHIMURIUM, RAT (2412)*
 ALCOHOL DEHYDROGENASE, HEPATOMA CELL
 HYBRIDS, RAT (4190)*
 ALPHA-FETOPROTEIN, MALIGNANCY, HUMAN
 (2144)*
 AMP DEAMINASE, 3'-METHYL-4-DIMETHYL-
 AMINOAZOBENZENE, BINDING, RAT (3710)
 ASCITES HEPATOMA, ANTIGEN, RAT (5971)
 BENZO(A)PYRENE HYDROXYLASE,
 3-METHYLCHOLANTHRENE, FETAL RAT
 (1580)
 BILIRUBIN GLUCURONIDATION, 3-METHYL-
 CHOLANTHRENE (1279)*
 BINDING PROTEIN, AMINO-AZO-DYE, RAT
 (0972)*
 BIOPSY, HODGKIN'S DISEASE, HUMAN
 (3994)
 BLOOD, CATALASE ACTIVITY, TUMOR-
 BEARING MOUSE (4187)*
 CANCER
 ALPHA-1-FETOPROTEIN, HUMAN (3993)
 AUSTRALIAN ANTIGEN, INCIDENCE,
 AFRICA (3157)
 BENZIDINE, MOUSE (0052)
 CIGARETTE SMOKE, TISSUE CULTURES,
 MOUSE (5154)
 DIETARY AFLATOXINS
 HEPATOMEGALY, INCIDENCE,
 THAILAND (3008)
 INCIDENCE, THAILAND (4418)
 P-DIMETHYLAMINOAZOBENZENE,
 ESTROGEN EFFECT, RAT (2956)
 P-DIMETHYLAMINOAZOBENZENE-INDUCED,
 ALKALOID EFFECT, FUNTUMINE AND
 IREHDIAMINE, RAT (2957)
 ETIOLOGY
 CLINICAL STUDY (3297)
 REVIEW (3631)*

GLYCOLYTIC ENZYMES, HUMAN (0867)*
 PRIMARY AND SECONDARY, ALPHA-
 FETOPROTEIN RADIOIMMUNOASSAY,
 HUMAN (4627)
 SERUM ALPHA-FETOglobULIN, HUMAN
 (3926)*
 1-CARBON ENZYME ACTIVITIES, ADMINIS-
 TRATION OF HEPATOCARCINOGENS, RAT
 (3022)*
 CARBON TETRACHLORIDE
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 ADRENAL GLAND, RAT (4414)
 3-METHYLCHOLANTHRENE, CIRRHOSIS,
 RAT (0064)
 CARCINOGENESIS
 2-ACETYLAMINOFLUORENE, 3-METHYL-
 CHOLANTHRENE, DNA-BINDING,
 RNA-BINDING, RAT (2941)
 BOUND DYE, GLUTATHIONE,
 4-DIMETHYLAMINOAZOBENZENE, RAT
 (0659)*
 DIETHYLNITROSAMINE, ENZYME-
 DEFICIENT ISLAND, RAT (0356)
 4-DIMETHYLAMINOAZOBENZENE, RNA
 POLYMERASE SUPPRESSION, NITRO-
 FURAN, RAT (2946)
 ETHIONINE, ULTRASTRUCTURE, RAT
 (3717)*
 INHIBITION
 2-DIACETAMIDOFUORENE, ALLOXAN
 DIABETES, RAT (0939)
 DIMETHYLNITROSAMINE, AMINO-
 ACETONITRILE, RAT (0967)
 LIPOPROTEINS,
 N-2-FLUORENYLACETAMIDE, RAT
 (0792)*
 3-METHYL-4-DIMETHYLAMINOAZOBENZENE
 ALPHA-FETOPROTEIN, RAT (4626)
 CELL POPULATION, RAT (2300)
 CARCINOMA
 2-ACETYLAMINOFLUORENE,
 PHENOBARBITAL, RAT (1244)
 ALPHA FETOPROTEIN
 HUMAN (0290)*
 ISOLATION, HUMAN (1079)*
 SYNTHESIS, REVIEW (0901)
 THOROTRAST CARRIERS (6048)*
 ANOMALOUS SERUM PROTEIN, HUMAN
 (0473)
 ATOM BOMB RADIATION, NAGASAKI,
 HIROSHIMA, HUMAN (2455)
 CIRRHOSIS, INCIDENCE, ISRAEL
 (3254)
 DIETHYLNITROSAMINE, INHIBITION,
 THYMUS TISSUES, RAT (5145)
 DIETHYLNITROSAMINE-INDUCED,
 HISTOLOGICAL CHANGES, HISTO-
 CHEMICAL CHANGES, RAT (5401)
 EHRLICH ASCITES, LIPIDS, MOUSE
 (2088)*
 N-2-FLUORENYLACETAMIDE, MITO-
 CHONDRIAL FUNCTION, RAT (1415)
 GLUTAMIC DEHYDROGENASE (2102)*
 HEPATECTOMY, DIMETHYLNITROSAMINE,
 RAT (1267)
 INCIDENCE
 INDIA (0827)*
 IVORY COAST (0218)*
 MESOTHELIOMA, INTERSTITIAL CELL
 TUMOR, NITROSAMINE, GENITAL
 MESOTHELIUM, RAT (2951)
 NUCLEAR INCLUSION, CYTOPLASMIC
 INCLUSION, HUMAN (1125)
 TRANSPLANTATION, ALPHA FETOPROTEIN

HUMAN (0759)
 ULTRASTRUCTURE, RAT (3695)
 CATALASE, IMPAIRED SYNTHESIS, RAT (3491)*
 CATALASE-DEPRESSING FACTOR, FRIEND VIRUS INFECTION, SPLEEN, MOUSE (3077)
 ER - CONTINUED
 CELL
 ARYL HYDROCARBON HYDROXYLASE, STIMULATION, POLYCYCLIC HYDROCARBON, RAT (1252)
 DNA SYNTHESIS STIMULATION, PROTEIN SYNTHESIS STIMULATION, SERUM, HEPATECTOMY, RAT (1791)
 NUCLEOLI, METHIONINE, ETHIONINE, GUINEA PIG (0363)
 CELL AGGREGATION, CHEMICAL CARCINOGEN, TUMOR TRANSPLANT, RAT (1269)
 CELL CARCINOMA, TRANSFORMATION, RAT (2823)
 CELL CULTURE, AGGREGATE FORMATION, DIETHYLAMINOAZOBENZENE, RAT (5793)
 CELL FOCI ALTERATIONS, DIETHYL-NITROSAMINE, QUANTITATIVE STUDY, RAT (3715)*
 CELL GROWTH, MORPHOLOGY, 4-DIMETHYL-AMINOAZOBENZENE, RAT (1257)
 CELL NUCLEI, MORRIS HEPATOMA, DNA SYNTHESIS, SUCROSE (1484)*
 CELL PROLIFERATION, 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE, RAT (0347)
 CHICK EMBRYO LETHAL ORPHAN VIRUS, HEPATOMA INDUCTION, HAMSTER (0703)
 CHOLANGIOCELLULAR TUMORS, NITROSOMORPHOLINE, RATS (2406)*
 CHOLESTEROL SYNTHESIS
 FEEDBACK CONTROL, HEPATOMA, HUMAN (3401)*
 N-2-FLUORENYLACETAMIDE, RAT (4782)
 CHOLESTEROL-LIPID ANOMALY, AFLATOXIN, DUCKLING (1622)*
 CHRYSOIDINE HEPATOMA, GROWTH, SPLENECTOMY, MOUSE (6027)*
 CIRRHOSIS
 HEPATOCARCINOMA, ALCOHOL, HUMAN, REVIEW (5070)*
 LYMPHOPROLIFERATIVE DISEASES, ETIOLOGICAL RELATIONSHIP, CASE REPORTS (4117)*
 PRIMARY CARCINOMA, INCIDENCE, IRAN (2771)
 CYCLOPHOSPHAMIDE METABOLISM, ENZYME, TOXIC METABOLITE, MOUSE (3660)
 CYST, TRANSFORMATION, AFLATOXIN, HUMAN (1555)
 CYTOMORPHOLOGICAL CHANGE, MYCOTOXIN, RAT (1282)*
 DEDIFFERENTIATED PATTERN OF ENZYMES, TUMOR-BEARING RATS (5515)*
 DIETHYLNITROSAMINE HEPATECTOMY, PARTIAL HEMANGIOENDOTHELIOMA, RAT (0374)*
 DIHYDROURACIL DEHYDROGENASE, REGENERATION, MORRIS HEPATOMA, RAT (0578)*
 N,N-DIMETHYLAMINOAZOBENZENE
 ADENOSINE TRIPHOSPHATASE, RAT (4784)
 METABOLISM, RAT (3688)
 DIMETHYLAMINOAZOBENZENE CARCINOGENESIS
 GLYCOLYSIS, RAT (5161)
 DNA REPAIR SYNTHESIS, 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE, RAT (2979)

DNA SYNTHESIS, 3'-METHYL-4-DIMETHYL-AMINOAZOBENZENE, RAT (1560)
 DRUG METABOLISM, PROTEIN SYNTHESIS, METHYLAZOXYMETHANOL (1280)*
 EHRlich ASCITES TUMOR, MORPHOLOGIC CHANGE, MOUSE (0279)*
 ENDOPLASMIC RETICULUM, PROLIFERATION, PHENOBARBITAL, 3-METHYLCHOLANTHRENE, ULTRASTRUCTURE, RAT (1655)*
 ENDOTHELIAL CELL SARCOMA, THOROTRAST, CASE REPORT (0677)*
 ENERGY METABOLISM, 1,4-DIHYDROPYRIDINE 1,6-DIHYDROPYRIMIDINE, TUMOR CELLS (3723)*
 ENZYME
 DIMETHYLNITROSAMINE, METABOLIC PRODUCT, MUTAGEN, MOUSE (1584)
 MAMMARY CARCINOMA, MORRIS HEPATOMA RAT (0364)
 ENZYME INDUCTION, URETHAN, SODIUM PENTOBARBITONE, ETHER, RAT (1611)*
 ENZYME INHIBITION, 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE, RAT (2299)
 ENZYME REGULATION, MORRIS HEPATOMA, CHOLESTEROL, RAT (4851)
 ENZYME SYSTEMS, CYTOPLASM, THIOACETAMIDE, RAT (0341)
 ENZYMIC RESPONSE, RESPIRATORY RESPONSE CORTICOSTERONE, DIETHYLNITROSAMINE, RAT (1648)*
 DL-ETHIONINE CARCINOGENESIS, LITHOCHOLIC ACID, RAT (1554)
 EXTRACT, MAMMARY TUMOR, GROWTH INHIBITION, MOUSE (4047)
 N-2-FLUORENYLACETAMIDE, METABOLISM, RAT (4430)
 GALLIUM, INTRACELLULAR DISTRIBUTION, TUMORIGENESIS, MOUSE (6384)*
 GLUCOSE-6-PHOSPHATASE, 4-DIMETHYLAMINOAZOBENZENE, RAT (0669)*
 L-GLUTAMINE, D-FRUCTOSE 6-PHOSPHATE AMIDOTRANSFERASE, YOSHIDA SARCOMA, RAT (0544)
 GLYCEROLPHOSPHATE DEHYDROGENASE, THYROID HORMONE, HEPATOMA, RAT (0980)*
 GLYCOGEN, WALKER 256 TUMOR, METASTASIS RAT (0253)
 GLYCOGEN LEVEL, METHYL METHANESULFONATE, RAT (1646)*
 GLYCOGEN PHOSPHORYLASE, FETAL LIVER, HEPATOMA, RAT (5339)
 GRANULOMA INDUCTION, STREPTOCOCCUS, CELL WALL, MOUSE (0283)*
 LIVER - CONTINUED
 HEMANGIOENDOTHELIAL SARCOMA, HISTOLOGY DIETHYLNITROSAMINE, RAT (3711)
 HEMANGIOENDOTHELIOMA, PATHOLOGY, HUMAN (4244)*
 HEPATIC CANCER, MULTIENZYME COMPLEX, SERUM HUMAN (4942)*
 HEPATIC CARCINOGENS, DNA BINDING (5825)*
 HEPATIC COPPER, CHROMIUM, MANGANESE, BRONCHOGENIC CANCER, HUMAN (2335)
 HEPATIC ENZYME ACTIVITIES, CASTRATION, SARCOMA 37 GROWTH, MOUSE (5000)*
 HEPATIC NECROSIS, 3-METHYLCHOLANTHRENE BLOCKING AGENT (2369)*
 HEPATOBLASTOMA, STRUCTURE, EPITHELIAL TYPE, CASE REPORT (3332)*
 HEPATOCARCINOGENESIS

- DIMETHYLNITROSAMINE, NEWT (4467)*
 ENZYME HISTOCHEMISTRY, RADIO-AUTOGRAPHY, RAT (4452)*
 KARYOKINESIS AND NUCLEAR STRUCTURE NITROSOMORPHOLINE HEPATOCYTES, RAT (4472)*
 LIPID METABOLISM, 4-DIMETHYLAMINO-AZOBENZENE, RAT (4440)
 HEPATOCARCINOMA, CIRRHOSIS, COINCIDENCE, CHILD (1084)
 HEPATOCELLULAR CARCINOMA
 ACID PHOSPHATASE, N-2-FLUORENYL-DIACETAMIDE, RAT (0048)
 AFLATOXIN B1, ALPHA-FETOPROTEIN, RAT (5335)
 ALKALINE PHOSPHATASE VARIANT, SERA HUMAN (4922)*
 ALPHA-FETOPROTEIN, IMMUNOFLUORESCENT LOCALIZATION, HUMAN (1392)
 ANDROGENIC-ANABOLIC STEROID THERAPY, CASE REPORTS (5843)*
 ANDROGENIC STEROIDS, HUMAN (5839)*
 AUSTRALIA ANTIGEN, HUMAN (4683), (4813), (5912)
 AUTOPSY STUDY, NIGERIANS, REVIEW (4351)*
 DIAGNOSIS, ALPHA-FETOPROTEIN, UGANDAN PATIENTS (4644)
 DIETHYLNITROSAMINE-INDUCED, GROWTH KINETICS, CELL POPULATIONS, RAT (5073)
 HEPATITIS ASSOCIATED ANTIGEN, TAIWAN (1797)
 HEPATITIS ASSOCIATED ANTIGEN AND ANTIBODY, HUMAN (3166)
 IMMUNITY, BACILLUS CALMETTE-GUERIN VACCINE, GUINEA PIG (4655)
 PORPHYRIA CUTANEA TARDA, FREQUENCY HUMAN (4042)
 PROTOCOLLAGEN PROLINE HYDROXYLASE, UGANDANS (4882)*
 ULTRASTRUCTURE, HUMAN (1155)*
 VERTEBRAL METASTASES, RADICULAR COMPRESSION, CASE REPORTS (5568)*
 HEPATOCYTE, CYTOPLASMIC ALTERATIONS, NITROSAMINE, RAT (5855)*
 HEPATOCYTE PROLIFERATION, MITOTIC ABNORMALITIES, DIETHYLNITROSAMINE, RAT (2384)*
 HEPATOMA
 AFLATOXIN B1, MOUSE (5152)
 ALPHA-FETOPROTEIN, IMMUNO-FLUORESCENT LOCALIZATION, HUMAN (1435)
 BIOCHEMISTRY, CYTOGENETICS, CELL LINER, RAT (5456)
 CELLULAR IMMUNITY, MACROPHAGE MIGRATION, GUINEA PIG (4650)
 4-DIMETHYLAMINOAZOBENZENE, CYTOSKELETON ALTERATIONS, CELLS, RAT (5131)
 DNA SYNTHESIS, FERRITIN, HEPATECTOMY, RAT (1472)*
 FETAL MOLECULAR ENZYME FORMS, RAT, HUMAN, REVIEW (5716)
 GROWTH RATE, ULTRASTRUCTURE, MOUSE (6088)*
 HYDROXYMETHYLGLUTARYL COENZYME, FEEDBACK CONTROL, CHOLESTEROL, RAT (0536)
 PHOSPHODIESTERASE ACTIVITY, RAT (6114)
 PRECANCEROUS CONDITION, 4-DIMETHYLAMINOAZOBENZENE, STAINING, RAT (0992)*
 PROTEINS, IMMUNOELECTROPHORESIS, RAT (4732)*
 REGIONAL VARIATION, REVIEW (2223)*
 SURFACE MEMBRANE ANTIGEN DELETION, 4-DIMETHYLAMINOAZOBENZENE, RAT (4678)
 THOROTRAST-INDUCED, CASE REPORT (4500)*
 HEPATOMA DEVELOPMENT, BENZENE HEXACHLORIDE, MOUSE (4462)*
 HEPATOMA INDUCTION, RESISTANCE, 4-DIMETHYLAMINOAZOBENZENE, BLOOD TRANSFUSION, RAT (2931)
 HEPATOTOXICITY, CARBON TETRACHLORIDE, BENZO(A)PYRENE PRETREATMENT, RAT (4451)*
 HEXOKINASE, PYRUVATE KINASE ACTIVITY, EHRLICH ASCITES TUMOR, MOUSE (6126)
 HISTONE, DNA SYNTHESIS INHIBITION, DIMETHYLNITROSAMINE, RAT (0643)
 HYPERBASOPHILIC FOCI, DIMETHYLAMINO-AZOBENZENE, RAT (0956)
 HYPERPLASTIC LESION
 HEPATOMA
 2-FLUORENYLACETAMIDE, HISTOCHEMISTRY, RAT (0953)
 HEPATECTOMY, RAT (0945)
 HYPERPLASTIC NODULE, N-2-FLUORENYL-ACETAMIDE, RAT (5772)
 INVASION, NOVIKOFF HEPATOMA, ULTRA-TURE, RAT (6281)*
 IRON, NEOPLASTIC AND PRENEOPLASTIC LESIONS, 8-HYDROXYQUINOLINE-INDUCED SIDEROSIS, RAT (4389)
 KUPFFER CELL, PHAGOCYTOSIS, HUMORAL RECOGNITION FACTOR, LEUKEMIA, RAT (5298)
 LIVER - CONTINUED
 LEUCINE INCORPORATION, 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE, CHLORAMPHENICOL, DIET, RAT (1559)
 LIPOMATOSIS, CIRRHOSIS& CASE REPORT (0876)*
 LUNG, TUMORIGENESIS, 4-DIMETHYLAMINO-AZOBENZENE, DERIVATIVES, MOUSE (0958)
 LYSOSOME, AFLATOXIN, RAT (1621)*
 MACROMOLECULE SYNTHESIS, INHIBITION, N-HYDROXY-2-FLUORENYLACETAMIDE, RAT (1251)
 MALIGNANT HEMANGIOENDOTHELIOMA, CHRONIC ARSENICISM, HUMAN (3017)*
 MALIGNANT NODULES, CYCLIC AMP LEVELS, ETHIONINE TREATED RATS (5806)
 MEMBRANE-SPECIFIC ANTIGEN, RAT CELL (3899)
 METABOLISM
 DIMETHYLAMINOAZOBENZENE, RAT (1561)
 HEPATOMA, ISCHEMIA, RAT (4857)
 POLYCYCLIC HYDROCARBONS, EPOXIDES, RAT (1533)
 METASTASIS
 ANGIOGRAPHY, HISTOLOGY (4256)*
 LIPOPROTEIN, ALKALINE PHOSPHATASE, HUMAN (2884)*
 STOMACH CARCINOMA, ALPHA FETOPROTEIN, HUMAN (1842)*
 METAL DISTRIBUTION, MICROSOMAL ENZYME, PHENOBARBITAL, BENZO(A)PYRENE, CARBON TETRACHLORIDE, RAT (4403)
 METHYLCHOLANTHRENE, BINDING AND

DISTRIBUTION, RAT (2953)
 METHYLCHOLANTHRENE BINDING, CORTICOSTEROID BINDER, CYTOSOL, RAT (1264)
 METHYL-4-DIMETHYLAMINOAZOBENZENE CARCINOMA, AGE, SEX, RAT (2967)
 PYRUVATE KINASE ISOZYME, RAT (1562)
 MITOCHONDRIAL AZOREDUCTASE, BETA-DIETHYLAMINOETHYL DIPHENYLPROPYLACETATE, 2,4-DICHLORO-6-PHENOXYETHYLAMINE, PHENOBARBITAL, 3-METHYLCHOLANTHRENE, RAT (1627)*
 MITOCHONDRIAL MIXED-FUNCTION OXIDASE, BENZO(A)PYRENE, RAT, MOUSE (1650)*
 MITOCHONDRIAL
 ANTIGENITICITY, 2:3 DIMETHYL-4-AMINOAZOBENZENE, MOUSE (2930)
 BENZO(A)PYRENE HYDROXYLASE, SPIRONOLACTONE, ETHYLSTRENOL, RAT (1138)*
 DAB EFFECT, RAT (2301)
 GLUCURONYL TRANSFERASE, 3-METHYLCHOLANTHRENE, GUINEA PIG, RAT (0963)
 MITOCHONDRIA
 BENZO(A)PYRENE, STEROID HORMONES, RAT (2314)
 BENZO(A)PYRENE EFFECT, RAT (2313)
 MORRIS HEPATOMA
 ENZYME ALTERATION, RESPIRATION, REVIEW (5011)
 PHYTOSTEROL, RAT (3301)
 SINGLE-CELL SUSPENSION PREPARATION, MOUSE, RAT (6179)*
 NECROSIS, SODIUM NITRITE, MOUSE (0975)*
 CYTOPLASMS
 ALPHA-FETOPROTEIN, HUMAN (4713)*
 GLYCOGEN METABOLISM, RAT, MOUSE (3996)
 GRANULOCYTIC ALKALINE PHOSPHATASE, HUMAN (4266)*
 VIRUS GROWTH, ANTIBODY, HEPATITIS, RAT (4544)
 SPIROFF HEPATOMA, AGGLUTINATION, ANTIBODY, RIBOSOMAL SUBUNITS, ANTISERA, RAT (4617)
 NUCLEAR ACIDIC PROTEIN, BINDING, 2-ACETAMIDOFLUORENE, RAT (0936)
 NUCLEIC ACID
 2-ACETYLAMINOFLUORENE BINDING, 3-METHYLCHOLANTHRENE, DIET, RAT (1283)*
 URETHANE EFFECT, MOUSE (2329)
 NUCLEIC ACID SYNTHESIS
 AGING, CAFFEINE, RADIATION, MOUSE (1639)*
 DIMETHYLNITROSAMINE, RAT (1587)
 HEPATOCYTES, INJURY, AFLATOXIN B1, ULTRASTRUCTURE, RAT (1635)*
 HEPATOCYTES, DAMAGE, HODGKIN'S DISEASE, HUMAN (6388)*
 PARTIAL HEPATECTOMY, NUCLEIC ACID, URETHANE BINDING, MOUSE (2933)
 PATHOLOGIC CHANGES, 1,10-PHENANTHROLINE, ETHIONINE FED RATS (4461)*
 PHENOBARBITAL BINDING, RAT (5127)
 ADENYLIC ACID HYDROLASE, CARCINOGENESIS, DIMETHYLAMINOAZOBENZENE, RAT (3654)
 POLYRIBOSOME
 AMINO ACID INCORPORATION DIMETHYLNITROSAMINE, RAT (5166)
 BENZENE, RAT (0943)
 POLYSOMAL DISAGGREGATION, DIMETHYLNITROSAMINE, LASIOCARPINE, 2-DIETHYLAMINOETHYL-2,2-DIPHENYL-VALERATE, MOUSE (1652)*
 POLYSOMAL DISAGGREGATION, DIMETHYLNITROSAMINE, LASIOCARPINE, ETHANOL, MOUSE (1287)*
 PRECANCEROUS, METABOLIC CONTROLS, CHOLESTEROL SYNTHESIS, N-2-FLUORENYLACETAMIDE, RAT (2963)
 LIVER - CONTINUED
 PRIMARY CANCER
 ALPHA-FETOPROTEIN, INCIDENCE, HUMAN (4723)*
 AUSTRALIAN ANTIGEN, HUMAN (3842)
 HEPATITIS, CIRRHOSIS, ETIOLOGIC RELATIONSHIP (4018)
 POLYCYTHAEMIA VERA TREATMENT, RADIOACTIVE PHOSPHORUS, CASE REPORT (4499)*
 PRIMARY CARCINOMA
 AFRICA, REVIEW (0006)
 ALPHA-FETOGLUBULIN, HUMAN (3219)*
 PATHOLOGY (4257)*
 PATHOLOGY, CASE REPORTS (3337)*
 PRIMARY LIVER CELL CARCINOMA
 HUMAN, REVIEW (4324)*
 ULTRASTRUCTURE, AFRICAN (3865)
 PRIMARY TUMOR, CASE REPORT (4159)*
 PROLIFERATIVE RESPONSE, CYTOPLASMIC MASS, RAT (3441)*
 PROTEIN, CARCINOGEN TREATED, RAT (2366)*
 PROTEIN CONJUGATE, 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE, RAT (5102)
 PROTEIN DISTRIBUTION, 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE, RAT (5100)
 PROTEIN H, CARCINOGEN SUSCEPTIBILITY, IMMUNOLOGY, RAT, MOUSE, HAMSTER, GUINEA PIG, RABBIT (5082)
 PROTEIN LABELING, DIMETHYLNITROSAMINE, 3-METHYLCHOLANTHRENE PRETREATMENT, RAT (1586)
 PYRUVATE KINASE ISOZYMES, SARCOMA CHROMATINS, RAT (4223)*
 REGENERATION
 AFLATOXIN, RAT (1557)
 AMINOACYL SYNTHETASES, ISOACCEPTING TRANSFER RNA, RAT (3359)*
 CARBON TETRACHLORIDE, SERUM ALPHA FETOPROTEIN, RAT (0762)
 CARCINOGENESIS, MAGNESIUM ION CONCENTRATION, INORGANIC PYROPHOSPHATASE, RAT (5151)
 COLLAGEN DEPOSITION, DIMETHYLNITROSAMINE-INDUCED CIRRHOSIS, RAT (4479)*
 DIETHYLNITROSAMINE, HEPATECTOMY, RAT (1633)*
 HEPATOMA, METABOLISM, MOUSE (0981)*
 METABOLIC ALTERATIONS, ENHANCED DNA SYNTHESIS, 5-AZACYTIDINE-TREATED RATS (4466)*
 NUCLEAR PROLIFERATION, DNA, MOUSE (3390)*
 NUCLEIC ACIDS, (3H)ETHYL CARBAMATE INTERACTION, MOUSE (2436)*
 RIBOSOME MONOMER, DIMETHYLNITROSAMINE, RAT (4393)
 RNA, URETHANE, MOUSE (0371)*
 RNA AND PROTEIN SYNTHESIS, COMPARATIVE STUDY, RAT (5192)*
 RNA METHYLATION, METHYL METHANE-SULPHONATE, NN-DIMETHYLNITROSAMINE,

- (RAT) (5122)
RNA SYNTHESIS INHIBITION, METHYL AZOXY-
METHANOL ACETATE, RAT (5128)
SARCOMA, SPONTANEOUS RECOVERY, CASE
REPORT (5380)*
SERUM PROTEIN, SOLUBLE PROTEIN,
ELECTROPHORETIC ANALYSIS, HEPATO-
CARCINOGENESIS, MOUSE (1893)
SPLEEN, LEUKEMIC CELL, INFILTRATION,
HUMAN (0271)*
SPONTANEOUS LESIONS, MORPHOLOGY, MOUSE
(2717)
SQUAMOUS CELL CARCINOMA, NON-PARASITIC
CYST, CASE REPORT (6315)*
STEROL SYNTHESIS REGULATION, BETA-
HYDROXY-BETA-METHYLGLUTARYL
REDUCTASE, HEPATOMA, MOUSE (1483)*
STRUCTURAL CHANGES, MICROCIRCULATION,
ALPHA-NAPHTHYL-ISOTHIOCYANATE, RAT
(1552)
THIOACETAMIDE, RIBONUCLEOPROTEIN, RAT,
BIOCHEMISTRY, ULTRASTRUCTURE (1249)
TOXICATION-DETOXICATION SYSTEMS,
BENZO(A)PYRENE, DRUG METABOLISM,
ENZYME INDUCTION, REVIEW (5720)*
TOXICITY
HEPATOMA, LUTEOSKYRIN, CYCLO-
CHLOROTINE, RICE, MOUSE (2354)
SODIUM NITRITE, DIMETHYLAMINE,
MOUSE (5778)
LIVER - CONTINUED
TUMOR
2-ACETYLAMINOFLUORENE, PHENO-
BARBITAL, RAT (5084)
BETA-GLUCURONIDASE MARKER, MOUSE
(2874)
CHILDREN (0012)*
N,N-DIMETHYL-P-(M-TOLYLAZO)ANILINE
DIET DEFICIENCY, RAT (0041)
ENDOPLASMIC RETICULUM, LIPID,
GLYCOGEN, RAT (1986)
FINE STRUCTURAL CHANGES, MICRO-
SOMAL HYPOFUNCTION, RAT (3379)*
GLUCOSE-6-PHOSPHATASE DEFICIENCY,
ULTRASTRUCTURE, HUMAN (0241)
HEPATIC CATALASE ACTIVITY,
OXIDATION INHIBITION, RAT
(3322)*
INDUCTION, 2-ACETYLAMINOFLUORENE,
RAT (3716)*
ISOZYME, N,N'-2,7-FLUORENYLENE-
BISACETAMIDE, MOUSE (1551)
RIBOSOMAL SUBUNIT, RAT (1429)
SIALIC ACID SYNTHESIS, ENZYME
ACTIVITY, RAT (1452)*
TOBACCO, HAMSTER (3722)*
TRNA N2-GUANINE DIMETHYLASE, RAT
(4862)
TUMOR INDUCTION
ADENOVIRUS SA7(C8), MOUSE (2532)
CYCASIN, RAT (5783)
N-2-FLUORENYLACTAMIDE TESTOSTERONE
EFFECT, RAT (2338)
NITROSAMINES, FISH (2324)
TUMOR PROMOTION, PHENOBARBITAL,
ACETYLAMINOFLUORENE, RAT (0934)
TUMORIGENESIS
CYCASIN, RAT (5119)
P-DIMETHYLAMINOAZOBENZENE, PAPAIN,
RAT (4432)
MUTATION, NEUTRON IRRADIATION,
MOUSE (3732)
TYROSINE, 2-OXOGLUTARATE AMINOTRANS-
FERASE, EHRLICH ASCITES TUMOR, MOUSE
(0874)*
TYROSINE TRANSAMINASE REGULATION,
HEPATOMA CELLS, RAT (3295)
VIRAL HEPATITIS, CIRRHOSIS, PRIMARY
CANCER, IVORY COAST (3255)
YOSHIDA ASCITES HEPATOMA, TUMOR CELL
ANTIGEN, CELL ELECTROPHORESIS (1822)
ZINC CONCENTRATIONS, CARCINOMA, HUMAN
(2447)*
LIVER CELLS
TRANSPLANTATION, HISTOLOGY, RAT
(2034)*
LIVER NEOPLASMS
VIRAL HEPATITIS, METASTASIS, REVIEW
(1528)*
LOCALIZATION
CARCINOMA, PROSTATIC (1526)*
LONGEVITY
SEX DIFFERENTIAL, GONADECCTOMY, HORMONE
TREATMENT, NORMAL HAMSTERS,
NEOPLASTIC HAMSTERS (6364)*
TRANSFORMED AMNION CELL, SV40, HUMAN
(1756)
LSONICOTINIC ACID
TUMORIGENESIS, HAMSTER (2349)
LUCKE RENAL ADENOCARCINOMA
VERTICAL TRANSMISSION, FROG (3759)
LUNG
ABNORMALITIES, ASBESTOS, OCCUPATIONAL
HAZARD, INCIDENCE, BELFAST (1102)
ADENOCARCINOMA, ULTRASTRUCTURE, HUMAN
(4218)*
ADENOMA
CARCINOGENS, MOUSE (2375)*
CARCINOMA, CHROMOSOME, HUMAN (0245)
CHEMICAL CARCINOGEN, NEWBORN MOUSE
(0033)
URETHANE, MAMMARY GLAND EXCRETION,
MOUSE (0362)
URETHANE-INDUCED
CELLULAR IMMUNITY, MOUSE (2326)
SUPPRESSION, TREHALOSE-6,6-DIMYCO-
LATE, BACILLUS CALMETTE-GUERIN,
MOUSE (2330)
ALVEOLAR CELL CARCINOMA
CALCIFIED BODIES, CYTOPATHOLOGY,
CASE REPORTS (4273)*
ULTRASTRUCTURE, HUMAN (3497)*
ALVEOLI, TUMOR, ULTRASTRUCTURE, MOUSE
(1132)
ASBESTOS
ASBESTOSIS, REVIEW (0916)*
FLOOR-TILE INSTALLATION, HUMAN
(0983)*
ASBESTOS BODIES, ENVIRONMENTAL FACTOR,
MAN (0662)*
BRONCHI, PRIMARY EPIDERMAL CARCINOMA,
SMOKING, STATISTICAL STUDY (5817)*
BRONCHIAL ADENOMA, METHYLNITROSUREA,
ORGANOTROPISM, MOUSE (1590)
BRONCHIAL CANCER, TOBACCO SMOKING,
HUMAN, REVIEW (5006)
BRONCHIAL CARCINOID, ULTRASTRUCTURE,
CASE REPORT (6305)*
BRONCHIAL CARCINOID TUMORS, ACTH
SECRETION, CASE REPORTS (6366)*
BRONCHIAL CARCINOMA
ANALYSIS OF CASES (3259)
CYTOSTATIC TREATMENT, IMMUNO-
LOGICAL BEHAVIOR, HUMAN (3216)*
EPIDEMIOLOGY, ETIOLOGY, REVIEW
(2298)*
ETIOLOGY, PATHOGENESIS, REVIEW
(2283)*

FORMIMINOGLUTAMINIC ACID LEVELS,
 URINE, CLINICAL STUDY (6184)*
 HISTOLOGY, HISTOGENESIS, HUMAN
 (6069)*
 SEX RATIO, INCIDENCE, WORLD-WIDE
 DIFFERENCES (3261)
 SMOKING, WOMEN, STATISTICAL STUDY
 (5816)*
 TUBERCULOSIS, JOINT OCCURRENCE,
 CASE REPORT (5658)*
 ONCHIOLEAR EPITHELIUM, URETHANE,
 MOUSE (1092)*
 ONCHIOLO-ALVEOLAR CARCINOMA,
 TREATMENT, HUMAN, REVIEW (3607)
 ONCHIOLO-ALVEOLAR CELL CARCINOMA,
 ULTRASTRUCTURE, HUMAN (5468)*
 ONCHOGENIC CANCER, HEPATIC COPPER,
 CHROMIUM, MANGANESE, HUMAN (2335)
 ONCHOGENIC CARCINOMA
 ENDOSCOPIC LOCALIZATION, CASE
 REPORTS (4928)*
 INCIDENCE, MINNESOTA (0214)*
 METASTASIS, CASE REPORT (4887)*
 ONCHOPULMONARY, ONCOGENESIS,
 HORMONAL ASPECT, HUMAN (3365)*
 ONCHOPULMONARY CANCER CELLS, BLOOD
 STREAM, HUMAN (3363)*
 ONCHOPULMONARY CARCINOMA, RADON,
 INHALATION, RAT (5197)
 NCER
 AIR-POLLUTION, HUMAN (2408)*
 ALLERGIES, HUMAN (4762)*
 ASBESTOS, OCCUPATIONAL HAZARD,
 EPIDEMIOLOGY, REVIEW (4303)
 BLOOD AND URINARY TRACE ELEMENTS,
 METABOLIC DISORDERS (3574)*
 CARDIAC METASTASIS, CASE REPORT
 (4184)*
 CHLOROPRENE, OCCUPATIONAL HAZARD
 (5768)
 CIGARETTE SMOKING, REVIEW (5010)
 CYTOLOGIC IMMUNOLOGICAL TESTS,
 HUMAN (3221)*
 ENDOCRINE DISEASE (2870)
 ENVIRONMENTAL HAZARD, STEEL
 MANUFACTURE, FLUORIDE, CANADA
 (5414)
 ENVIRONMENTAL INFLUENCE, INCIDENCE
 ITALY (3267)
 ETIOLOGY, INCIDENCE, UNITED STATES
 (2769)
 FIBRINOGEN LOCALIZATION, AUTO-
 RADIOGRAPHIC STUDY, RABBIT
 (4384)
 FLUORIDE, HUMAN, REVIEW (4353)*
 FLUORIDE LEVELS, OCCUPATIONAL
 HAZARD, STEEL INDUSTRY, CANADA
 (4823)
 IMMUNOREACTIVE GROWTH HORMONE,
 HUMAN (3927)*
 INCIDENCE
 JAMAICA (3253)
 MALE, CZECHOSLOVAKIA (6101)*
 SPAIN (2786)*
 METASTASES, CRANIAL BASIS (3576)*
 MORPHOLOGY, IRON MINER (0970)*
 MORTALITY
 INCIDENCE, DIAGNOSIS AND TREAT-
 MENT, INTERNATIONAL, REVIEW
 (4301)
 NEWSPAPER WORKERS, ENGLAND
 (2754)
 7-NITROQUINOLINE-1-OXIDE, LACTATE
 DEHYDROGENASE ACTIVITY, MOUSE
 (2982)
 N-NITROSOHEPTAMETHYLENEIMINE-
 INDUCED, RAT (5113)
 PERIPHERAL CATHETERIZATION, CYTO-
 LOGICAL FEATURES, HUMAN (3562)*
 PROGNOSIS, REVIEW (2264)*
 RATS, URANIUM DUST RADON, INHALA-
 TION (3028)
 RESPIRATORY INFECTION, REVIEW
 (2263)*
 RISK FACTORS, AGE (1942)*
 SMOKING
 INCIDENCE, WOMEN, NETHERLANDS
 (6096)*
 OCCUPATIONAL HAZARD, AIR POLLU-
 TION, REVIEW (5018)
 SURVIVAL, HUMAN (3693)
 SMOKING METHODS, HUMAN, REVIEW
 (2901)
 TOBACCO, SUGAR CONTENT, PH OF
 SMOKE (3645)
 LUNG - CONTINUED
 CANCER CAVERNS, NEOPLASTIC AUTOPHAGY,
 ENZYMES, HUMAN (4106)*
 CANCER MORTALITY, ASBESTOS, INSULATION
 WORKER, OCCUPATIONAL HAZARD,
 NORTHERN IRELAND (1103)
 CARCINOGENESIS
 DIMETHYLNITROSAMINE, PHORBOL,
 HEPATOMA, MOUSE (4392)
 3-METHYLCHOLANTHRENE, 4-NITRO-
 QUINOLINE 1-OXIDE, RABBIT (3696)
 3-METHYLCHOLANTHRENE, RAT (4404)
 CARCINOMA
 ASBESTOS, INCIDENCE, HUMAN (5782)
 BENZO(A)PYRENE, DUST, RAT (3617)
 BRONCHITIS, SMOKING, ASSOCIATION,
 HUMAN (0381)*
 CHRONIC FIBROSIS, HUMAN (0497)*
 CIGARETTE SMOKING HUMAN (1617)*
 COINCIDENT TUBERCULOSIS, HUMAN
 (3446)*
 ETIOLOGY, REVIEW (1217)*
 GLYCOLYTIC ENZYMES, LACTIC ACID
 FORMATION, HUMAN (4442)
 GROWTH HORMONE, HUMAN (3023)*
 GROWTH HORMONE SYNTHESIS, CELL
 CULTURE (2839)
 HIGH-RISK GROUP, REVIEW (1236)*
 HISTOGENESIS, HUMAN, REVIEW
 (5060)*
 INCIDENCE
 AGE FACTOR, RUSSIA (1946)*
 CASE REGISTRATION, SWEDEN (0210)
 JERSEY, CHANNEL ISLES (1096)
 SENEGAL (0825)*
 STATISTICAL PROCEDURE (1940)*
 INDUCTION, DIETHYLNITROSAMINE,
 INFLUENZA VIRUSES, MOUSE (5079)
 JAAGSIEKTE, LYMPH NODE, SERUM
 PROTEIN, SHEEP (4634)
 METASTASIS TO JAWS, VIA SPUTUM TO
 MORTALITY, INCIDENCE, SWEDEN
 (0813)
 NECROPSY FINDINGS, HUMAN, REVIEW
 (2902)
 PNEUMOSCLEROSIS, HUMAN (1899)*
 RADIATION, ATOMIC BOMB, HUMAN,
 REVIEW (2219)
 RADON IRRADIATION, OCCUPATIONAL
 HAZARD (1691)*
 SMALL-CELL(OAT-CELL), OSTEOLASTIC
 METASTASIS, CASE REPORT (4888)*
 SMOKING, ETIOLOGY, REVIEW

- (1018), (1214)*
 TOOTH SOCKETS, CASE REPORT (5615)*
 CELL CULTURE, MALIGNANT TRANSFORMATION
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
 RAT (5104)
 CELL TRANSFORMATION, URETHANE,
 INFLUENZA VIRUS, HUMAN EMBRYO
 (4396)
 CELLS, DIFFERENTIATION, GROWTH IN
 VITRO, NEOPLASIA, ULTRASTRUCTURE,
 HUMAN EMBRYO (4009)
 CHEMODECTOMA, PATHOLOGY, HUMAN (0897)*
 CONGENITAL CYSTS, TUMOR DEVELOPMENT,
 CASE REPORT (6374)*
 CYTOMORPHOLOGICAL CHANGE, MYCOTOXIN,
 RAT (1282)*
 DISEASE, DELAYED HYPERSENSITIVITY
 (1861)*
 EFFUSION, RNA VIRUS PARTICLE, HUMAN
 (1692)
 EPIDERMAL CARCINOMA, CIGARETTE SMOKE
 CONDENSATE, RAT (4383)
 EPITHELIUM, 3-METHYLCHOLANTHRENE,
 VITAMIN A, MOUSE (4425)
 FETAL TISSUE, DDT ADMINISTRATION,
 MOUSE (2995)
 GLASS-FIBER BODIES, GUINEA PIG
 (0081)*
 GRANULOMA, FOREIGN BODY, NARCOTIC
 ABUSE, JAPAN, CASE REPORT (1489)*
 HODGKIN'S DISEASE, HUMAN (6385)*
 IMMUNOLOGICAL RELEASE OF HISTAMINE,
 CYCLIC AMP INFLUENCE, HUMAN (2697)*
 INDUCED CARCINOGENESIS, BENZO(A)PYRENE
 FERRIC OXIDE, HAMSTER (2312)
 INDUCED LESIONS, N-NITROSO-N-METHYL-
 URETHANE, ULTRASTRUCTURE, CRYSTALL-
 INE CELLULAR INCLUSIONS, MOUSE
 (5101)
 LEIOMYOMA, ULTRASTRUCTURE, HUMAN
 (0892)*
 LEWIS CARCINOMA, GROWTH, TREATMENT,
 CYCLOPHOSPHAMIDE SENSITIVITY, MOUSE
 (3377)*
 LIVER, TUMORIGENESIS, 4-DIMETHYLAMINO-
 BENZENE, MOUSE (0958)
 LOCAL METASTASIS OF PRIMARY LUNG TUMOR
 (3592)*
 LYMPHANGIOMA, TUBEROUS SCLEROSIS,
 CASE REPORT (3334)*
 LYMPHOMA, ADENOMA, NITROSAMIDE
 FORMATION, METHYLUREA, ETHYLUREA,
 NITRITE, MOUSE (2966)
 LYMPHOSARCOMA, PATHOLOGY, CASE REPORTS
 (4196)*
 LUNG - CONTINUED
 MESOTHELIOMA, DIAGNOSIS, AUTOPSY
 (1934)*
 METASTASIS VOLUME, IRRADIATION DAMAGE,
 REPAIR, HUMAN (3725)
 METASTATIC CANCER, LYMPHANGITIC SPREAD
 (1474)*
 METAL DISTRIBUTION, MICROSOMAL ENZYMES
 PHENOBARBITAL, BENZO(A)PYRENE,
 CARBON TETRACHLORIDE, RAT (4403)
 NEEDLE BIOPSY, DISSEMINATION OF CANCER
 CELLS, CASE REPORT (2824)
 NEOPLASM, MURINE SARCOMA VIRUS, MOUSE
 (0730)*
 NITROSOMETHYLUREA, DIMETHYLNITROSAMINE
 HYPERPLASIA, MOUSE (0650)*
 OAT-CELL CARCINOMA, HISTOGENESIS,
 MORPHOLOGY, CLINICAL STUDY (5403)
 PAPILLARY ADENOCARCINOMA, PSAMMOMA
 BODIES, HUMAN (4231)*
 PLEURAL MESOTHELIOMA, ASBESTOSIS,
 HUMAN, REVIEW (5709)
 PLEURAL PLAQUE, ASBESTOS, JOINER,
 OCCUPATIONAL HAZARD, INCIDENCE
 (1111)*
 PLEURAL-PULMONARY MALIGNANCY, ASBESTOS
 RELATIONSHIP, LIGURIA (3016)*
 PRIMARY CARCINOMA, HUMAN, REVIEW
 (5729)*
 PRIMARY EPITHELIAL CANCER, LEUKEMIA,
 CHRONIC LYMPHOID, CASE REPORT
 (4105)*
 PULMONARY ADENOMATOSIS, JAAGSIEKTE,
 ULTRASTRUCTURE, SHEEP (0278)*
 PULMONARY CANCER, PERSISTANT CAVITARY
 FORM, CLINICAL STUDY (6353)*
 PULMONARY CARCINOMA, OAT CELL TYPE,
 NEW FLOATING CELL LINE, HUMAN
 (5526)*
 PULMONARY CYTOLOGY, STUDY METHOD, RAT,
 HAMSTER (3405)*
 PULMONARY FUNCTION CHANGES, CIGARETTE
 SMOKING, HUMAN (2399)*
 PULMONARY LYMPHOMA, PSEUDOLYMPHOMA,
 CLINICAL STUDY (6314)*
 PULMONARY METASTASES
 RHINOPHARYNX TUMORS, CASE REPORTS
 (5589)*
 SOLID MALIGNANT TUMOR, INHIBITION
 BY INTERFERON, MOUSE (3341)*
 PULMONARY NEOPLASMS, TUMOR ASSOCIATED
 ANTIGENS, CLINICAL STUDY (4729)*
 RADIOLOGY, ASBESTOS, HUMAN (0977)*
 RNA AND PROTEIN SYNTHESIS, COMPARATIVE
 STUDY, RAT (5192)*
 SCLEROSING HEMANGIOMA, ULTRASTRUCTURE,
 CASE REPORT (3960)*
 SQUAMOUS CELL CARCINOMA, GLYCOGEN
 METABOLISM, PHOSPHORYLASE METABOLISM
 HISTOCHEMICAL STUDY (6121)
 STOMACH, TUMOR CELL, NUCLEIC ACID,
 CYTOPHOTOMETRY (1162)*
 LUNG - CONTINUED
 TUMOR
 ACINIC CELL, HUMAN (2165)*
 BENZO(A)PYRENE, 1,2,5,6-DIBENZ-
 ANTHRACENE, 7,12-DIMETHYLBENZ(A)
 ANTHRACENE, DOSE RESPONSE RAT
 (1576)
 ELEVATED ATPASE, HUMAN (2846)
 HYDRAZINE SULFATE, PREGNANT AND
 PSEUDOPREGNANT MICE (4476)*
 INCIDENCE, CALCIUM CHROMATE DUST,
 INFLUENZA VIRUS, X-RADIATION,
 MOUSE (4413)
 JAAGSIEKTE, ULTRASTRUCTURE, SHEEP
 (0183)
 LOW MOLECULAR WEIGHT, NUCLEAR RNA,
 HUMAN (1428)
 RNA/DNA RATIO, HUMAN (0244)
 SCINTISCANNING, HUMAN (4255)*
 TUMOR INDUCTION, MALIGNANT LYMPHOMA,
 METRONIDAZOLE, MOUSE (2999)
 TUMOR LYMPHATIC LEUKEMIA, BRACKEN
 FERN, MOUSE (4387)
 TUMORIGENESIS
 HYDRAZINE, METHYLHYDRAZINE,
 METHYLHYDRAZINE SULFATE,
 AMMONIUM HYDROXIDE, MOUSE (3692)
 METHYL METHANESULPHONATE, MOUSE
 (0658)*
 YOSHIDA SARCOMA METASTASES, E-AMINO-
 CAPROIC ACID ADMINISTRATION/ BINTROM

RAT (3439)*
 TEOMA
 VIRILIZING, STEROID HORMONE CONTENT
 PREGNANCY, HUMAN (1177)*
 MPH
 COMPOSITION, HODGKIN'S DISEASE, HUMAN
 (0883)*
 MPH NODE
 ANTITUMOR ACTIVITY, SARCOMA, METHYL-
 CHOLANTHRENE, MOUSE (1826)
 CELL
 ADHERENCE, BP8 TUMOR, MOUSE
 (1066)*
 ANTI-GROWTH EFFECT, EHRlich CANCER
 MOUSE (4779)*
 BP8 TUMOR, INFLAMMATORY MEDIATOR,
 ELECTROPHORESIS, MOUSE (1072)*
 GAMMA GLOBULIN, SYNTHESIS,
 SECRETION (2048)*
 SPECIFIC CYTOTOXICITY, MOLONEY
 SARCOMA VIRUS, SERUM, IMMUNE
 MOUSE (2605)
 CYTOTOXICITY, SPLEEN CELL, SUPPRESSION
 ASCITES TUMOR, MOUSE (4752)*
 HISTOLOGY, ADENOCARCINOMA, GROWTH,
 MOUSE (0782)*
 HODGKIN'S DISEASE, HUMAN, ULTRA-
 STRUCTURE (1438)
 HUMAN, NORMAL LYMPHOMA, MALIGNANT
 LYMPHOMA, ORGAN CULTURE (3571)*
 HYPERPLASIA, HYALINE-VASCULAR AND
 PLASMA CELL TYPES, CASE REPORTS
 (3383)*
 IMMUNE REACTION, TUMOR CELL INVASION,
 RAT (0775)*
 IMMUNOLOGIC COMPETENCE, MAMMARY
 CARCINOMA, HUMAN (1788)
 IMMUNOLOGICAL ROLE, SIMULATED COLON
 CARCINOMA, RABBIT (4742)*
 INVASION, CANCER OF TONGUE, HUMAN
 (3344)*
 IRRADIATION, BARRIER, RABBIT (2061)*
 JAAGSIEKTE, SHEEP (4634)
 LARYNGEAL CANCER, HISTOLOGY, HUMAN
 (0157)
 LYMPHOCYTE, TUMOR CELL, MAMMARY GLAND
 HUMAN (3191)
 MAMMARY CARCINOMA, SPREAD, HUMAN
 (0285)*
 METASTASIS, SARCOMA TRANSFER, MOUSE
 (0895)*
 METASTASIS DISTRIBUTION, CARCINOMA,
 DIGESTIVE TRACT, RESPIRATORY TRACT,
 HUMAN (4029)
 NUCLEIC ACID CONTENT AND SYNTHESIS,
 LYMPHORETICULAR TISSUES,
 ADENOCARCINOMA GROWTH, MOUSE (0760)
 PELVIC, HYALINOSIS, CERVICAL CARCINOMA
 CLINICAL STUDY (6171)*
 PLAQUE-FORMING CELL RESPONSE, MAMMARY
 ADENOCARCINOMA, SPLEEN, MOUSE (0758)
 PRIMARY MALIGNANT NEOPLASM, PATHOLOGY,
 CASE REPORT (4203)*
 REACTION, RAUSCHER LEUKEMIA VIRUS,
 LACTIC DEHYDROGENASE VIRUS, MOUSE
 (4530)
 SKIN GRAFT, LYMPHOMA GRAFT, RESPONSE,
 MITOSIS, MOUSE (4666)
 SYNGENEIC LYMPHOMA, CELLS, MOUSE
 (3492)*
 MPHANGIOMA
 KIDNEY, CYSTIC FORMATIONS, CASE REPORT
 (6259)*
 MESOCYSTIC, CHILDREN (3349)*

LYMPHANGIOMYOMA
 TUBEROUS SCLEROSIS, CASE REPORT
 (3334)*
 LYMPHANGIOSARCOMA
 CHRONIC LYMPHEDEMATOUS EXTREMITIES,
 CLINICAL STUDY (5565)*
 IDIOPATHIC LYMPHOEDEMA, CHRONIC
 CONGENITAL, HUMAN (3422)*
 LYMPHATIC TUMOR
 GROWTH RETARDING MECHANISMS, MOUSE,
 HUMAN (5726)*
 INFLUENZA, PREGNANCY, INCIDENCE,
 ENGLAND (6083)
 LYMPHATICS
 DERMAL, BREAST CANCER DISSEMINATION,
 HUMAN (4805)*
 DISSEMINATION OF CANCER CELLS
 ENRlich CARCINOMA, MOUSE (4806)*
 METASTASIS, REVIEW (4081)*
 PROPAGATION, HODGKIN'S DISEASE, BLOOD
 STREAM, MAN (0899)*
 LYMPHOBLAST
 CHEMICAL MUTAGENESIS, PHOSPHORIBOSYL-
 TRANSFERASE LOCUS, HUMAN (2448)*
 LEUKEMIC, HERPESVIRUS ANTIGEN
 ACTIVATION, GUINEA PIG (5382)*
 LYMPHOBLASTOID CELL
 CHROMOSOME ABERRATION, HUMAN (1488)*
 CULTURE, CHROMOSOME ABERRATION,
 LEUKEMIA, HUMAN (2831)
 EPSTEIN-BARR VIRUS, INFECTION, HUMAN
 (4575)
 ESTABLISHMENT OF CELL LINES,
 PERIPHERAL BLOOD, LYMPH NODE,
 JAPANESE PATIENTS (4595)*
 SHAPE, MOTILITY, HUMAN (4974)*
 LYMPHOCYTE
 ACTIVATION, PHYTOHEMAGGLUTININ,
 MALIGNANT DISEASE, HUMAN (0481)
 ACTIVITY, NEOPLASMA, HUMAN (2126)*
 ANTIBODY, PROSTATE CARCINOMA, HUMAN
 (1865)*
 ANTIGEN BINDING, SPECIFICITY (1837)
 ANTIGENIC PROPERTIES, CHRONIC LYMPHO-
 CYTIC LEUKEMIA, HUMAN (5396)*
 ANTIGENIC STIMULATION, LEUKEMIA,
 TUMOR ANTIGEN, HUMAN (5966)
 ANTISERUM, THYMUS, SPLEEN, TUMOR
 ALLOGRAFT, RAT, RABBIT (1077)*
 ANTITUMOR EFFECT, EHRlich ASCITES
 TUMOR, MOUSE (1398)
 ATP-ASE ACTIVITY, HUMAN (5988)*
 AUTOLOGOUS, CYTOTOXICITY, TUMOR CELL,
 HUMAN (0460)
 AVIAN TRANSMISSIBLE LYMPHOID TUMOR,
 CULTURE, CHICKEN (2873)
 B, PLASMACYTOMA CELL, IMMUNOGLOBULIN
 RECEPTOR, MOUSE (3853)
 BLASTIC TRANSFORMATION
 INHIBITION, ANTI-HL-A SERUM, HUMAN
 (1879)*
 NEOPLASTIC DISEASES, IMMUNOLOGY,
 IMMUNOLOGY, HUMAN, REVIEW
 (5044)*
 RETICULO ENDOTHELIAL MALIGNANCY,
 HUMAN (1862)*
 BLASTIC TRANSFORMATION IN VITRO,
 IMMUNOLOGY, CANCER, HUMANS (3925)*
 BLASTOGENESIS, L-ASPARAGINASE, RAT
 (2691)*
 BLASTOGENESIS RESPONSE, MALIGNANT
 TISSUE, BENIGN TISSUE, NORMAL TISSUE
 HUMAN (3878)
 BLASTOGENIC RESPONSE

CULTURED ALLOGENIC TUMOR CELLS,
 HUMAN (2641)
 PHYTOHEMAGGLUTININ INDUCED STIMULATION
 SERUM-STIMULANT CELL INTERACTIONS,
 MOUSE (2667)*
 BLOOD
 CHRONIC LYMPHOCTIC LEUKEMIA,
 SURFACE IMMUNOGLOBULIN, HUMAN
 (1829)
 ULTRASTRUCTURE, LYMPHOCTIC AND
 LYMPHOSARCOMA CELL LEUKEMIA,
 HUMAN (3339)*
 CANCER, HUMAN (2669)*
 CELL LINE, KARYOTYPE, VIRUS, MOUSE
 (5308)
 T CELLS
 B CELLS, KILLING OF ALLOGENIC
 TARGET CELLS, MOUSE (3226)*
 LEUKEMIA PATIENTS (6017)*
 CHROMATIN ALTERATIONS, CHRONIC
 LEUKEMIA, HUMAN (3505)*
 CHRONIC LYMPHOCTIC LEUKEMIA,
 PROLIFERATION, CELL CYCLE KINETICS,
 RAT (5958)
 CULTURE, ACUTE LEUKEMIA, REMISSION,
 HUMAN (1391)
 CYTOTOXIC ACTIVITY DEVELOPMENT,
 LEUKEMIA CELLS, MOUSE (3196)
 CYTOTOXICITY
 BLOCKING, TUMOR ELUATE, HUMAN
 (4671)
 LEUKEMIA, IDENTICAL TWIN, HUMAN
 (4674)
 PERITONEAL CAVITY, LEUKEMIA, MOUSE
 (5307)
 CYTOTOXICITY OF AFLATOXIN B1, PHYTO-
 HEMAGGLUTININ CULTURE (3018)*
 DEPLETION, TUMOR CELL INOCULATION,
 MOUSE (3859)
 DNA, RNA, SYNTHESIS INHIBITION,
 LEUKEMIC CELLS, HUMAN (5957)
 DNA POLYMERASE
 LYMPHOID LEUKEMIA, OX (5940)*
 NORMAL HUMAN (5445)
 DNA REPAIR
 CHEMICAL CARCINOGEN, ALKYLATING
 AGENT, HUMAN (0935)
 DEOXYRIBONUCLEOSIDE INCORPORATION,
 HYDROXYUREA, HUMAN (1117)
 DNA SYNTHESIS, UV RADIATION, HUMAN
 (2467)*
 ELEVATED ATPASE, CARCINOMA, HUMAN
 (2846)
 GASTROINTESTINAL CARCINOMA,
 CARCINOEMBRYONIC ANTIGEN, HUMAN,
 IMMUNITY (0483)*
 HISTONE PHOSPHORYLATION,
 PHYTOHEMAGGLUTININ, PIG (1129)
 IGG DETECTION, SPLEEN AND LYMPH NODES,
 MOUSE (5365)
 IMMUNE, CYTOTOXICITY, ANTISERUM
 CONCENTRATION, MOLONEY SARCOMA VIRUS
 MOUSE (3869)
 IMMUNE CYTOLYSIS, LEUKEMIA CELL, MOUSE
 (4688)
 IMMUNE PERITONEAL, CYTOTOXICITY
 ENHANCEMENT, ANTIGENIC YOSHIDA
 SARCOMA CELL, RAT (2634)
 IMMUNE RESPONSE, LEUKEMIA, HUMAN
 (1083)*
 IMMUNITY, CARCINOMA (0016)*
 LYMPHOCYTE - CONTINUED
 IMMUNOGLOBULIN, HUMAN (1407)*
 IMMUNOGLOBULIN DISTRIBUTION,
 HYPERGAMMAGLOBULINEMIA, IMMUNE
 DEFICIENCY, CHRONIC LYMPHATIC
 LEUKEMIA, HUMAN (1376)
 IMMUNOLOGICAL RESPONSIVENESS, MAREK'S
 DISEASE, CHICKEN (1394)
 IMPAIRED TRANSFORMATION, ACUTE
 LYMPHATIC LEUKEMIA, HUMAN (3210)
 INFECTED, HERPESVIRUS SAIMIRI, ANTIGEN
 MARMOSET (3806)
 INFILTRATION, NEUROBLASTOMA, SURVIVAL
 RAT, CHILDREN (6233)*
 INHIBITION
 LYMPHOSARCOMA CELLS, HUMAN (1800)
 PLASMA, CARCINOEMBRYONIC ANTIGEN,
 SERUM ALPHA-GLOBULIN, COLON
 CANCER, HUMAN (3181)
 IN-VITRO ACTIVATION, HUMAN (2031)*
 LEUKEMIA, HISTOLOGY (2045)*
 LEUKEMIC, IMMUNE REACTIVITY, PHYTO-
 HEMAGGLUTININ, METABOLISM, LEUKEMIA
 PATIENTS (5975)
 LONG-LIVED, RECOVERY, RADIATION, RAT
 (1679)*
 LYMPH NODE
 DNA CONTENT, METHYLCHOLANTHRENE-
 INDUCED CARCINOGENESIS, MOUSE
 (5785)
 TUMOR CELL, MAMMARY GLAND, HUMAN
 (3191)
 LYMPHOTOXIN PRODUCTION, HODGKIN'S
 DISEASE, HUMAN (0548)
 MITOTIC POTENTIAL, ELECTROMAGNETIC
 RADIATION, MONKEY (3726)
 MIXED REACTION, CALCIUM, MAGNESIUM,
 CYCLIC ADENOSINE 3',5'-MONOPHOSPHATE
 HUMAN (3186)
 MOLONEY VIRUS-TRANSFORMED, IMMUNE
 LYSIS, CELL CYCLE-DEPENDENT, VIRAL
 ANTIGEN, RAT (1832)
 PERIPHERAL, ZINC STIMULATION IN VITRO,
 HODGKIN'S DISEASE, CHRONIC
 LYMPHOCTIC LEUKEMIA (3917)*
 PERIPHERAL BLOOD, HYPOGAMMA-
 GLOBULINEMIA, LYMPHOCTIC LEUKEMIA,
 HUMAN (3837)
 PHA STIMULATION, INFLUENCE OF
 HODGKIN'S DISEASE SERUM, HUMAN
 (3165)
 PHYTOHEMAGGLUTININ, DNA POLYMERASE,
 HUMAN (5906)
 PHYTOHEMAGGLUTININ TRANSFORMATION,
 IN VITRO, PROTEIN SYNTHESIS (0840)
 PROLIFERATION
 DNA SYNTHESIS, HUMAN (1397)
 VITAMIN A, HAMSTER (5786)
 PROLIFERATIVE ACTIVITY, IMMUNOLOGIC
 STATUS, RAT (2684)*
 RADIATION EFFECT, HUMAN (1677)*
 REACTIVITY, SERUM, HUMAN (1408)*
 REACTIVITY IMPAIRMENT, CELIAC DISEASE,
 HUMAN (1835)
 RESPONSE, MOLONEY SARCOMA VIRUS, MOUSE
 (5888)
 SENSITIZATION
 ADVANCED CANCER, HUMAN (4734)*
 BRAIN, PROTEIN, CARCINOMA, HUMAN
 (1187)*
 ENCEPHALITIC FACTOR, BRAIN, HUMAN
 (1050)
 MEDIATOR PRODUCTION, GUINEA PIG
 (2696)*
 SOLUBLE FACTOR, CARCINOGENESIS, MAN
 (0835)
 SPLEEN, PHYTOHEMAGGLUTININ RESPONSE,

IMPAIRMENT, MAREK'S DISEASE, CHICKEN (4672)
 STIMULATION, AUTOCHTHONOUS TUMOR CELL, BLOCKING EFFECT, SERUM, HUMAN (0482)
 SURFACE STRUCTURE, EFFECT OF MITOGENS, CELL CULTURES, HUMAN (5486)*
 T AND B
 CHRONIC LEUKEMIA, HUMAN (2645)
 CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN (1855)*
 THYMUS-DERIVED, ROSETTE-FORMATION, LYMPHOID CELL LINES, HUMAN (4948)*
 LYMPHOCYTE - CONTINUED
 TRANSFORMATION
 ACUTE LYMPHOBLASTIC LEUKEMIA, HUMAN (1795)
 L-ASPARAGINASE, ACUTE LEUKEMIA, HUMAN (4049)*
 DNA SYNTHESIS, DIBUTYRYL ADENOSINE CYCLIC 3',5'-MONOPHOSPHATE, HUMAN (0160)
 KAPOSI'S SARCOMA PATIENTS (6279)*
 LEUKEMIA, ANTILYMPHOCYTE SERA EFFECT, ANTIPARABLAST SERA EFFECT, CHILDREN (3847)
 LYMPHORETICULAR MALIGNANCY, HUMAN (0765)
 PHYTOHEMAGGLUTININ
 ENDOCYTOSIS, LYSOSOME FORMATION (3435)*
 IMMUNOPROLIFERATIVE DISORDERS, HUMAN (4641)
 INFANT (0873)*
 SERUM, CANCER PATIENT (0454)
 PROTEOLYTIC ENZYME INHIBITOR, GUINEA PIG (6125)
 THYMIDINE KINETICS, HUMAN (1041)
 TRANSFER RNA, HUMAN (1126)
 TUMOR, CELLULAR IMMUNITY, HUMAN (0155)
 ULTRASTRUCTURE, LYMPHATIC LEUKEMIA, HUMAN (5491)*
 URIDINE-3H, ACETATE 14C INCORPORATION, NORMAL AND LEUKEMIC INDIVIDUALS (4996)*
 VIRUS PARTICLES, HERPES TYPE, MAREK'S DISEASE (2597)*
 LYMPHOCYTIC LEUKEMIA
 PATHOGENESIS, GASTRIC CARCINOMA (1907)*
 LYMPHOCYTOMA
 GIANT FOLLICULAR, IMMUNOGLOBULIN FORMATION, NEOPLASMIC DISTURBANCES, SPLEEN, CASE REPORT (4632)
 LYMPHOCYTOSARCOMA
 RETICULUM CELL-SARCOMA, INCIDENCE, GERMANY (5420)
 LYMPHOGRANULOMA
 MALIGNANT, HISTOPATHOLOGY, CASE REPORT (4114)*
 LYMPHOGRANULOMATOSIS
 BLOOD SERUM PROTEINS, IMMUNOELECTROPHORETIC STUDIES, HUMAN (3217)*
 BONES, CLINICAL STUDY (6149)*
 IMMUNOGLOBULIN LEVELS, HUMAN (5326)
 IMMUNOLOGICAL DEFICIENCY, HUMAN (5355)
 IMMUNOLOGICAL DETERMINATION, HUMAN (1857)*
 IMMUNOLOGICAL PROBLEMS, HUMAN (6050)*
 IMMUNOPATHOLOGICAL ALTERATIONS, REVIEW (2260)*
 MULTIPLE MYELOMA, HL-A ANTIGENS, CLINICAL STUDY (6040)*
 SINGLE-OVUM TWINS, CASE REPORT (0857)
 LYMPHOID CELLS
 CULTURE, EPSTEIN-BARR VIRUS, HUMAN CELL (5913)
 CYTOTOXICITY, CANCER-BEARING MICE (6003)*
 EPSTEIN-BARR VIRUS, ANTIGENS, HUMAN (4635)
 LEUKEMIA
 ELECTRON MICROSCOPY, HUMAN (2078)*
 NORMAL, HUMAN, REVIEW (4306)
 LEUKOCYTE MIGRATION, IMMUNOSUPPRESSION
 FRIEND LEUKEMIA VIRUS, MOUSE (4574)
 LYSIS IN VITRO, MOUSE SARCOMA CELLS, GUINEA PIG (3922)*
 TUBULORETICULAR STRUCTURES, ULTRA-STRUCTURE (6291)*
 LYMPHOID NEOPLASIA
 PATHOGENESIS, IMMUNOLOGIC CELL PATHWAYS, CAT (4788)
 LYMPHOID TISSUE
 NORMAL, MALIGNANT, CELL LINE ESTABLISHMENT, IMMUNOGLOBULIN PRODUCTION, HUMAN (2613)
 LYMPHOMA
 ACTIVE RIBOSOME SUBUNITS, MOUSE (3480)*
 ADULT CELIAC DISEASE, HUMAN (0193)*
 ALLOGRAFT IMMUNITY, THYMOCYTE, BONE MARROW CELL, CYTOTOXICITY, MOUSE (3873)
 BREAST, HISTOLOGY, PATHOLOGY, HUMAN (4235)*
 BURKITT'S, CLINICAL ASPECTS (2049)*
 T CELL, B CELL, MOUSE (3179)
 CELL-COLONIES, ALKYLATING AGENTS, MOUSE (3466)*
 CELL MIGRATION, INHIBITION, ANTISERA, MOUSE (3897)
 CHEMICAL INDUCTION, REGRESSION, MOUSE (4444)
 CHEMICALLY MODIFIED CELL, IMMUNIZATION MOUSE (1816)
 COLONIC, ULCERATIVE COLITIS, CASE REPORTS (6306)*
 DELTA-AMINOLEVULINIC ACID EXCRETION, HUMAN (4202)*
 N,N'-DIMETHYLNITROSOUREA, INDUCTION, MICE, REVIEW (2215)
 DNA SYNTHESIS, AGGLUTINATION, PHYTOHEMAGGLUTININ, CONCAVALIN A, MOUSE (4646)
 EPIDEMIOLOGY, BUENOS AIRES PROVINCE (4821)
 FRIEND VIRUS-INDUCED, CHEMOIMMUNOTHERAPY (4605)*
 GLUCOCORTICOID, CYTOLYSIS, RECEPTOR, MOUSE (6127)
 GRAFT, LYMPH NODE RESPONSE, MITOSIS, MOUSE (4666)
 GRAFT REJECTION, ANTIBODY, COMPLEMENT, MOUSE (3182)
 GROSS VIRUS
 CELLULAR IMMUNITY, RAT (4621)
 SURFACE ANTIGEN, ANTIBODY BINDING, RAT (3903)
 GROWTH, LUCITE CYLINDER IMPLANTATION, ALLOGENEIC MICE (3733)*
 HERPES ZOSTER-VARICELLA INFECTION, HODGKIN'S DISEASE, ANALYSIS (3208)
 HISTIOCYTIC TYPE, SCLEROSING RETICULUM CELL SARCOMA, CASE REPORTS (3356)*
 HISTOCOMPATIBILITY ANTIGEN, HUMAN (5337)

- HODGKIN'S-LIKE, BIOLOGICAL, HISTOLOGICAL AND ULTRASTRUCTURAL ASPECTS, MICE (3572)*
- IMMUNOGLOBULIN RECEPTOR, MOUSE (3184)
- IMMUNOLOGICALLY INDUCED, MORPHOGENESIS MOUSE (4007)
- IMMUNOTHERAPY RESPONSE, TUMOR ANTIGENICITY, MOUSE (4633)
- INCREASED INCIDENCE, THYMECTOMIZED MICE (3206)
- INDUCTION, HERPESVIRUS SYLVILAGUS, RABBIT (2536)
- INDUCTION BY SILICA, RAT (3651)
- INFILTRATING MACROPHAGES, ULTRASTRUCTURE, HAMSTER (5959)
- INTESTINAL
- MALABSORPTION, INCIDENCE, MEDITERRANEAN POPULATIONS (3271)
- SPRUE (1449)*
- LEUKEMIA
- EPIDEMIOLOGY, COLOMBIA (0461)
- PATHOGENESIS, ATOMIC BOMB, REVIEW (5013)
- LEUKOCYTE ALKALINE-PHOSPHATASE, HUMAN (2851)
- LYMPHOCYTIC
- CHRONIC LYMPHOCYTIC LEUKEMIA, EPSTEIN-BARR VIRUS, ANTIBODY, HUMAN (2516)
- EPSTEIN-BARR VIRUS, SERUM ANTIBODY HUMAN (3814)
- MACROGLOBULINEMIA, CASE REPORT (6029)*
- LYMPHOMA - CONTINUED
- MALIGNANT
- BETA 1 A/C CONCENTRATION, SERUM, HUMAN (5354)
- CHROMOSOMES, FLUORESCENT PATTERN, HUMAN (3309)
- CROHN'S DISEASE, SCHISTOSOMIASIS (0196)*
- CYTOGENETICS, CASE REPORTS (3317)
- EPSTEIN-BARR VIRUS, HUMAN, REVIEW (5738)*
- FLUORESCENT MARKER CHROMOSOMES (2558)
- GRAFT-VERSUS-HOST REACTION, MOUSE (6039)*
- HERPESVIRUS, RABBIT, REVIEW (5713)
- HERPESVIRUS SAIMIRI, ATELES, MONKEY (5925)
- HISTIOCYTIC TYPE, MORPHOLOGY, CLINICAL BEHAVIOR (4052)*
- HUMAN LYMPH NODES, ORGAN CULTURE (3571)*
- HYPOGLYCEMIA, HUMAN (6226)*
- IMMUNOLOGIC INDUCTION, GENETIC FACTORS, GRAFT-VS-HOST MODEL (4628)
- LYMPHOCYTIC LEUKEMIA, HERPESVIRUS SAIMIRI, MONKEY (1337)*
- ONCOGENIC VIRUSES, IMMUNOREGULATION, HUMAN, REVIEW (5745)*
- PEYER'S PATCHES, PATHOLOGY, MOUSE (5498)*
- RHESUS MONKEY (2040)*
- SPINAL CORD INVOLVEMENT, SYSTEMIC SPREAD, CASE REPORT (4056)*
- TUMOR INDUCTION, METRONIDAZOLE, MOUSE (2999)
- MEDIASTINUM, MORPHOLOGY, HUMAN (4165)*
- MEDITERRANEAN ABDOMINAL, MALABSORPTION PATHOLOGY, ISRAEL (3231)
- NON-HODGKIN'S, BONE MARROW INVOLVEMENT (2880)
- OVARY, CASE REPORT, INDIA (0728)*
- PASSIVE IMMUNIZATION, ANTISERA, MOUSE (4701)
- PATHOGENESIS, CHRONIC ANTIGENIC STIMULATION (0322)*
- PATHOLOGY, CLASSIFICATION, REVIEW (5740)*
- PLASMA MEMBRANE, GLYCOPROTEIN, L-ASPARAGINASE (4040)
- PRIMARY GASTROINTESTINAL, CLINICAL STUDY (6198)*
- PRIMARY MALIGNANT
- CERVIX UTERI, CASE REPORT (4879)*
- DIGESTIVE TRACT, CASE REPORTS (5684)*
- PULMONARY, PSEUDOLYMPHOMA, CLINICAL STUDY (6314)*
- RETICULUM CELL, DELAYED HYPERSENSITIVITY, CASE REPORT (0772)*
- SALIVARY GLAND, C-TYPE VIRUS PARTICLE, CAT (0695)
- SERUM COPPER MEASUREMENT, HUMAN (3408)*
- SPLENIC, STEMLINE EVOLUTION, A TYPE PARTICLE, MOUSE (3941)
- SPONTANEOUS, IMMUNOGLOBULIN, MOUSE (5991)*
- SPONTANEOUS DEVELOPMENT, MOUSE (3223)*
- SYSTEMIC MAST CELL DISEASE, IGG PARAPROTEIN, CASE REPORT (4239)*
- TESTICULAR
- CASE REPORT (3333)*
- HUMAN (3328)*
- THYMUS, CHEMICALLY AND GAMMA-IRRADIATION INDUCED, IMMUNOLOGIC PROPERTIES, MOUSE (3227)*
- TYPE C VIRUS, MOUSE (3789)
- TYPE C VIRUS PARTICLE, PLEURAL EFFUSION CULTURE, HUMAN (0401)
- URETHANE, SKIN-GRAFT REJECTION, MOUSE (0755)
- VIRAL ETIOLOGY, MOUSE, REVIEW (5724)*
- VIRAL INDUCTION, GRAFT-VERSUS-HOST REACTION, MOUSE (1780)
- LYMPHOPROLIFERATIVE DISEASE
- CIRRHOSIS, ETIOLOGICAL RELATIONSHIP, CASE REPORTS (4117)*
- IMMUNOELECTROPHORESIS, SERUM, HUMAN (4720)*
- INFECTIOUS MONONUCLEOSIS, RELATIONSHIP REVIEW (2232)*
- LYMPH NODE, DNA, HUMAN (6225)*
- LYMPHOCYTIC TRANSFORMATION, PHYTOHEMAGGLUTININ (6032)*
- PAROXYSMAL NOCTURNAL HEMOGLOBINURIA-LIKE RED CELL ABNORMALITY, CASE REPORT (5652)*
- LYMPHORETICULAR MALIGNANCY
- IRRADIATION, CLINICAL STUDY, ADULTS (5574)*
- LYMPHOCYTE TRANSFORMATION, HUMAN (0765)
- LYMPHORETICULAR PROLIFERATIVE DISEASE
- HOMOZYGOUS ALEUTIAN GENE, MINK (5612)*
- LYMPHORETICULOSARCOMA
- IMMUNOLOGICAL DETERMINATION, HUMAN (1857)*
- SMALL INTESTINE, CASE REPORT (3369)*
- LYMPHOSARCOMA
- ACUTE MYELOGENOUS LEUKEMIA, CASE REPORT (4937)*
- BINDING, DIBENZ(A,H)ANTHRACENE, DIBENZ(A,C)ANTHRACENE, MOUSE EMBRYO CELL (1565)

BLASTIC TRANSFORMATION, PHA-STIMULATED CULTURES, LYMPHOCYTES, HUMAN (4843)
BONE MARROW, KARYOTYPE, COW (3937)
BOVINE, C-TYPE VIRUS-LIKE PARTICLES, INOCULATION, CALVES (3113)
CELL LEUKEMIA, BLOOD LYMPHOCYTES, ULTRASTRUCTURE, HUMAN (3339)*
CELL LINE, KARYOTYPE, BURKITT'S LYMPHOMA, HUMAN (1116)
CHROMOSOME ABERRATIONS, CASE REPORT (6110)
FELINE LEUKEMIA VIRUS, CAT (3805)
HERPES-LIKE VIRUS, ISOLATION, COW (3737)
IMMUNOSUPPRESSION, ANTIGEN CHALLENGE, IMMUNE RESPONSE, MOUSE (5341)
JAW, BURKITT'S TUMOR, CASE REPORTS (6317)*
LEUKOCYTE, CYTOPLASMIC IMMUNO-FLUORESCENCE, HUMAN (3856)
LUNG, PATHOLOGY, CASE REPORTS (4196)*
LYMPHATIC LEUKEMIA, IMMUNOGLOBULINS, GAMMA FRACTION, HUMAN (5290)
LYMPHOCYTIC, GALLBLADDER, CASE REPORT (4891)*
METASTASIS, TEMPORAL BONE, HUMAN (3542)*
METASTASIS TO GLUCOSE CONTROL CENTER, HYPOGLYCEMIA, CASE REPORT (4911)*
MOLONEY VIRUS, GROWTH, ULTRASTRUCTURE, MOUSE (3097)
NOVIKOFF HEPATOMA, LYSINE-RICH HISTONE DISTRIBUTION, CALF, RAT (1113)
POLYPHENYLALANINE, SYNTHESIS, RAT (2821)
RETICULOSARCOMA, TUMOR CELL KINETICS (3573)*
SERUM PROTEIN, SULFHYDRYL GROUPS, RAT (0572)*
SMALL INTESTINE, CLINICOPATHOLOGIC STUDY, HUMAN (3381)*
TRANSMISSION, GENETICS, PIG (1478)*
POSARCOMA
C-TYPE VIRUS
GIBBON (5264)
TRANSFER, COW, SHEEP (5236)
TISSUE CULTURE STUDY, MIXOID AND PLEOMORPHIC FORMS (3570)*
YSINE
HISTONE, NEOPLASTIC TISSUE, MOUSE (1189)*
YSOSOME
AUTOLYSIS, BIOLOGICAL VARIABILITY, LYTIC CHAIN REACTION (6181)*
FORMATION, ENDOCYTOSIS, LYMPHOCYTE TRANSFORMATION, PHYTOHEMAGGLUTININ (3435)*
GLIAL, TUMOR, HUMAN (2121)*
LEUKEMIA, DNASE ACTIVITY, HUMAN (2120)*
LIVER, AFLATOXIN, RAT (1621)*
YSOZYME
LEUKEMIA, ACUTE, CHRONIC (2017)
LEUKOCYTES, NORMAL, CHRONIC MYELOGENOUS LEUKEMIA PATIENTS, COMPARATIVE STUDY (6287)*
MACROGLOBULINEMIA
LYMPHOMA, CASE REPORT (6029)*
MACROMOLECULE
AROMATIC NITROGEN MUSTARD DERIVATIVES, HYDROLYSIS (1625)*
BINDING, BENZ(A)ANTHRACENE, DIBENZ(A,H)ANTHRACENE, K-REGION EPOXIDE, HAMSTER CELL (3709)
SYNTHESIS, LIVER, INHIBITION, N-HYDROXY-2-FLUORENYLACETAMIDE, RAT (1251)
MACROPHAGE
ALVEOLAR
CIGARETTE SMOKING, RABBIT (1291)*
TOBACCO, MARIJUANA, SMOKING, HUMAN (0663)*
ANTIBODY, WALKER CARCINOSARCOMA, GROWTH, RAT (1406)*
ANTITUMOR EFFECT, EHRlich ASCITES TUMOR, MOUSE (1398)
L-CELL HYBRID, IMMUNOLOGIC PROPERTIES (1850)*
CONTROL OF CARCINOGENESIS, MOUSE (4984)*
DELAYED HYPERSENSITIVITY, REVIEW (1231)*
FOAMY, HODGKIN'S DISEASE, CLINICAL STUDY (6205)*
GRANULOMA, NITROSOQUINOLINE, GIANT CELL, RAT (5097)
INTERFERON PRODUCTION, HERPES VIRUS, IMMUNOLOGICAL REACTIVITY, RABBIT (5997)*
MIGRATION
ALLOGENEIC TUMOR, ISOGENEIC TUMOR, MOUSE (4700)
HEPATOMA, CELLULAR IMMUNITY, GUINEA PIG (4650)
MIGRATION INHIBITION
PLASMACYTOMA, CELL-MEDIATED IMMUNITY, MOUSE (3893)
TUMOR ANTIGEN
FIBROSARCOMA, MOUSE (4673)
MOUSE (5974)
PRODUCTION, BONE MARROW, TUMOR-BEARING MICE (6280)*
TRANSFORMATION, SV40, MOUSE (0432)
VIRUS, IMMUNITY, REVIEW (1230)*
MAGNESIUM
DEFICIENCY, LEUKEMOGENESIS, ONCOGENESIS, BIOGENESIS (0018)*
LEUKEMIA, INCIDENCE, CHILDREN, POLAND (5427)*
NICKEL, UTERINE CANCER, HUMAN (2389)*
PHOSPHORUS, TUMOR, CALCIUM, HUMAN, ANIMAL (0538)
MALARIA
PARASITE INFECTION, LYMPHOMA, VIRUS PARTICLES, MOUSE (0114)
MALIC ACID
MALATE DEHYDROGENASE, LEUKEMIA, HUMAN (6143)*
MALIGNANCY
ACQUIRED HYPERTRICHOSIS LANUGINOSA, CASE REPORTS (5665)*
ANTINUCLEAR ANTIBODIES, HUMAN (6011)*
CERVIX UTERI, HISTOLOGY, DNA, HUMAN (2089)*
CHILDHOOD, INCIDENCE, INDIA (5409)
CHORION (1987)
DECREASE, 3-METHYLCHOLANTHRENE, TRANSFORMATION, CLONE, MOUSE (2316)
GRANULAR CELL OVARIAN TUMORS, MOUSE (6058)*
IMMUNITY, MAN, REVIEW (2212)
LIVER, ALPHA-FETOPROTEIN, HUMAN (2144)*
MALIGNANCY ASSOCIATED CHANGES
NUCLEAR ABERRATION, CLASSIFICATION, HUMAN (1891)
MALIGANT
ENDOCRINE, ADRENAL, EVOLUTION, HUMAN

- (1978)
 LYMPHOMA, RHESUS MONKEY (2040)*
 MALIGNANT CHANGE
 WOUND, SCAR, HUMAN, REVIEW (1507)
 MALIGNANT DISEASE
 CORONARY HEART DISEASE, RELATIONSHIP (1915)
 METASTATIC, CARDIAC LYMPHATIC INVOLVEMENT, HUMAN (3388)*
 PERITONEAL HEALING, RAT (5636)*
 PNEUMOCYSTIS CARINII, CHILDREN (3387)*
 SERUM GLYCOPROTEIN LEVELS, FEMALE BREAST, CLINICAL STUDY (6156)*
 SMOOTH MUSCLE ANTIBODY, HUMAN (3860)
 MALIGNANT LYMPHOGRANULOMATOSIS
 INCIDENCE, POLAND (1098)
 MALIGNANT LYMPHOMA
 ATOMIC BOMB SURVIVOR, INCIDENCE, JAPAN (1656)
 HL-A ANTIGEN FREQUENCY, HUMAN (3891)
 LEUKEMIA, MULTIPLE MYELOMA, MORTALITY, NEW ZEALAND (5411)
 MALIGNANT MELANOMA
 AMINO ACID INCORPORATION, PROTEIN, INHIBITION, HAMSTER (0270)*
 ANTIBODIES
 CELL MEMBRANE, CYTOPLASM, HUMAN (5328)
 IMMUNOLOGY, IMMUNOFLOUORESCENCE (5392)*
 IMMUNOSUPPRESSION, HUMAN (0179)*
 BONE METASTASES, HUMAN (3490)*
 COLLAGENASE DISTRIBUTION, ACID PHOSPHATASE ACTIVITY, HUMAN (3528)*
 CONGENITAL GANGLIONEUROMATOSIS, CHOROID, HUMAN (0865)*
 CYTOTOXIC REACTION, LYMPHOCYTE, IMMUNIZATION, RADIATION, HUMAN (0168)*
 DELAYED CUTANEOUS HYPERSENSITIVITY, AUTOLOGOUS TUMOR EXTRACT, HUMAN (4657)
 FALCK HILLARP'S FLUORESCENT TECHNIQUE, CASE REPORT (5677)*
 INCIDENCE
 AUSTRALIA (6105)*
 ENGLAND (0198), (6106)*
 JAPAN (0807)
 QUEENSLAND, REVIEW (5755)*
 KAPOSI'S SARCOMA, HODGKIN'S DISEASE, COINCIDENCE, HUMAN (0585)*
 LYMPHOGRAPHY, CLINICAL STUDY (6145)*
 MELANOTIC FRECKLE, ULTRASTRUCTURE, CASE REPORTS (6368)*
 MORPHOGENESIS, HUMAN (4787)
 RNA SYNTHESIS INHIBITION, CYTOTOXICITY SERUM, HUMAN (3883)
 SKIN, IMMUNOSTIMULATION PROCEDURES, THERAPY, PATIENTS (5376)*
 SPOUSES, CASE REPORT (0858)*
 SURFACE MEMBRANE IMMUNOFLOUORESCENCE, SPECIFICITY, HUMAN (4728)*
 TUMOR ANTIBODY, CLINICAL COURSE, HUMAN, REVIEW (0307)
 TUMOR SPECIFIC ANTIGEN, HAMSTER (4652)
 TYROSINASE INHIBITOR, INTRACELLULAR DISTRIBUTION, HAMSTER (5699)*
 VIRUS-LIKE PARTICLE, HUMAN (5224)
 VULVA, CHROMOSOME, HUMAN (3940)
 MALIGNANT TISSUE
 NORMAL TISSUE, CELL PROLIFERATION, REVIEW (1503)
 MALIGNANT TROPHOBLASTIC NEOPLASIA
 CHORIOCARCINOMA, INCIDENCE, SINGAPORE (0809)
 MALIGNOLIPIN
 NINHYDRIN, AMINO ACID, THIN-LAYER CHROMATOGRAPHY (1173)*
 MAMMARY CARCINOMA
 ESTRADIOL RECEPTORS (2007)
 MALE, INCIDENCE, HUMAN (3966)
 METASTASES (2036)*
 AXILLARY NODES, HUMAN (2114)*
 PROTECTION, HORMONE, HUMAN (1616)*
 REGRESSION, DIMETHYLBENZANTHRACENE, NURSING PERIOD, RAT (3655)
 MAMMARY GLAND
 ACUTE CANCERS, CLINICAL STUDY (5597)*
 ADENOCARCINOMA
 ESTROGEN-RECEPTOR, RAT (6116)
 GROWTH INHIBITION
 ESTROGEN, PROLACTIN, RAT (0830)
 LIVER EXTRACT, MOUSE (4047)
 IMMUNITY, TUMOR CELL, MOUSE (0490)*
 RNA, MOUSE, MAMMARY TUMOR VIRUS, HUMAN (5926)
 TRANSPLANTABILITY, NEURAMINIDASE, MOUSE (0746)
 BENIGN CONDITION, ESTROGEN, HUMAN (4429)
 BITTNER MILK FACTOR, CARCINOMA (0017)*
 BREAST, ALTERATIONS, EXTRALOBULAR DUCTS, EPITHELIUM, HUMAN (2721)
 BREAST CANCER
 BREAST-FEEDING (2589)*
 IMMUNE RESPONSE, MORPHOLOGICAL EVIDENCE, REVIEW (2211)
 PLASMA-CORTISOL, PLASMA-ANDROGEN SULPHATES, IMMUNE RESPONSE, HUMAN (2636)
 VIRAL ETIOLOGY, HUMAN (2590)*
 BREAST CANCER ETIOLOGY, VIRUS LIKE PARTICLES, CHRONIC MASTITIS, HUMAN (3056)
 BREAST CARCINOMA
 FIBROADENOMA, ADRIAMYCIN, DAUNOMYCIN RAT (2343)
 KLINEFELTER'S SYNDROME, HUMAN (2834)
 POST-BIOPSY, IMMUNOLOGY, HUMAN (2649)
 PROTEIN-BOUND FUCOSE, HUMAN (2898)*
 THORIUM RADIATION, HUMAN (2460)*
 CANCER
 AMYLOID-LIKE SUBSTANCE, HUMAN (5585)*
 COLLAGEN SYNTHESIS, PEPTIDYLPROLINE HYDROXYLASE ACTIVITY, MOUSE (6331)*
 EPIDEMIOLOGY, ITALY (0205)
 ESTROGEN-RECEPTOR, HUMAN (1485)*
 IMMUNOLOGY, MOUSE, REVIEW (3606)
 INCIDENCE, GERMANY (2793)*
 LONG-TERM ESTROGEN ADMINISTRATION, WOMEN (4449)*
 TESTOSTERONE, ETIOLOGICAL FACTOR, HUMAN (4858)
 CARCINOGENESIS
 CONTRACEPTIVES, GESTAGENS, MALE AND FEMALE MICE (4390)
 EPIDEMIOLOGY, HUMAN, REVIEW (5022)
 FISSION NEUTRON IRRADIATION, 3-METHYLCHOLANTHRENE, RAT (2317)
 ORAL CONTRACEPTIVE, HUMAN (0604)
 CARCINOMA
 ADENYLIC ACID, ADENOSINE DEAMINASE, MOUSE (0793)*
 ADOLESCENCE, CASE REPORT (0808)*

ANTIGENIC CHANGES, HUMAN (1786)
 BACTERIA, ESTROGEN, DIET,
 EPIDEMIOLOGY, HUMAN, REVIEW
 (0611)
 BIOCHEMICAL DEFECT, RAT (2872)
 BLOOD GROUP DISTRIBUTION (0763)
 BREAST-FEEDING (0893)*
 CELLULAR RESPIRATION, MOUSE
 (4188)*
 CERUMEN ALLELE, EPIDEMIOLOGY
 (0508)
 CONNECTIVE TISSUE, HISTOCHEMICAL
 STUDY, HUMAN (6137)*
 CULTURE, C-TYPE VIRUS, RAT (0119)
 CYTOLOGIC DIFFERENTIATION,
 ULTRASTRUCTURE, HUMAN (1145)*
 ENZYME, DNA, FLUPHENAZINE
 HYDROCHLORIDE, RAT (0833)
 ESTROGEN
 HUMAN (1250)
 VAGINAL CYTOLOGY, HUMAN (4145)*
 FAMILY, INHERITANCE (0557)*
 GLUCURONIC ACID, URINE, BLOOD,
 HUMAN (6122)
 GRAFT REJECTION, DNA TREATMENT,
 CELL DEBRIS TREATMENT, RAT
 (4695)
 GROWTH
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 INSULIN, OOPHORECTOMY, HYPO-
 PHYSECTOMY, RAT (1563)
 HUMAN (4822)
 OVARIAN HORMONE, RAT (1144)*
 GROWTH INHIBITION, CIS-PLATINUM
 DIAMMINODICHLORIDE-II, RAT
 (1300)*
 HIGH-RISK GROUP, REVIEW (1234)*
 HORMONE (0284)*
 INCIDENCE
 HISTOPATHOLOGY, DOG (0799)*
 SLOVENIA (0808)
 YOUNG WOMEN, ITALY (6158)*
 LACK OF ANTIGENICITY, MOUSE (4681)
 LIVER ENZYMES, MORRIS HEPATOMA,
 RAT (0364)
 LYMPH NODE IMMUNOCOMPETENCE, HUMAN
 (1788)
 MALIGNANCY, TUMOR GROWTH,
 IMMUNOCOMPETENCE, MOUSE (0457)
 MAMMARY TUMOR VIRUS, HUMAN (5305)
 MASON-PFIZER VIRUS, ANTIGEN,
 MONKEY (0138)*
 METASTASIS (2119)*
 CHROMOPHOBE ADENOMA, HYPOPHYSIS,
 HUMAN (3436)*
 SURVIVAL, HUMAN (6358)*
 METASTATIC ADENOPATHY, HUMAN
 (1108)*
 MILK, 9,10-DIMETHYL-1,2-BENZ-
 ANTHRACENE, RAT (1284)*
 MITOCHONDRIA, IMMUNOLOGY, MOUSE
 (3202)
 MODAL DNA, SURVIVAL RATE, HUMAN
 (4270)*
 MORPHOLOGY, HORMONAL CONTRACEPTIVE
 HUMAN (2973)
 ONCOGENIC RNA VIRUS, MONKEY,
 (1694)
 ORAL CONTRACEPTIVE (1600)
 PARATHYROID HORMONE, ECTOPIC
 PRODUCTION, HUMAN (0596)*
 PROLACTIN DEPENDENCE, DEHYDRO-
 GENASE, HUMAN (5129)
 RNA-DIRECTED DNA POLYMERASE,
 MOUSE (3803)
 SERUM IMMUNOFLOUORESCENCE, HUMAN
 (1802)
 SEX CHROMATIN, HUMAN (0863)*
 SEX HORMONE DEPENDENCY, RODENT,
 HUMAN (0838)
 SKELETAL METASTASES, HUMAN (3489)*
 SPREAD, LYMPH NODE, HUMAN (0285)*
 STEROID, ANDROGEN, EXCRETION,
 HUMAN (0789)
 STROMA, ALKALINE PHOSPHATASE,
 HUMAN (0184)
 THYMECTOMY, MOUSE (0469)
 TRANSPLANTATION, RADIATION
 RESPONSE, MOUSE (4493)
 VIRAL-SPECIFIC RNA, EVIDENCE FOR
 TRANSLATION, MOUSE (2489)
 VIRUS, NUCLEIC ACID, DNA POLYMER-
 ASE, MONKEY (1696)
 VIRUS AND NON-VIRUS PRODUCING,
 IMMUNOLOGICAL CROSS REACTIONS,
 MOUSE (5884)
 VIRUS PARTICLE PENETRATION,
 PRODUCTIVE CELL, MOUSE (1701)
 MAMMARY GLAND - CONTINUED
 CARCINOMA IN SITU, INFILTRATIVE
 CARCINOMA, PATHOGENESIS, REVIEW
 (1515)
 CARCINOMA CELL SUBLINE, IMMUNO-
 SUSCEPTIBILITY, TRANSPLANTABILITY,
 MORPHOLOGY, KARYOTYPE, MOUSE (3851)
 CARCINOMA CELLS, SURFACE PROPERTIES OF
 NON-TUMORIGENIC VARIANTS, MOUSE
 (3840)
 CARCINOMA LOBULARE IN SITU, PATHO-
 GENESIS, HUMAN (3956)*
 CARCINOMA VIRUS, ONCOGENIC RNA VIRUSES
 ULTRASTRUCTURAL COMPARISON, MONKEY
 (3116)
 CORPUS UTERI, CANCER, ANTIGONADOTROPIC
 FACTOR, HUMAN (6175)*
 CYCASIN, TARGET ORGAN SHIFT, INTESTINE
 RAT (5781)
 CYSTIC DISEASE, CARCINOMA HYPER-
 PLASTIC LESION, DNA DISTRIBUTION,
 HUMAN (0785)
 CYSTOSARCOMA PHYLLODES, ULTRASTRUCTURE
 HUMAN (0579)*
 7,12-DIMETHYLBENZ(A)ANTHRACENE
 CELLULAR IMMUNITY, BACILLUS
 CALMETTE-GUERIN, RAT (0637)
 TUMOR INDUCTION, MITOTIC RATE,
 RAT (5797)
 9,10-DIMETHYL-1,2-BENZANTHRACENE,
 VITAMIN B15, RAT (3667)
 EPITHELIAL CELL CULTURE, NEW METHOD,
 HUMAN (4885)*
 EPITHELIUM, GROWTH, HUMAN (4940)*
 EXCRETION, URETHANE, LUNG TUMOR,
 MOUSE (0362)
 FIBROADENOMA
 PROGESTERONE, ESTROGEN, RAT
 (4420)
 SEX CHROMATIN, HUMAN (4122)*
 HYPERPLASTIC ALVEOLAR NODULE, TUMOR,
 PHENYLALANINE, DIET, MOUSE (0185)
 HYPERPLASTIC NODULE, PITUITARY
 ISOGRAFT, ADRENO-OVARIETOMY, MOUSE
 (0154)
 IMMUNE RECOGNITION, ENDOTOXIN, MOUSE
 (5303)
 INDUCED ADENOCARCINOMA, GENETIC
 FACTORS, HAMSTER (2318)
 INDUCED TUMOR, N,N'-DIBUTYL- α -

- ALPHA¹-(3-CHLORO-4-METHOXYPHENYL)-
ETHYLENEODIAMINE, RAT (2431)*
MAMMARY TUMOR VIRUS, HYPERPLASTIC
NODULE, HORMONE, PITUITARY GRAFT,
MOUSE (0416)
MEMBRANE PROLIFERATION, PHOSPHATIDYL-
CHOLINE SYNTHESIS, MOUSE (6052)
3-METHYLCHOLANTHRENE, ESTROGEN,
CASTRATION, MOUSE (4435)
MILK, VIRUS-LIKE PARTICLE, HUMAN
(1693)
MINIMAL BREAST CANCER, HUMAN, REVIEW
(4307)
NEOPLASIA
7,12-DIMETHYLBENZ(A)ANTHRACENE,
X-RAY, RAT (2309)
EPIDEMIOLOGY, SENEGAL (0204)
OSTEOCHONDROID STRUCTURES, HUMAN
(6178)*
NEOPLASM, PROGESTOGENS, DOG (4193)*
NEOPLASTIC TRANSFORMATION, HORMONES,
CASEIN AND HISTONE SYNTHESIS,
MOUSE (4799)*
NODULES, HYPERPLASTIC, INFLAMMATORY,
CANINE (2817)
NORMAL, DYSPLASTIC, HYPERPLASTIC,
NEOPLASTIC TISSUES, ORGAN CULTURE,
HUMAN (4804)*
PARENCHYMA DNA, 7,12-DIMETHYLBENZ(A)-
ANTHRACENE, BINDING, RAT (1564)
PRENEOPLASTIC, NEOPLASTIC, NUCLEAR
MAGNETIC RESONANCE SPECTROSCOPY,
MOUSE (3230)
PRENEOPLASTIC LESIONS, NEOPLASIA,
DNA DISTRIBUTION, HUMAN (0788)
SARCOMA, MORPHOLOGY, HISTOGENESIS, DOG
(4268)*
SERIALLY TRANSPLANTED TUMOR, TISSUE
CULTURE-ADAPTED DERIVATIVE,
CHARACTERISTICS, MOUSE (4964)*
SERUM REACTIVITY, TUMOR ANTIGEN,
LYMPHOID CELL, HUMAN (1374)
SPONTANEOUS CARCINOMA, VIRUS-LIKE
PARTICLE, CAT (1131)
SPONTANEOUS TUMOR
INHIBITION, AGING OF INHIBITOR
EFFECT, MOUSE (3451)*
TUMOR SPECIFIC TRANSPLANTATION
ANTIGEN, MOUSE (0747)
SPONTANEOUS TUMOR INCIDENCE
ACCELERATION, HEAT-DENATURED TUMOR
INJECTION, MOUSE (4938)*
STRUCTURE, CANCER INCIDENCE, MOUSE
(0575)*
TA3 CARCINOMA SUBLINES, ANTIBODY
BINDING, IMMUNOSENSITIVITY, MOUSE
(3874)
TISSUE GROWTH, HORMONE REQUIREMENT,
IN VITRO, HUMAN (4173)*
MAMMARY GLAND - CONTINUED
TUMOR
ARGINASE, GLUCOSE-6-PHOSPHATE
DEHYDROGENASE, MOUSE (0187)
ASCITES TUMOR, ANTIGEN CROSS-
REACTIVITY, MOUSE (3930)*
C57BL/M AND C57BL/HE MICE (4577)
CELL SURFACE ALTERATIONS,
GLYCOPROTEIN, HUMAN (6054)*
CELLULAR IMMUNITY, BLOCKING
ACTIVITY, MOUSE (3879)
CHARACTERISTICS, RNA ADMINISTRA-
TION, MOUSE (2838)
DIMETHYLBENZANTHRACENE, ESTRADIOL-
BINDING CHROMATIN, FRACTIONATION
RAT (1263)
7,12-DIMETHYLBENZ(A)ANTHRACENE
HORMONE-INDUCED STIMULANT
EFFECTS, MOUSE, REVIEW (5064)*
IMMUNOELECTROPHORETIC ANALYSIS,
RAT (1258)
OOPHORECTOMY, BIOCHEMICAL
CHANGE, RAT (0959)
PROGESTERONE, OVARICTOMY,
ADRENALECTOMY, RAT (1546)
REGRESSION AND RECURRENCE, RAT
(3013)
DNA TRANSLOCATION, BLOOD, RAT
(1130)
ESTRADIOL BINDING, RAT (1242)
ESTRADIOL BINDING SITE, MOUSE
(4406)
ESTRADIOL UPTAKE, STEROID
EXCRETION, HUMAN (1183)*
ESTROGEN, MOUSE (0340)
GALLIUM ACCUMULATION, HUMAN (2826)
GROWTH, HOST RESISTANCE, MOUSE
(1396)
HORMONE DEPENDENCE, REVIEW (5034)*
HYDRAZINE SULFATE, PREGNANT AND
PSEUDOPREGNANT MICE (4476)*
HYPERPLASTIC ALVEOLAR NODULE,
INHIBITION, PHENYLALANINE
DEFICIENCY, MOUSE (1243)
INHIBITORY EFFECT OF ESTROGEN,
PITUITARY ISOGRAFT,
7,12-DIMETHYLBENZ(A)ANTHRACENE,
RAT (2305)
MAMMOSEMATOTROPIC TUMOR RESECTION,
REGRESSION, RAT (2829)
MASON-PFIZER VIRUS
MONKEY (4522)
SEROLOGY, STRUCTURE, MONKEY
(1695)
3-METHYLCHOLANTHRENE TREATMENT,
SERIAL TRANSPLANTATION, MOUSE
(3004)
MURINE LEUKEMIA VIRUS, MAMMARY
TUMOR VIRUS, ANTIGENS, MOUSE
(3784)
N-NITROSOBUTYLUREA, RAT (5136)
PRECANCEROUS CONDITION, MOUSE
(5400)
PROLACTIN, MOUSE (2942)
REGRESSION, 7,12-DIMETHYLBENZ-
ANTHRACENE, ERGOCORININE, RAT
(2929)
RNA POLYMERASE ACTIVITY, RAT
(5829)*
RNA VIRUS PARTICLE, HUMAN (1692)
SERUM ENZYMES, HUMAN (6238)*
STROMA CELL, DNA SYNTHESIS, MOUSE
(1468)*
ULTRASTRUCTURE
HUMAN (4146)*, (4850), (5596)*
RAT (5083)
URETHANE-INDUCTION, SERIAL TRANS-
PLANTATION, MOUSE (3003)
VIRUSES, REVIEW (5015)
TUMOR ANTIGEN, LYMPHATIC CELL, MOUSE
(2610)
TUMOR CELL LINE, VIRUS PRODUCTION,
KINETICS, MOUSE (3049)
TUMOR CELLS
LYMPHOCYTE, LYMPH NODE, HUMAN
(3191)
TISSUE CULTURE STUDIES, MOUSE
(4597)*
TUMOR DEVELOPMENT, THYMUS, MOUSE

(4037)
TUMOR EXTRACT, DELAYED HYPER-
SENSITIVITY, SURVIVAL, HUMAN (1641)*
TUMOR RECURRENCE, 7,12-DIMETHYLBENZ(A)
ANTHRACENE, RAT (2310)
TUMOR REGRESSION
AUTOPHAGY, NEOPLASTIC CELLS, RAT
(5158)
HORMONE-DEPENDENT TISSUE, PHYSIO-
PATHOLOGIC CHARACTERISTICS, RAT
(5157)
LYSOSOMAL ENZYME ACTIVITY, RAT
(6290)*
TUMOR TRANSPLANT GROWTH, C. PARVUM,
ANTITUMOR GLOBULIN, MOUSE (5315)
TUMOR VIRUS
HUMAN, REVIEW (1501)
REPLICATION, GROWTH REGULATION,
MOUSE (3067)
MAMMARY GLAND - CONTINUED
TUMORIGENESIS
CHLORMADINONE, MESTRANOL, RAT
(0375)*
N-NITROSOBUTYLUREA, OVARIAN
HORMONES, RAT (4382)
PHENYLALANINE DEFICIENCY,
PITUITARY ISOGRAFT, MOUSE
(2932)
PITUITARY ISOGRAFT, PREGNANCY,
LACTATION, MOUSE (4846)
TUMORIGENESIS INHIBITION
ANTIOXIDANT, 7,12-DIMETHYLBENZ(A)-
ANTHRACENE, RAT (3689)
ERGOT ALKALOIDS, MOUSE (2975)
TUMORIGENESIS PROMOTION, PITUITARY
ISOGRAFTS, MOUSE (2975)
ULTRASTRUCTURE, HUMAN, REVIEW (0930)*
MAMMARY TUMORS
REGRESSION, ERGOT DRUGS, RAT (1951)
VASCULAR SUPPLY, MOUSE (2003)
MANDIBLE
AMELOBLASTOMA, LUNG METASTASIS, CASE
REPORT (4051)*
EPITHELIAL ODONTOGENIC TUMOR, ULTRA-
STRUCTURE, CASE REPORT (4100)*
OSTEOBLASTOMA, CASE REPORTS (5566)*
OSTEOMYELITIS, RETICULUM CELL SARCOMA,
HUMAN (0191)*
PRIMARY MALIGNANT MIXED TUMOR, CASE
REPORT (5570)*
MANNOSAMINE
ASCITES TUMOR CELL, ULTRASTRUCTURE,
RAT (1534)
MAREK'S DISEASE
AVIAN NEUROLYMPHOMATOSIS, CHICK
(3084)
HERPES-TYPE VIRUS
CHARACTERIZATION, CHICKEN (1020),
(1022)
HERPESVIRUS
ANTIGENIC RELATIONSHIPS, INFEC-
TIOUS BOVINE RHINOTRACHEITIS,
BURKITT'S LYMPHOMA (4611)
AVIAN LEUCOSIS VIRUS, INTERACTION,
TISSUE CULTURE (3762)
CHICKEN, REVIEW (5714)
IMMUNOFLOUORESCENT ANTIGEN, LYMPHOID
LESION, CHICKEN (0786)
LYMPHOCYTE, IMMUNOLOGICAL RESPONSIVE-
NESS, CHICKEN (1394)*
ORGAN TISSUE, ULTRASTRUCTURE, CHICKEN
(0144)*
PERIPHERAL NERVE LESIONS, ULTRA-
STRUCTURE, FOWL (4592)*
SPLEEN LYMPHOCYTE, PHYTOHEMAGGLUTININ
RESPONSE, IMPAIRMENT, CHICKEN (4672)
VIRUS
ANTIGEN, FEATHER FOLLICLE, CHICKEN
(0451)
ASSAY, CHICKEN (1006)
ONCOGENICITY, DNA SYNTHESIS, BIRD
(4586)*
REPLICATION, CHICKEN, ELECTRON
MICROSCOPY (0146)*
MARIJUANA
TOBACCO, SMOKING, ALVEOLAR MACRO-
PHAGES, HUMAN (0663)*
MAST CELL
MASTOCYTOMA, IMMUNOGLOBULIN RECEPTOR,
MOUSE (3180)
NEOPLASMS, CAT (1992)
NEOPLASTIC, PROLIFERATION, AMINO ACID
DEPRIVATION (1471)*
MASTOCYTOMA
ALLOGRAFT IMMUNITY, T CELL, MOUSE
(5310)
ATP-SULFURYLASE
ENZYME-SUBSTRATE COMPLEXED, MOUSE
(4860)
PROPERTIES, MOUSE (2085)*
BETA-GLUCURONIDASE, MOUSE (0861)*
CELL IMMUNIZATION, CYTOLYTIC LYMPHOID
CELL, INDUCTION, MOUSE (1811)
DEGRADATION, HEPARIN, MOUSE (2163)*
DNA CONTENT, RNA SYNTHESIS, INHIBITION
(2020)
METABOLISM, MOUSE (2178)*
MAXILLA
ANTRUM, CARCINOMA, SNUFF, TRACE METAL
CONTENT, HUMAN (0091)*
MAXILLARY ANTRUM
CANCER, TRACE ELEMENTS, SOIL, PLANTS,
SNUFF USERS (5184)*
MEDIASTINUM
NEUROGENOUS TUMORS, CLINICAL STUDY
(5656)*
PRIMARY LYMPHATIC TUMORS, MORPHOLOGY,
HUMAN (4165)*
TERATOMA, MALIGNANT TRANSFORMATION,
HUMAN (1890)
TUMOR
ETIOLOGY, PATHOGENESIS, REVIEW
(2284)*
PATHOLOGICAL ANATOMY, HUMAN
(4284)*
MEDULLOBLASTOMA
ATYPICAL MITOSES, HUMAN (5452)
CELL NUCLEUS, ULTRASTRUCTURE, HUMAN
(4852)
HISTOGENESIS, REVIEW (1523)*
MYELIN FIGURES, CYTOPLASMIC MEMBRANES,
HUMAN (4985)*
TISSUE CULTURE, ULTRASTRUCTURE, CASE
REPORTS (4908)*
MEDULLOEPITHELIOMA
MALIGNANT INTRAOCULAR, RHABDOMYO-
SARCOMATOUS DIFFERENTIATION, CASE
REPORTS (5643)*
REVIEW (2287)*
MELANIN
PRODUCING STRUCTURE, MELANOMA,
CYTOPLASM, HUMAN (1159)*
SYNTHESIS, CHOROIDAL MALIGNANT
MELANOMA, ULTRASTRUCTURE, HUMAN
(1151)*
MELANOBLASTOMA
CEREBRAL LEPTOMENINGES, REVIEW (2911)*
SPONTANEOUS, HISTOPATHOLOGY, RABBIT

(6248)*
 MELANOCYTOMA
 MENINGEAL, ULTRASTRUCTURE, CASE REPORT
 (6068)*
 MELANOMA
 ADJACENT MELANOCYTE, HUMAN (0262)*
 AMELANOTIC
 CLINICOPATHOLOGIC STUDY (5654)*
 MORPHOLOGY, 5-BROMODEOXYURIDINE,
 IN VITRO (4088)*
 CELL, TYROSINASE (4871)
 CELL KINETICS, HUMAN (1105)
 CELL MEMBRANE, IMMUNOGLOBULIN, IMMUNO-
 FLUORESCENCE, HUMAN (6036)*
 CELLS, GROWTH INHIBITION, C-REACTIVE
 PROTEIN, ACTIVATED LYMPHOCYTES,
 HUMAN (2702)*
 CHOROIDAL MALIGNANT, MELANIN
 SYNTHESIS, ULTRASTRUCTURE, HUMAN
 (1151)*
 CLINICAL MONOGRAPHS, REVIEW (2242)*
 CYTOCHEMISTRY, KARYOMETRICS, HUMAN
 (2062)*
 DEVELOPMENT, MATERNAL EFFECT, HYBRID
 FISH (5464)*
 ENDOGENOUS INHIBITOR, MOUSE (1436)
 ETIOLOGY, COMMUNICABLE (1519)*
 FACE, HISTOPATHOLOGY, HUMAN (6222)*
 FAMILIAL
 CLINICAL CHARACTERISTICS, HUMAN
 (0842)
 NON-BLOOD RELATED INDIVIDUALS
 (4835)*
 FIBROBLAST, HYBRIDS, GENETIC (2177)*
 HARDING-PASSEY
 HORNING-MITCHELY KIDNEY TUMOR,
 NUCLEIC ACID, PROTEIN, CYTO-
 CHEMISTRY (1470)*
 HYDROLYTIC ENZYMES, CYTOCHEMISTRY,
 MOUSE (5458)*
 KARYOMETRICAL STUDY, MITOTIC INDEX
 MOUSE (5459)*
 NUCLEIC ACIDS, PROTEINS, CYTO-
 CHEMISTRY, MOUSE (5457)*
 TRANSPLANTATION, MOUSE (1157)*
 HARDING-PASSEY MELANOMA, KIDNEY TUMOR,
 CYTOCHEMISTRY, MOUSE, HAMSTER
 (5457)*
 HETEROLOGOUS SERUM, MOUSE (2709)*
 HOST FACTOR, REVIEW (0931)*
 INCIDENCE, SUNLIGHT, OCCUPATIONAL
 EXPOSURE, ENGLAND, SWEDEN (3252)
 INDUCTION, GARDNER-FELINE FIBROSARCOMA
 VIRUS, GNOTOBIOTIC, CAT (3066)
 INHERITANCE, FAMILY (0250)
 JUVENILES, HUMAN (2038)*
 LYMPHOCYTES, CYTOTOXIC, IMMUNE, HUMAN
 (2710)*
 MALIGNANT
 AXILLARY METASTASIS, TATTOO, HUMAN
 (2386)*
 CHOROID, ULTRASTRUCTURE, CASE
 REPORT (4154)*
 CHROMOSOMAL ALTERATIONS, HUMAN
 (0565)*
 EPIDEMIOLOGY (2788)*
 HUMAN REVIEW (2274)*
 IMMUNOLOGY IMMUNOFLUORESCENCE
 (5392)*
 INCIDENCE
 AUSTRALIA (6105)*
 ENGLAND (6106)*
 LYMPHOGRAPHY, CLINICAL STUDY
 (6145)*

MELANOTIC FRECKLE, ULTRASTRUCTURE,
 CASE REPORTS (6368)*
 PENIS, CASE REPORT (4144)*
 SKIN CARCINOMA, INCIDENCE, INDIA
 (0526)*
 TYROSINASE, IMMUNOLOGY, HUMAN
 (0779)*
 TYROSINASE INHIBITOR, INTRACELL-
 ULAR DISTRIBUTION, HAMSTER
 (5699)*
 MELANOMA - CONTINUED
 MALIGNANT CELLS, IMMUNE PHAGOCYTOSIS
 HUMAN (6038)*
 MALIGNANT COLLAGENASE DISTRIBUTION,
 ACID PHOSPHATASE ACTIVITY, HUMAN
 (3528)*
 MARKER CHROMOSOMES, HAMSTER (0246)
 MELANIN-PRODUCING STRUCTURE, CYTOPLASM
 HUMAN (1159)*
 METASTASES
 BONE, HUMAN (3490)*
 PATHOLOGICAL ANATOMY, HUMAN
 (4163)*
 METASTATIC
 BALLOON CELL CHANGES, CASE REPORTS
 (5472)*
 PRESENCE OF SEX CHROMATIN, CASE
 REPORT (3338)*
 MORBIDITY, INCIDENCE, TEXAS (0819)*
 MORTALITY, SWITZERLAND (6094)*
 MULTIPLE AGMINATED JUVENILE, CASE
 REPORT (5692)*
 NEVUS, SEX CHROMATIN, DNA, HUMAN
 (0546)
 PIGMENTARY TUMORS, BIOLOGICAL FEATURES
 ULTRASTRUCTURE (6051)
 PIGMENTED NEVI, ULTRASTRUCTURE, HUMAN
 (2029)*
 PRIMARY MALIGNANT SKIN, METASTASIS,
 EYE, CASE REPORTS (6326)*
 PROPAGATION, CHOROID MEMBRANE, HISTO-
 PATHOLOGY, CASE REPORT (3371)*
 PROPERTIES, MICE (2055)*
 PROTEIN METABOLISM, HAMSTER (6391)*
 RETICULUM CELL SARCOMA, WART, PROTEIN,
 MAN (0232)
 RNA POLYMERASES, HAMSTER (6390)*
 SKIN, METASTASES TO THE STOMACH, CASE
 REPORT (4265)*
 SUNLIGHT, HUMAN (1310)*
 TRANSPLANT, IMMUNOLOGICAL RESPONSE,
 MOUSE (0487)*
 TRANSPLANTABLE, ULTRASTRUCTURE,
 HAMSTER (2889)*
 TYROSINASE ANTISERUM, PREPARATION,
 MOUSE (4714)*
 ULTRASTRUCTURE, HAMSTER (0600)*
 UVEAL, AUTOIMMUNE SERUM, HUMAN (3889)
 VULVA, CLINICAL STUDY (5483)*
 MELANOSOME
 PIGMENTARY TUMORS, BIOLOGICAL FEATURES
 ULTRASTRUCTURE (6051)
 MEMBRANE
 ALTERATIONS, TRANSFORMATION, SV40,
 HUMAN, HAMSTER (3094)
 BIOSYNTHESIS, SACCHARIDE RESIDUE
 DISTRIBUTION, MYELOMA-CELL
 HOMOGENATE (4915)*
 GLYCOPROTEIN, LYMPHOMA, L-ASPARAGINASE
 (4040)
 NUCLEAR, DNA REPLICATION, LEUKEMIA
 CELLS (4975)*
 SURFACE, STRUCTURAL CHANGES, MALIGNANT
 CELL TRANSFORMATION, HAMSTER (3938)*

SURFACE CHANGE, ADENOVIRUS INFECTION, HUMAN (3748)
TUMOR CELL, BINDING SITE, CONCAVALIN A, WHEAT GERM AGGLUTININ (4864)
ENADIONE
AFFINITY LABEL SYNTHESIS, MYELOMA PROTEIN REACTION (3532)*
ENINGIOMA
ANGIOBLASTIC, HEPATIC METASTASIS, CASE REPORTS (3392)*
DERIVED CELL CULTURES, COMMON ANTIGEN, HUMAN (2650)
ELECTRON MICROSCOPY, HUMAN (2197)*
FIBROBLASTIC, HUMAN (2157)*
GROWTH REGULATION, POLYAMINE (1451)*
HEMANGIOBLASTOMA, ELECTRON MICROSCOPY, HUMAN (2081)*
HISTOCHEMISTRY, BIOPSY, HUMAN (3548)*
MELANOTIC, ULTRASTRUCTURE, CASE REPORT (6068)*
PHARYNX, CASE REPORT (1090)*
ENOPAUSE
BREAST CANCER RISK, UNITED STATES. (3971)
ESENCHYMAL TUMOR
STOMACH, REVIEW (2248)*
ESOPHARNYX
MALIGNANT TUMORS, INCIDENCE, HUMAN (3955)*
ESOTHELIOMA
ASBESTOS
CLINICAL STUDY (5823)*
INCIDENCE, SCOTLAND (3270)
ASBESTOS MINING, OCCUPATIONAL HAZARD (0386)*
ATRIOVENTRICULAR NODE, HEART BLOCK, CASE REPORT (4075)*
GENITAL, NITROSAMINE, LIVER NEOPLASM, RAT (2951)
GENITAL TRACT, ADENOMATOID TUMOR, ULTRASTRUCTURE, CASE REPORTS (3962)*
INDUCTION, PLEURA, ASBESTOS, FIBROUS GLASS, RAT (3676)
LARGE OMENTUM, CASE REPORT (3567)*
LUNG, DIAGNOSIS, AUTOPSY (1934)*
MALIGNANT, CHILDREN, CASE REPORTS (4486)*
MALIGNANT FIBROUS, PLEURA, ULTRA-STRUCTURE, CASE REPORT (5475)*
PERITONEAL, CASE REPORT (4978)*
PLEURAL, ASBESTOSIS, HUMAN, REVIEW (5709)
TRANSPLANTABLE, C-TYPE VIRUS PARTICLES HAMSTER (5931)*
ULTRASTRUCTURE, ADENOMATOID, HUMAN (2110)*
ESTRANOL
CHLORMADINONE, MAMMARY TUMORIGENESIS, RAT (0375)*
METABOLISM
2-ACETAMIDONAPHTHALENE, DOG (5092)
ADENOCARCINOMA, SUBMAXILLARY GLAND, MOUSE (0654)*
ADENOSINE 3',5'-CYCLIC MONOPHOSPHATE, NEUROBLASTOMA CELLS (2866)
AFLATOXIN B1, MONKEY (5153)
AFLATOXINS, RAT (1640)*
ASCITES TUMOR, CATALASE, MOUSE (4289)*
BENZO(A)PYRENE
7,12-DIMETHYLBENZ(A)ANTHRACENE, HAMSTER EMBRYO CELLS, IN VITRO (1568)
VITAMIN A-INDUCED MODIFICATION, CELL CULTURES, HAMSTER (4362)
BONE MARROW LEUKOCYTES, CHRONIC MYELOID LEUKEMIA, HUMAN (4101)*
BUTYL(4-HYDROXYBUTYL)NITROSOAMINE, RAT (4458)*
CALCIUM
BONE TUMORS, HUMAN (6400)*
PHOSPHORUS, TUMORS, MOUSE (0537)
CARBOHYDRATE
DIMETHYLAMINOAZOBENZENE HEPATO CARCINOGENESIS, RAT (5161)
HEPATOMAS, ENZYME ACTIVITY, MOUSE, HAMSTER (5840)*
NEOPLASTIC PROCESS, HUMAN (3313)
NUCLEIC ACID, ENZYME ACTIVITY, GENETIC EXPRESSION REGULATION, CANCER CELL DETECTION (6141)*
1-CARBON GROUP, HEPATOMA, WALKER'S CARCINOMA, RAT (4210)*
CHOLESTEROL, PREPUTIAL GLAND TUMOR, MOUSE (4237)*
CRABTREE EFFECT, TUMOR CELL, REVIEW (5008)
CYTOLOGY, NEOPLASTIC CONVERSION, MOUSE CELL (1430)
DIBENZ(A,H)ANTHRACENE, DIBENZ(A,C)-ANTHRACENE, MOUSE EMBRYO CELL (1565)
N,N-DIMETHYLAMINOAZOBENZENE, LIVER, RAT (3688)
4-DIMETHYLAMINOSTILBENE,
4-DIMETHYLAMINODIBENZYL,
CARCINOGENICITY, RAT (0335)
7,12-DIMETHYLBENZ(A)ANTHRACENE
BENZO(A)PYRENE, CYTOTOXICITY, MAMMALIAN CELL (2311)
3-METHYLCHOLANTHRENE PRETREATMENT, DIGESTIVE TRACT, RAT (1570)
DRUG, ENZYME INDUCTION, HEPATIC TOXICATION-DETOXICATION SYSTEMS, BENZO(A)PYRENE, REVIEW (5720)*
EHRlich ASCITES TUMOR CELL,
RIBONUCLEOTIDE REDUCTASE, DNA SYNTHESIS, MOUSE (4212)*
ENERGY, INSULIN, 2-DEOXYGLUCOSE, GRANULOMA TISSUE, RAT (5495)*
ENVIRONMENTAL CHEMICALS, HUMAN, CARCINOGEN, CIGARETTE SMOKING, REVIEW (0306)
ENZYME INDUCTION, POLYCYCLIC AROMATIC HYDROCARBONS, PREGNANT AND FETAL RATS (5133)
ENZYMES, LEUKOCYTE, REVIEW (1517)
GAMMA AMINOBUTYRIC ACID, HYDRAZINE, RAT (0664)*
GLUCOSE
NOREPINEPHRINE, GLIOBLASTOMA CELLS, NEUROBLASTOMA CELLS, RAT (5558)*
SARCOMA VIRUS, TRANSFORMED CELL, CHICK EMBRYO (4558)
GLUTAMIC ACID, GAMMA-AMINOBUTYRIC ACID BRAIN TUMORS (6170)*
GLYCOGEN
PHOSPHORYLASE, SQUAMOUS CELL CARCINOMA, LUNG, HISTOCHEMICAL STUDY (6121)
REGENERATING LIVER, LIVER NEOPLASM RAT, MOUSE (3996)
GLYCOLYSIS, EHRlich ASCITES TUMOR, IN VITRO (4082)*
GUANINE, INHIBITION, ADENOSINE ANALOGUE, ADENOCARCINOMA (0265)*
HEPATOMA, REGENERATING LIVER, MOUSE (0981)*
HISTAMINE, PRETUMOROUS GASTRIC

DISEASES, HUMAN (1901)*
 INTRACRANIAL TUMOR CELL, HISTOENZYMOL-
 OBY, HUMAN (4264)*
 LIVER
 HEPATOMA, ISCHEMIA, RAT (4857)
 POLYCYCLIC HYDROCARBONS, EPOXIDES,
 RAT (1533)
 MICROELEMENTS, BLOOD AND URINE LEVELS,
 HUMAN (4109)*
 MUTAGENIC ACTIVITY, HOST-MEDIATED
 ASSAY, MOUSE (2410)*
 NEOPLASTIC CELL, REVIEW (5047)*
 NITROSAMINE, RNA ACTIVITY, LIVER, RAT
 (5160)
 NUCLEIC ACID
 CELL CYCLE, CELLULAR PROLIFERATION
 NORMAL TISSUES, MALIGNANT TISSUE
 HUMAN (6077)
 POLYOMA, ROUS SARCOMA VIRUS,
 EMBRYO CELL CULTURES, MOUSE,
 CHICKEN (5274)
 RAUSCHER VIRUS-INDUCED LEUKEMIA,
 MOUSE (5210)
 TUMOR AND NORMAL TISSUES, LIVER,
 RAT (4880)*
 ORNITHINE, HEPATOMA, LIVER, RAT
 (4989)*
 L-ORNITHINE, HEPATOMAS, RAT (5516)*
 OXIDATION, HORSERADISH PEROXIDASE,
 CARCINOGEN (0343)
 OXIDATIVE, GLUTAMINE, MALIGNANT CELLS,
 RAT (4844)
 POLYCYCLIC AROMATIC HYDROCARBON,
 PROSTATE CELL, MOUSE (4424)
 PROTEIN, MELANOMA, HAMSTER (6391)*
 RNA
 LIVER, RAT (5630)*
 NEONATAL ADMINISTRATION, SEX
 HORMONES, LIVER, RAT (2347)
 RNA AND DNA, MURINE CARCINOMA, GROWTH
 STAGES, MOUSE (4068)*
 SARCOMA, GLYCOLYSIS, RESPIRATION,
 CARTESIAN DIVER METHOD (4073)*
 TESTOSTERONE, PROSTATIC ADENOMA,
 CARCINOMA TISSUE (6169)*
 TRYPTOPHAN
 BREAST CANCER, CARCINOMA OF THE
 CERVIX, HUMAN (4920)*
 URINARY BLADDER CANCER, CLINICAL
 STUDY (6152)*
 VITAMIN B6, NICOTINAMIDE,
 ADMINISTRATION, HODGKIN'S
 DISEASE PATIENTS (4921)*
 ZINC, BLOOD GRANULOCYTES, HUMAN
 (2897)*
 METABOLITE
 WALKER'S CARCINOMA, EFFECTS ON
 DIFFERENT ORGANS, RAT (6381)*
 METAL
 CARCINOGEN, NICKEL, CADMIUM,
 SOLUBILITY, SERUM, MUSCLE (4448)
 DRINKING WATER, CANCER MORTALITY
 (4436)
 IONS, SUBCELLULAR BINDING, RHABDOMYO-
 SARCOMA, RAT (3702)
 LIGAND, CARCINOGENESIS, REVIEW (1504)
 NEOPLASTIC TISSUE, HUMAN (0233)
 NI+2 COMPLEX, BINDING CAPACITY,
 SUBCELLULAR FRACTION (3706)
 POTASSIUM IONS, SWELLING, NORMAL CELLS
 TUMOR CELLS, MOUSE (6153)*
 SMOOTH, MAXILLARY ANTRUM, CARCINOMA,
 HUMAN (0091)*
 TISSUE DISTRIBUTION, LUNG, LIVER,
 PHENOBARBITAL, BENZO(A)PYRENE,
 CARBON TETRACHLORIDE, RAT (4403)
 METASTASIS
 ADENOPATHY, MAMMARY CARCINOMA, HUMAN
 (1108)*
 ANTIGENS, ORGAN SPECIFIC, HUMAN
 (2658)*
 ASCITES TUMOR, INCIDENCE, MICE (2193)*
 AXILLARY NODES, MAMMARY, CARCINOMA,
 HUMAN (2114)*
 BASALIOMA, CONNECTIVE TISSUE (2184)*
 BLOOD, ORGAN, PRIMARY BROWN-PEARCE
 CARCINOMA, RABBIT (3516)*
 BLOOD BORNE, MALIGNANT EPITHELIAL
 TUMORS, HISTOGENESIS, HUMAN (3560)*
 BONE, BREAST CANCER, HUMAN (4236)*
 BREAST, HISTOLOGY, HUMAN (4224)*
 BREAST CARCINOMA, HISTOPATHOLOGY, CASE
 REPORT (6278)*
 BRONCHIOGENIC CYST, NECK, CASE REPORT
 (6254)*
 CANCER, SERUM ALKALINE PHOSPHATASE
 ISOENZYMES, RELATIONSHIP (3556)*
 CANCER TO CANCER, HISTOPATHOLOGY,
 CASE REPORT (6274)*
 CARCINOGENESIS, GROWTH, REVIEW (2231)*
 CARCINOMA
 OVARY, ENDOMETROID (1967)
 UTERINE CERVIX, HUMAN (4127)*
 CARDIA, PULMONARY CANCER, CASE REPORT
 (4184)*
 CERVICAL LYMPH NODE, HUMAN (3421)*
 CHORIOEPITHELIOMA, BRAIN, HUMAN
 (1200)*
 CHOROID
 BREAST CANCER, LUNG CANCER (4137)*
 CLINICAL STUDY (5578)*
 CHOROID, HUMAN (3527)*
 COLON, CARCINOMA, BLOOD, STREPTO-
 KINASE, HUMAN (0292)*
 CRYPTOGENIC, INCIDENCE, UGANDA (1918)
 DISTRIBUTION, LYMPH NODE, CARCINOMA,
 DIGESTIVE TRACT, RESPIRATORY TRACT,
 HUMAN (4029)
 EHRlich ASCITES TUMOR CELLS, HISTOLOGY
 ULTRASTRUCTURE, EMBRYONATED CHICKEN
 EGG (6285)*
 ENDOCRINE GLANDS, INCIDENCE, DISTRIBU-
 TION, HUMAN (6273)*
 ENHANCEMENT, SARCOMA, L-ASPARAGINASE,
 MOUSE (1069)*
 ESOPHAGUS, CARCINOMA, BREAST, HUMAN
 (2133)*
 EYE
 GASTRIC RETICULUM CELL SARCOMA,
 CASE REPORT (4157)*
 PRIMARY MALIGNANT SKIN MELANOMA,
 CASE REPORTS (6326)*
 FORMATION, HEMATOGENOUS DISSEMINATION,
 EHRlich ASCITES TUMOR CELLS, MOUSE
 (5502)*
 GASTRIC CARCINOMA, HYPERNEPHROID
 CANCER, KIDNEY, CASE REPORT (3554)*
 GROWTH RATE, SYSTEMIC RELATIONSHIP,
 MOUSE (2855)
 HAND FINGER, GRAWITZ TUMOR, CASE
 REPORT (4252)*
 HEPATIC
 ANOMALOUS SERUM PROTEIN, HUMAN
 (0473)
 REGRESSION, HUMAN (2162)*
 HUMAN TUMOR IMPLANTS, THYMECTOMIZED
 HAMSTERS (4733)*
 IMMUNOSELECTION, CONCOMITANT TUMOR

*INDICATES A PLAIN CITATION WITHOUT ACCOMPANYING ABSTRACT

IMMUNITY, MAMMARY FIBROSARCOMA, RAT (0757)
 INHIBITION
 INTERFERON, BROWN-PIERCE CARCINOMA RABBIT (1164)*
 TRITON WR 1339, MOUSE (2361)
 KIDNEY, REVIEW (2289)*
 LARYNX TUMOR, PATHOLOGY, HUMAN (4296)*
 LIP CANCER, CLINICAL STUDY (6311)*
 LIVER, ANGIOGRAPHY, HISTOLOGY (4256)*
 LIVER NEOPLASMS, VIRAL HEPATITIS, REVIEW (1528)*
 LIVER TUMOR, WALKER 256, GLYCOGEN, RAT (0253)
 LUNG
 ASCITES HEPATOMA, PROTEASE, RAT (1142)*
 THYROID ADENOCARCINOMA, AUTOPSY STUDY, HUMAN (4987)*
 VOLUME, IRRADIATION DAMAGE, REPAIR HUMAN (3725)
 LYMPH NODE, SARCOMA TRANSFER, MOUSE (0895)*
 LYMPHANGITIC SPREAD, LUNG (1474)*
 LYMPHATIC SPREAD OF CANCER CELLS, REVIEW (4081)*
 LYMPHOGRAPHY, RAT (0254)
 METASTASIS - CONTINUED
 MALIGNANT LYMPHOSARCOMA, TEMPORAL BONE HUMAN (3542)*
 MALIGNANT MELANOMA, BONE, HUMAN (3490)*
 MALIGNANT NEAVI, BONE, HUMAN (2053)*
 MAMMARY CARCINOMA (2036)*, (2119)*
 CHROMOPHOBE ADENOMA HYPOPHYSIS, HUMAN (3436)*
 SURVIVAL, HUMAN (6358)*
 MANDIBULAR AMELOBLASTOMA, LUNGS, LYMPH NODES, CASE REPORT (3522)*
 MECHANISMS OF ESTABLISHMENT, REVIEW (2908)
 MELANOMA, PATHOLOGICAL ANATOMY, HUMAN (4163)*
 NECK, HUMAN (2160)*
 NEOPLASM, BONE, SCAN, HUMAN (2071)*
 NEUROBLASTOMA, MANDIBLE, CASE REPORT (3419)*
 OPTIC DISC, LUNG CANCER, HUMAN (6176)*
 ORGAN DISTRIBUTION, INCIDENCE, HAMSTER (2192)*
 OSTEOLASTIC, SMALL-CELL (OAT-CELL) CARCINOMA, LUNG, CASE REPORT (4888)*
 OSTEOLYTIC, PRIMARY CANCER OF THE PROSTATE, HUMAN (4136)*
 OTORHINOLARYNGOLOGY, INCIDENCE, HUMAN (4135)*
 OVARIAN CARCINOMA, HISTOPATHOLOGY, HUMAN (6263)*
 OVARY
 BONE, PITUITARY TUMOR, TRANS-PLANTATION, RAT (0998)*
 HUMAN (2187)*
 PENILE CANCER, CASE REPORT (5674)*
 PERITONEAL, CERVIX, REVIEW (1524)*
 PLURONIC-F68, RAT (2356)
 PRIMARY BRONCHOGENIC CARCINOMA, CASE REPORT (4887)*
 PULMONARY
 GROWTH RATE, HUMAN (2842)
 INHIBITION, DEXTRAN SULFATE, RAT (5523)*
 RHINOPHARYNX TUMORS, CASE REPORTS (5589)*
 RADIATION, SARCOMA, RAT (6336)*
 RECTAL CANCER, VENOUS WALL CHANGES, LIVER, CLINICAL STUDY (6150)*
 RENAL ADENOCARCINOMA, HUMAN (2899)*
 RETICULUM CELL, SARCOMA, TRANSPLANT, HUMAN (2113)*
 SALIVARY GLAND TUMOR, MUCOEPIDERMOID TUMOR, HUMAN (0568)*
 SARCOMA
 ITERATED PASSAGING, RAT (4293)*
 RADIATION, RAT (0523)*
 RETICULUM CELL, SPLEEN, MICE (1981)
 SELECTIVE, RETICULAR SYSTEM TUMOR, REVIEW (5017)
 SERUM ENZYME PATTERN, LIVER, AH109A-BEARING RATS (6361)*
 SKIN
 HUMAN (2862)
 PRIMARY, GASTROINTESTINAL, TUMOR, HUMAN (2122)*
 SOFT TISSUE, BREAST CANCER, GROWTH RATE (3980)*
 SQUAMOUS CELL CARCINOMA, LIP, CASE REPORT (6296)*
 STIMULATION, SUPPRESSION, SYNGENEIC TUMOR CELLS, MOUSE (4074)*
 STOMACH, HUMAN (2479)*
 SUBCUTANEOUS SACROCOCCYGEAL EPENDYMOMA ULTRASTRUCTURE, CASE REPORT (5628)*
 TESTES, HISTOPATHOLOGY, HUMAN (6235)*
 TRANSPLANTABLE TUMOR, MODEL, SYRIAN HAMSTER (0054)
 TRAUMA, LARYNX, HUMAN (2161)*
 TUMOR
 ASPIRIN, RABBIT (6310)*
 CARDIAC LYMPH INVOLVEMENT, HUMAN (3388)*
 OXYGEN, MICE (2185)*
 TUMOR CELL SPREAD, BIOPSY HAZARD (1148)*
 TUMOR TRANSPLANTATION, SARCOMA, MOUSE (0841)
 VASCULAR SYSTEM, NEOPLASTIC CELLS, MASTOMYS STOMACH (3985)
 VESTIBULAR LARYNX CANCER, HUMAN (3552)*
 METHEMOGLOBIN
 AMINOAZO DYES-INDUCED, RAT (5195)*
 METHIONINE
 DEPRIVATION, SV40-TRANSFORMED CELL, DNA SYNTHESIS, MOUSE (1349)
 ETHIONINE, LIVER CELL, NUCLEOLI, GUINEA PIG, TOXICITY (0363)
 PROTEIN METHYLATION,
 DIMETHYLNITROSAMINE, NUCLEUS, RAT (0966)
 PROTEIN SYNTHESIS, NORMAL CELLS, TUMOR CELLS, RAT (5583)*
 METHOTREXATE
 CARCINOGENIC ACTIVITY, MOUSE (3662)
 L5178Y MOUSE LEUKEMIA, RESISTANCE (4168)*
 METHOXYAMINE
 HYDROXYLAMINE, MUTAGENESIS, CHEMICAL BASIS (2449)*
 N-METHYL-4-AMINOAZOBENZENE
 MUTAGENICITY, CARCINOGENICITY, FRUIT FLY (5164)
 METHYLATION
 DNA, CHRONIC GRANULOCYTIC LEUKEMIA, HUMAN (4036)
 NUCLEAR AND CYTOPLASMIC RNA,
 DIMETHYLNITROSAMINE-3H, LIVER, MOUSE (2322)

TRANSFER RNA
 ASCITES HEPATOMAS, MOUSE (4003)
 KIDNEY TUMOR, RAT (4002)
 TRANSFER RNA, E.COLI-SPECIFIC, NORMAL
 LIVER AND PLASMACYTOMA, MOUSE
 (5637)*
 METHYLAZOXYMETHANOL
 PROTEIN SYNTHESIS, DRUG METABOLISM,
 LIVER (1280)*
 METHYLAZOXYMETHANOL ACETATE
 ACTIVATION, PHYSOSTIGMINE, SERUM
 FACTOR, HELA CELLS (4411)
 TUMORIGENESIS, RNA SYNTHESIS INHIBI-
 TION, LIVER, RAT (5128)
 7-METHYLBENZ(A)ANTHRACENE
 EPOXIDES, FRAMESHIFT MUTAGEN,
 SALMONELLA (2984)
 2-METHYL-P-BENZOQUINONE
 CARCINOGENICITY, RAT (0377)*
 N-METHYLBENZYLAMINE
 SODIUM NITRITE, ESOPHAGEAL TUMOR, RAT
 (1608)*
 1-METHYL-2-BENZYLHYDRAZINE
 CHROMOSOME BREAKAGE, CANCER CELLS,
 MOUSE (5824)*
 METHYLCHOLANTHRENE
 BINDING AND DISTRIBUTION, LIVER, RAT
 (2953)
 CARCINOGENESIS, LYMPH NODE LYMPHOCYTES
 DNA CONTENT, MOUSE (5785)
 ENDOMETRIAL CARCINOMA, ULTRASTRUCTURE,
 HISTOLOGY, MOUSE, RAT (1632)*
 ESTRADIOL, BENZOATE, CERVICAL CARCINO-
 GENESIS, MONKEY (0095)*
 FIBROSARCOMA
 GROWTH, MYCOBACTERIUM BOVIS,
 NEURAMINIDASE-TREATED CELLS,
 COMPARATIVE EFFECT, MOUSE (4682)
 IRRADIATION, IMMUNE STATUS, MOUSE
 (4686)
 INDUCED STOMACH TUMORS, FACTORS
 DETERMINING TUMOR SITES, RAT (3661)
 INDUCED TUMOR, CELL-MEDIATED IMMUNE
 RESISTANCE, RAT (3868)
 LIPOSARCOMA INDUCTION, TUMOR-SPECIFIC
 ANTIGEN, GUINEA PIG (3838)
 MOLONEY SARCOMA, ADSORPTION, ELUTION,
 ANTIBODY (0453)
 MOROXYDINE, LATENT VIRUS,
 CARCINOGENESIS, MOUSE (0353)
 NEOPLASMS, GUINEA PIGS (2394)*
 ONCOGENIC EFFECT, IMMUNODEPRESSED MICE
 (2622)
 SARCOMA, ANTITUMOR ACTIVITY, LYMPH
 NODES, MOUSE (1826)
 SARCOMA, HOST IMMUNITY, GUINEA PIG
 (4703)
 SENSITIZATION, TRACE ELEMENT LEVELS,
 KIDNEY TISSUES, MOUSE (5809)
 THYROID TUMOR, INDUCTION, C-CELLS,
 RAT (5090)
 THYROIDITIS, AUTOIMMUNITY, RAT (1815)
 TUMOR GROWTH, IMMUNE RESPONSE, SPLEEN
 SIZE, RAT (3911)*
 VACCINIA VIRUS, NEOPLASTIC EFFECT,
 GENETIC FACTOR, MOUSE (1319)
 VIRUS, HUMAN TUMORS, MOUSE, TUMOR-
 SPECIFIC ANTIGENS, BLOCKING ANTIBODY
 (0460)
 3-METHYLCHOLANTHRENE
 AKR LEUKEMIA VIRUS, INFECTED CELL,
 TRANSFORMATION, MOUSE (2315)
 ARYL HYDROCARBON HYDROXYLASE, PHYTO-
 HEMAGGLUTININ, LEUKOCYTE, HUMAN

(5121)
 BENZO(A)PYRENE
 DIMETHYLBENZANTHRACENE NUCLEIC
 ACIDS, CARCINOGENIC HYDROCARBON
 MECHANISM, MOLECULAR
 CHARACTERISTICS (0639)
 TRANSPLACENTAL ACTION, MOUSE
 (0649)*
 BENZO(A)PYRENE FIXATION, DNA, RAT
 (5130)
 BILIRUBIN GLUCURONIDATION, LIVER
 (1279)*
 BINDING, CORTICOSTEROID BINDER, LIVER
 CYTOSOL, RAT (1264)
 BIOCHEMICAL STUDY, PASSAGE THROUGH
 PLACENTA, MOUSE (3658)
 BLOCKING AGENT, HEPATIC NECROSIS,
 BROMOBENZENE, CARBON TETRACHLORIDE-
 INDUCED (2369)*
 BRAIN TUMOR, RADIOACTIVE TRACER,
 EXTRACELLULAR SPACE, INCORPORATION,
 MOUSE (0061)
 BRONCHIAL HYPERPLASIA, ULTRASTRUCTURE,
 KERATIN, RAT (0063)
 CANTHARIDIN, ASIATICOSIDE, SKIN,
 RETICULOSES, MOUSE (4391)
 CARBON TETRACHLORIDE, LIVER, CIRRHOSIS
 RAT (0064)
 CARCINOGENESIS, EPIDERMAL TRANS-
 PLANTATION, STROMAL PERMUTATION
 HYPOTHESIS, MOUSE (5802)
 CARCINOGENESIS, SQUAMOUS CELL
 CARCINOMA, LUNG, RAT (4404)
 CERVICAL SQUAMOUS CARCINOMA, ORIGIN,
 MOUSE (0060)
 CLONAL CELLS, ANTIGENICITY, MOUSE
 (4401)
 CONTACT SENSITIVITY INDUCTION,
 TOLERANCE, GUINEA PIG (2937)
 DECIDUOMATA MAINTENANCE MECHANISM,
 PROGESTIN SECRETION, RAT (3006)
 DERIVATIVES
 BENZO(A)PYRENE HYDROXYLASE, LIVER,
 FETAL RAT (1580)
 IRRADIATION (1295)*
 DIET, LIVER, NUCLEIC ACID, 2-ACETYL-
 AMINOFLUORENE BINDING, RAT (1283)*
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 BENZO(A)PYRENE, TERATOGENESIS, TOAD
 (0067)
 DNA-BINDING, RNA-BINDING,
 2-ACETYLAMINOFLUORENE, LIVER, RAT
 (2941)
 DRUG OXIDATION, CONJUGATION, TISSUES,
 RAT (5832)*
 ENDOPLASMIC RETICULUM, PROTEIN, RAT
 (1579)
 EPIDERMIS, CARCINOMA, ANTIGENS, MOUSE
 (5361)
 ESTROGEN BINDING, UTERUS (5771)
 EXCRETION, CONVERSION, INTESTINAL
 TRACT, MOUSE (2370)*
 FIBROSARCOMA, CELL LINE ESTABLISHMENT,
 RAT (4465)*
 FIBROSARCOMA, NEURAMINIDASE EFFECT,
 GROWTH, RAT (2968)
 FISSION NEUTRON IRRADIATION, MAMMARY
 CARCINOGENESIS, RAT (2317)
 GLIOSARCOMA, BRAIN, HISTOLOGY, MOUSE
 (0065)
 GLUCURONYL TRANSFERASE, LIVER
 MICROSOME, GUINEA PIG, RAT (0963)
 HEPATOMA, SARCOMA, EMBRYONIC ANTIGEN,
 RAT (5332)

HUMORAL IMMUNE RESPONSE, MOUSE (4363)
 INDUCED VIRUS PRODUCTION, TRANSFORMED
 CELL LINE, HAMSTER (5271)
 KIDNEY CELL, TRANSFORMATION, MOUSE
 (1582)
 KIDNEY TUMOR, RAT (5183)
 LEUKEMIA AND SARCOMA DEVELOPMENT,
 AGE FACTOR, MOUSE (5149)
 LEUKEMIA INDUCTION, X-IRRADIATION, RAT
 (0068)
 LIVER, ENDOPLASMIC RETICULUM,
 PROLIFERATION, ULTRASTRUCTURE, RAT
 (1655)*
 LIVER MICROSOMAL AZOREDUCTASE,
 2,4-DICHLORO-6-PHENOXYETHYLAMINE,
 BETA-DIETHYLAMINOETHYL DIPHENYL-
 PROPYLACETATE, RAT (1627)*
 LUNG CANCER, RABBIT (3696)
 LUNG TISSUE, VITAMIN A, MOUSE (4425)
 MAMMARY NODULE TREATMENT, SERIAL TUMOR
 TRANSPLANTATION, MOUSE (3004)
 PAPILLOMA
 ALLOGRAFT SURVIVAL, MOUSE (0459)
 NONIMMUNE REGRESSION, MOUSE (1381)
 METHYLCHOLANTHRENE - CONTINUED
 PERIPHERAL NERVE, MALIGNANT TUMOR, RAT
 (0380)*
 PRETREATMENT, 7,12-DIMETHYLBENZ(A)-
 ANTHRACENE, METABOLISM, DIGESTIVE
 TRACT, RAT (1570)
 RAUSCHER MURINE LEUKEMIA VIRUS,
 TRANSFORMATION, RAT (3713)
 RESPIRATORY TRACT, SQUAMOUS CELL
 CARCINOMA, MOUSE (1265)
 RHABDOMYOSARCOMA, KARYOLOGY, RAT
 (5112)
 SARCOMA, CARCINOGENESIS INHIBITION,
 VACCINE, VIRUS, MOUSE (2964)
 SARCOMA GROWTH, PREDNISONE (1604)*
 SCHMIDT-RUPPIN ROUS SARCOMA VIRUS,
 TRANSFORMATION, HUMAN CELL (0691)
 SKIN CARCINOMA, IMMUNOSUPPRESSION,
 MOUSE (1388)
 SV40, TRANSFORMATION INHIBITION, MOUSE
 (4504)
 TOXICITY, EPIDERMAL CELL, HUMAN (0964)
 TRANSFORMED CELL, CLONE, MALIGNANCY
 DECREASE, MOUSE (2316)
 TRANSPLACENTAL CARCINOGENESIS, MOUSE
 (0962)
 TRANSPLACENTAL SENSITIZATION,
 THYMECTOMY, RAT (5831)*
 TUMOR
 RNA C-TYPE VIRUS
 ANTIGEN EXPRESSION, MOUSE (2500)
 ISOLATION, HAMSTER (1581)
 TUMOR CELL, TUMOR-SPECIFIC IMMUNITY,
 MOUSE (0854)
 TUMOR INDUCTION, PRESENCE OF C-TYPE
 GROUP-SPECIFIC ANTIGEN, MOUSE (3848)
 TUMOR REGRESSION, NEURAMINIDASE,
 BACILLUS CALMETTE-GUERIN, MOUSE
 (3199)
 TUMOR-SPECIFIC ANTIGEN INDUCTION,
 CELLS, MOUSE (5353)
 TUMORIGENESIS, INHIBITION,
 POLYINOSINIC-POLYCYTIDYLIC ACID,
 MOUSE (0066)
 URIDINE DIPHOSPHATE GLUCURONYLTRANS-
 FERASE, LIVER, RAT, GUINEA PIG
 (0671)
 UTERINE CERVIX, ESTROGEN, MOUSE (4370)
 VACCINIA VIRUS, COMBINED CARCINO-
 GENICITY, GENETIC FACTOR, MOUSE
 (3121)
 VACCINIA VIRUS, SKIN TUMORIGENESIS,
 MOUSE (2486)
 20-METHYLCHOLANTHRENE
 BRAIN TUMORS, MOUSE (5849)*
 CARCINOGENESIS, ADRENAL CORTEX FUNC-
 TION, VITAMIN B12, MOUSE (5185)*
 TUMOR CELLS, TRANSFORMATION, POLYOMA
 VIRUS, HAMSTER (5819)*
 TUMORIGENESIS, PERSISTENT ESTRUS,
 ESTROGEN DEFICIENCY, RAT (2943)
 1-METHYLCYTOSINE
 BENZO(A)PYRENE, PHOTOCHEMICAL
 COUPLING, PHOTOENHANCEMENT OF
 CARCINOGENICITY (3025)*
 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE
 ALPHA-FETOPROTEIN, HEPATOCARCINOGENE-
 SIS, RAT (5098)
 AMINO AZO DYE, BINDING PROTEIN, LIVER,
 RAT (1256)
 AMP DEAMINASE, BINDING, LIVER, RAT
 (3710)
 CARCINOGENESIS, ACID PHOSPHATASE
 CHANGE, LIVER, RAT (3714)
 CARCINOMA, LIVER, AGE, SEX, RAT
 (2967)
 DIET, LEUCINE INCORPORATION, RAT
 (1559)
 DNA REPAIR SYNTHESIS, LIVER, RAT
 (2979)
 ENZYME INHIBITION, LIVER RAT (2299)
 HEPATOCARCINOGENESIS, HYPOPHYSECTOMY,
 HISTOPATHOLOGICAL STUDY, RAT (4361)
 LIVER
 CELL PROLIFERATION, RAT (0347)
 DNA SYNTHESIS, RAT (1560)
 PROTEIN DISTRIBUTION, RAT (5100)
 PYRUVATE KINASE ISOZYME, RAT
 (1562)
 LIVER CARCINOGENESIS
 ALPHA-FETOPROTEIN, RAT (4626)
 CELL POPULATION, RAT (2300)
 LIVER CARCINOMA, ULTRASTRUCTURE, RAT
 (3695)
 LIVER-PROTEIN CONJUGATE, RAT (5102)
 PROTEIN DETECTION, LIVER, RAT (5807)
 7-METHYL GUANINE
 URINARY EXCRETION, CHEMICAL CARCINOGEN
 ADMINISTRATION, RAT (5076)
 METHYLHYDRAZINE SULFATE
 LUNG TUMORIGENESIS, MOUSE (3692)
 METHYL MALVALATE
 TUMOR PROMOTION, AFLATOXIN, HEPATOMA,
 TROUT (0376)*
 METHYL METHANE SULFONATE
 DNA METHYLATION OF GUANINE,
 ALKYLATING MUTAGENS (4480)*
 HEPATIC GLYCOGEN LEVEL, RAT (1646)*
 RNA METHYLATION, LIVER, RAT (5122)
 SINGLE STRAND DNA BREAKS, NITROSO-
 GUANIDINE, HAEMOPHILUS INFLUENZAE
 (1540)
 TUMORIGENESIS, LUNG, MOUSE (0658)*
 3-METHYL-4-METHYLAMINO BENZENE N-DEMETHYLAS
 ALTERATIONS, RAT (2302)
 1-METHYL-3-NITRO-1-NITROSOGUANIDINE
 DECOMPOSITION, EFFECTS OF CYSTEINE
 (2368)*
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
 COLON, RECTUM, CARCINOMA, RAT (0949)
 DERIVATIVES, MUTAGENESIS, HAMSTER
 (0630)
 FREE RADICAL CONVERSION, ELECTRON SPIN
 RESONANCE (5094)

- GASTRIC CARCINOMA, HISTOPATHOLOGY, DOG (1293)*
- MALIGNANT TRANSFORMATION, THYMUS CELL, LUNG CELL, RAT (5104)
- MUTAGENESIS, CROWN-GALL TUMOR INDUCTION, AGROBACTERIUM TUMEFACIENS (4421)
- NEOPLASTIC TRANSFORMATION, CLONED CELL LINES, MOUSE (5770)
- STOMACH CARCINOMA INDUCTION, RAT (2355)
- TRANSFORMATION, CHROMOSOME ABERRATION, HAMSTER, CELL (3677)
- 3-METHYL-4-NITROPYRIDINE-1-OXIDE FIBROSARCOMA, MOUSE (1593)
- METHYLENE-BIS-ORTHO-CHLOROANILINE OCCUPATIONAL HAZARD (1543)
- METHYLNITROSOUREA
- ADENOCARCINOMA, SMALL INTESTINE, RABBIT (5767)
- BRAIN TUMOR, HISTOGENESIS, RAT (1409)
- BRONCHIAL ADENOMA, ORGANOTROPISM, MOUSE (1590)
- CELL CYCLE DEPRESSION, DNA SYNTHESIS, MOUSE EMBRYO (2934)
- CENTRAL NERVOUS SYSTEM, GIANT CELL TUMORS, DOG, RAT (5109)
- CYTOTOXICITY, NERVE CELLS, RAT (5078)
- DNA METHYLATION PRODUCTS, MOUSE (0359)
- HEART TUMOR INDUCTION, RAT (5765)
- MALIGNANT TRANSFORMATION, MOUSE EMBRYO (0968)
- NERVOUS SYSTEM TUMOR, RAT (1589)
- NERVOUS SYSTEM TUMORS, TRANSPLACENTAL INDUCTION, RAT (5830)*
- TUMOR INDUCTION, NERVOUS SYSTEM, RAT (5178)
- N-METHYLNITROSOUREA
- BLADDER CANCER INDUCTION, HISTOLOGY, RAT (4431)
- DNA, ALKYLATION SITE, 3-METHYLGUANINE (3674)
- EXTRANEURAL TUMORS, RAT (5118)
- MUTAGEN ACID, ALKYLATION (2971)
- SPINAL CORD, EUPLOID SARCOMA, KARYOTYPE ABERRATION, RAT (1268)
- TUMORS, PERIPHERAL NERVOUS SYSTEM, DOG (5088)
- N-METHYL-N-NITROSOUREA
- BRAIN TUMOR, SPINAL TUMOR, RAT (1592)
- FERTILITY DISORDER, RAT (0978)*
- RETINAL ATROPHY, CATARACT, MOUSE (2421)*
- METHYL STEARATE
- CARCINOGENESIS, ACTIVITY BIOASSAY, MOUSE (2981)
- METHYL STERULATE
- HEPATOMA, LIVER TUMOR, TROUT, AFLATOXIN (0376)*
- METHYLTHIOURACIL
- GOITROGENESIS, ONCOGENESIS, MOUSE (2359)
- IODINE, THYROID TUMOR, HAMSTER (5170)
- THYROID CARCINOGENESIS, HAMSTER (3735)*
- THYROID TUMOR, IODINE UPTAKE, RAT (5087)
- METHYLUREA
- LUNG ADENOMA INDUCTION, NITROSAMIDE FORMATION, MOUSE (2966)
- METRONIDAZOLE
- LUNG TUMOR INDUCTION, MALIGNANT LYMPHOMA, MOUSE (2999)
- MICROSOME
- BLASTOMOGENESIS, THYROID, RAT (5296)
- DRUG METABOLIZING ENZYMES, POLYCYCLIC HYDROCARBONS, PHENOBARBITAL, INDUCTION, REPRESSION, THEORETICAL MODEL (1578)
- LIVER, DRUG METABOLIZING ENZYMES, EFFECT OF HEPATOMA ASCITES FLUID, RAT (3460)*
- MIDDLE EAR
- EPITHELIOMA, PATHOGENESIS, CHILD, CASE REPORT (5408)*
- MIGRATION
- INHIBITION, MACROPHAGE, PLASMACYTOMA, CELL-MEDIATED IMMUNITY, MOUSE (3893)
- MILK
- MAMMARY, VIRUS-LIKE PARTICLE, HUMAN (1693)
- MAMMARY CARCINOMA, 9,10-DIMETHYL-1,2-BENZANTHRACENE, RAT (1284)*
- RNA DETECTION, HIGH-MOLECULAR-WT, HUMAN (3804)
- MINERAL OIL
- CANCER, INCIDENCE, HUMAN (5426)
- CANCER OF THE SCROTUM, NETHERLANDS (3024)*
- MITOCHONDRIA
- N-ACETYL-4-AMINOBIIPHENYL INTERACTION, RAT LIVER (3675)
- ADRENAL CORTICAL CARCINOMA, ULTRA-STRUCTURE, NUCLEI, HAMSTER (5837)*
- BENZO(A)PYRENE, LIVER, RAT (2313)
- CHEMILUMINESCENCE, CARCINOGENIC HYDROCARBONS (5790)
- CRABTREE AND PASTEUR EFFECTS, PHOSPHATE MEDIATION, ENERGY METABOLISM, CARCINOGENESIS, REVIEW (5008)
- DNA, REPLICATION, SV40, HUMAN, MONKEY, RODENT (5894)
- DNA SYNTHESIS, STIMULATION CYTOPLASMIC FACTOR, TUMOR, RAT (4022)
- FUNCTION, N-2-FLUORENYLACETAMIDE, LIVER CARCINOMA, RAT (1415)
- FUNCTION INHIBITORS, ROUS SARCOMA VIRUS REPLICATION, MALIGNANT TRANSFORMATION, CHICK EMBRYO CULTURE (3771)
- HEPATIC, X-RAY, THERAPY, RAT (2156)*
- N-HYDROXY-N-ACETYL-AMINOFLUORENE, ATP, SHOWDOMYCIN, RAT (0933)
- HYPERPLASIA, ONCOCYTOMA, MAN (1480)*
- IONIZING RADIATION, ULTRASTRUCTURE, MOUSE (5872)*
- LIVER, BENZO(A)PYRENE, STEROID HORMONES, RAT (2314)
- PROTEIN, GLYCOPROTEIN SYNTHESIS, MOUSE (5947)*
- RAT LIVER, BENZO(A)PYRENE, PHOTOTOXIC, ANTIOXIDANTS (0352)
- RESPIRATION, ISLET-CELL TUMOR, LIVER, HAMSTER (5640)*
- RIBOSOMES, EHRLICH ASCITES TUMOR CELLS, MOUSE (6371)*
- ROUS SARCOMA VIRUS
- CHICKEN (0127)
- REPLICATION, TUMOR, CHICKEN (0125)
- TISSUE RESPIRATION, LIVER, TUMOR-BEARING RATS (6188)*
- VOLUME CHANGE, ATP, DIBENA(A,H)-ANTHRACENE METABOLITE, LIVER, RAT (3697)
- MITOCHONDRIAL RNA

HELA CELLS (2183)*
 ITOGEN
 ARYL HYDROCARBON HYDROXYLASE
 STIMULATION, HUMAN LYMPHOCYTES
 (4443)
 PLANT, LYMPHOCYTE STIMULATION,
 CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN
 (5811)
 ITOSIS
 ABNORMALITIES, HEPATOCYTE PROLIFERA-
 TION, DIETHYLNITROSAMINE, RAT
 (2384)*
 ATYPICAL, BRAIN TUMORS, HUMAN (5452)
 CELL CYCLE, CARCINOGENESIS, REVIEW
 (1514)
 CELL CYCLE TIME, TUMOR GROWTH,
 RETARDATION (3887)
 CELL REPLACEMENT, CHALONE, SKIN,
 TUMOR, REVIEW (5707)
 CHROMOSOME PULVERIZATION, SENDAI VIRUS
 HAMSTER (0541)
 CHRONIC MYELOCYTIC LEUKEMIA, BLOOD
 (0227)
 EPIDERMIS, BASAL CELL LAYER, MOUSE
 (0266)*
 INDUCED CHROMOSOME REPLICATION,
 T-ANTIGEN, AUTORADIOGRAPHY, MOUSE
 (0434)
 INHIBITION
 EPIDERMIS, BASAL CELL, MOUSE
 (1133)
 KILHAM RAT VIRUS, RAT EMBRYO CELL
 (1702)
 TUMOR GROWTH, ASCITES, MOUSE
 (0831)
 KINETICS, LEUKEMIA, MOUSE (4031)
 LYMPH NODE RESPONSE, LYMPHOMA GRAFT,
 MOUSE (4666)
 MAMMARY GLAND, METABOLIC STATE, RAT
 (5797)
 MITOTIC INDEX, BRONCHOGENIC CARCINOMA,
 HUMAN (1109)*
 MOLONEY LEUKEMIA VIRUS, ANTIGEN, MOUSE
 (0409)
 N-(4-(5-NITRO-2-FURYL)-2 THIAZOLYL)-
 FORMAMIDE, URINARY-BLADDER
 EPITHELIUM, RAT (2360)
 RADIOAUTOGRAHY, SOLID TUMORS (1972)
 REGULATION, CHO CELL LINE, NATURAL
 SYNCHRONIZATION, CANCER THEORY
 (0224)
 TUMOR, CELL CYCLES, HUMAN, REVIEW
 (2216)
 TUMOR CELL, ACTINOMYCIN D, THYROXINE,
 INSULINE, IN VITRO (0231)
 VIRUS-INFECTED CELL, REVIEW (1219)*
 YOSHIDA ASCITES HEPATOMA, RAT (4120)*
 IXED TUMOR
 H10ZE, HAMSTER (2032)*
 ONONUCLEOTIDE
 ACID-SOLUBLE, RRNA, 32P-PHOSPHATE
 INCORPORATION, MYELOID TUMOR, MOUSE
 (5499)*
 ONOSACCHARIDE
 COMPOSITION, PLASMA MEMBRANE, POLYOMA
 VIRUS, FORSMANN ANTIGEN, HAMSTER
 (1044)
 SERUM PROTEIN-BOUND FUCOSE LEVELS,
 GYNECOLOGIC CANCER PATIENTS (5484)*
 ORBIDITY
 CANCER
 ISRAEL (3970)
 TUBERCULIN, SKIN REACTIVITY,
 BULGARIA (6037)*

LEUKEMIA, ENVIRONMENTAL FACTORS,
 POLAND (3977)*
 MORPHOLOGY
 AMELANOTIC MELANOMA, 5-BROMODEOXY-
 URIDINE, IN VITRO (4088)*
 BASALOMA, CAPILLARY STRUCTURE, HUMAN
 (6246)*
 BRONCHIAL CARCINOMA, HUMAN (4285)*
 CARCINOGENIC HYDROCARBON, HAMSTER,
 IN VITRO, TRANSFORMATION (0640)
 CARCINOMA, RENAL PARENCHYMA, HUMAN
 (4143)*
 CENTRAL NERVOUS SYSTEM, SARCOMA, RAT
 (4856)
 CONGENITAL MESOTHELIOMA, ATRIOVENTRI-
 CULAR NODE, CASE REPORT (4075)*
 CYTOLOGICAL CHARACTERIZATION OF
 CANCER, EXUDATES, HUMAN (6244)*
 GASTRIC MUCOSA, GASTRIC CARCINOMA,
 ACID SECRETION, MAN (0189)
 GLIOMA, HISTOCHEMISTRY, MOUSE, IN
 VITRO (4055)*
 HEPATOMA TRANSPLANT, CELL LINES, MODEL
 (4205)*
 HISTOCHEMISTRY, BLADDER TUMOR, HUMAN
 (6245)*
 IMMUNE RESPONSE, BREAST CANCER, REVIEW
 (2211)
 KROMPECHER'S CARCINOMA, INVOLUTIONAL
 ELASTOSIS, HUMAN (4278)*
 LYMPHOSARCOMA, CHRONIC LYMPHOCYTIC
 LEUKEMIA, CASE REPORT (4282)*
 MALIGNANT LYMPHOMA, HISTIOCYTIC TYPE,
 CASE HISTORIES (4052)*
 MALIGNANT MELANOMA, PIGMENTED NEVUS,
 CASE REPORTS (4283)*
 MAMMARY CARCINOMA CELL, SUBLINE,
 IMMUNOSUSCEPTIBILITY, MOUSE (3851)
 MAMMARY GLAND SARCOMA, HISTOGENESIS,
 DOG (4268)*
 MYELOID LEUKEMIA, RABBIT, CASE REPORT
 (4067)*
 NEURINOMA, RETROPERITONEUM, CASE
 REPORT (4261)*
 ODONTOGENIC TUMORS, FISH, MAMMALS
 (4291)*
 POLYNUCLEAR GIANT CELL ENDOTHELIUM,
 VEIN, MALIGNANT TUMORS, HUMAN, RAT
 (4279)*
 SALIVARY GLAND TUMOR, INCIDENCE,
 CHILDREN (4096)*
 SARCOMA, BRAIN, CASE REPORTS (4250)*
 SKIN TUMORS, DIAZO-ACETIC ESTER, RAT,
 MOUSE (5763)
 SPONTANEOUS TUMORS, INCIDENCE, HAMSTER
 (4579)*
 TUMORS, ALKYLATION, NERVOUS SYSTEM,
 ANIMALS (5107)
 UVEAL TRACT MELANOMA, HUMAN (4134)*
 MORTALITY
 ASBESTOS CANCER, INDUSTRY WORKERS,
 U.S.S.R. (6099)*
 CANCER
 AIR POLLUTION, SWITZERLAND
 (6098)*
 ATOMIC BOMB SURVIVOR (1662)
 COMPARISON, BLACK AND WHITE
 POPULATION, UNITED STATES
 (4827)*
 GEOGRAPHIC CLUSTER, UNITED STATES
 (5415)
 ISRAEL (3969)
 JEWISH POPULATIONS, UNITED STATES
 (6075)

- NEW ZEALAND (6087)
 1950-1967, AMERICAN INDIANS (5421)
 1960'S, UNITED STATES, REVIEW
 (5050)*
 NONWHITE, WHITE, UNITED STATES
 (5413)
 NORTH AMERICA, WESTERN EUROPE
 (1917)
 DRINKING WATER, TRACE METAL (4436)
 ENVIRONMENTAL HAZARD, URANIUM,
 LANDFILL, COLORADO (5412)
 GASTRIC CARCINOMA, AGE FACTOR, HUMAN
 (6277)*
 GASTROINTESTINAL TRACT CANCER (0209)
 LEUKEMIA
 BCG VACCINATION, CHICAGO (6007)*
 GERMANY (6092)*
 LUNG CANCER, INCIDENCE, SWEDEN (0813)
 MALIGNANT TUMORS, KAZAN (3976)*
 MELANOMA, SWITZERLAND (6094)*
 OCCUPATION, CANCER, ENGLAND, REVIEW
 (4308)
 REPORTING PROCEDURES, ISRAEL (3967)
 RETINOBLASTOMA, NEGRO CHILDREN, WHITE
 CHILDREN, UNITED STATES (6089)*
 SQUAMOUS CELL CARCINOMA, SKIN, HUMAN
 (6223)*
 STOMACH CARCINOMA AND PANCREATIC
 CARCINOMA, UNITED STATES (3984)*
 MOUTH
 CANCER, TOBACCO, HUMAN (0917)*
 CARCINOMA, CIGARETTE SMOKING, HUMAN
 (1272)
 EPIDERMAL CARCINOMA, HUMAN, REVIEW
 (4327)*
 NEOPLASIA, TOBACCO CHEWING, COAL
 MINER, ENGLAND, REVIEW (1232)*
 ORAL CANDIDOSIS, CARCINOMA, MALIGNANT
 TRANSFORMATION, CASE REPORT (0797)*
 TUMOR, EPITHELIUM, HUMAN ULTRA-
 STRUCTURE (4785)
 MUCIN
 HISTOCHEMISTRY, NORMAL, NEOPLASTIC
 PANCREATIC TISSUE, HUMAN (6316)*
 MUCOPOLYSACCHARIDE
 PANCREATIC CANCER, HUMAN (3488)*
 MUCOSA
 COLONIC, CARCINOSARCOMA IMPLANTATION,
 RAT (5487)*
 GASTRIC, MORPHOLOGY, GASTRIC
 CARCINOMA, ACID SECRETION, MAN
 (0189)
 MUCOSUBSTANCE
 ABNORMAL MUCIN, WILM'S TUMOR,
 PATHOLOGY, CHILDREN (4228)*
 MULTIPLE MYELOMA
 BONE MARROW, CYTOLOGY, IMMUNOLOGY,
 HUMAN (5390)*
 HISTOMETRICAL GLOMERULAR STUDIES,
 KIDNEYS, HUMAN (3453)*
 HYPOSENSITISATION, HUMAN (3520)*
 INCIDENCE, ATLANTA, GEORGIA (6090)*
 KIDNEY STRUCTURE, HUMAN (6234)*
 LEUKEMIA
 MALIGNANT LYMPHOMA, MORTALITY,
 NEW ZEALAND (5411)
 OCCUPATIONAL HAZARD, INCIDENCE,
 FARMER, UNITED STATES (1932)
 LEUKEMIC PLASMA CELLS, ULTRASTRUCTURE,
 CASE REPORT (6346)*
 LEUKOCYTE, CYTOPLASMIC IMMUNO-
 FLUORESCENCE, HUMAN (3856)
 PATTERNS, HUMAN (2198)*
 PROSTATE CARCINOMA, 9S IGG PARAPROTEIN
 HUMAN (3928)*
 MURINE LYMPHOCYTES
 BLASTOGENIC EFFECT, PHYTOHEMAGGLUTININ
 MOUSE (2098)*
 MURINE LYMPHOMA
 DNA, REPLICATING UNIT (4035)
 MURINE TUMOR
 CELLS, SYNTHESIS, L-ASPARAGINE (2047)*
 MUSCLE
 CARCINOGENESIS, NICKEL SULFIDE, HUMAN,
 REVIEW (4348)*
 JENSEN SARCOMA, CHOLINESTERASE, RAT
 (0560)*
 MYOBLASTOMA, ORIGIN, HUMAN (1088)
 ORIGIN, URINARY BLADDER, GRANULAR
 CELL TUMOR, HUMAN (1411)
 RHABDOMYOSARCOMA,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 ULTRASTRUCTURE, HAMSTER (0987)*
 SKELETAL, PRIMARY TUMORS, HUMAN,
 REVIEW (4349)*
 TUMOR, STOMACH, CASE REPORT (1166)*
 MUTAGEN
 1-ALKYL-3-NITRO-1-NITROSOGUANIDINE,
 PROPHAGE INDUCTION (1278)*
 AROMATIC AMINES, 2-ACETYLAMINOFLUORENE
 METABOLITES, SALMONELLA (5787)
 BRACKEN FERN, T4-BACTERIOPHAGE (0937)
 CHEMICAL
 CHROMOSOME ABERRATION, SPERMATO-
 GONIA, MOUSE (1644)*
 DNA, TUMORIGENESIS, HAMSTER CELL
 (0379)*
 CHEMICAL CARCINOGEN, DETECTION,
 BACTERIA, DNA POLYMERASE DEFICIENCY
 (0590)*
 DNA, SPECIFICITY (1634)*
 N-METHYL-4-AMINOAZOBENZENE, CARCINOGEN
 FRUIT FLY (5164)
 NITROSOPIPERAZINES, SALMONELLA
 TYPHIMURIUM, HOST-MEDIATED ASSAY,
 MOUSE (4381)
 UV-RADIATION, ALKYLATING AGENTS,
 SYNERGISTIC EFFECT, E.COLI (2456)
 MUTAGENESIS
 AFLATOXIN, NEUROSPORA CRASSA (0044)
 CYCLOHEXYLAMINE, CYCLAMATE, MOUSE
 (0344)
 DIMETHYL SULPHATE,
 N-METHYL-N-NITROSOUREA, NUCLEIC
 ACID, ALKYLATION (2971)
 HYDROXYLAMINE, METHOXYAMINE, CHEMICAL
 BASIS (2449)*
 LYMPHO BLASTS, PHOSPHORIBOSYLTRANS-
 FERASE LOCUS, HUMAN (2448)*
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE,
 DERIVATIVES, HAMSTER (0630)
 N-NITROSOMORPHOLINE, HOST MEDIATION,
 SALMONELLA TYPHIMURIUM (0636)
 MUTAGENICITY
 N-ACETYL-2-AMINOFLUORENE, MOLECULAR
 PROPERTIES, CARCINOGENESIS,
 DROSOPHILA (2340)
 N-ALKYL-N'-NITRO-N-NITROSOGUANIDINES,
 HIGHER PLANTS (1642)*
 ASSAY SYSTEM, THYMIDINE KINASE LOCUS,
 LYMPHOMA CELLS, MOUSE (5871)*
 CHEMICAL CARCINOGEN
 NEUROSPORA CRASSA (4468)*
 RNA-FORMING GENE, DROSOPHILA
 (5780)
 10-DIMETHYL-1,2-BENZANTHRACENE,
 BENZO(A)PYRENE, DNA LINKAGE (1572)
 DIMETHYLNITROSAMINE

DIETHYLNITROSAMINE, HYDROXYLATION SYSTEM, SACCHAROMYCES (2325)
METABOLIC PRODUCT, LIVER ENZYME, MOUSE (1584)
DRUG TESTING (1619)*
FRAMESHIFT MUTAGENS, CARCINOGENIC POLYCYCLIC HYDROCARBONS, EPOXIDES, SALMONELLA (2984)
4-NITROQUINOLINE-1-OXIDE, BACTERIOPHAGE (1595)
N-NITROSO COMPOUNDS, HOST MEDIATED ACTIVITY, MOUSE (2410)*
PHENTHYL NITROGEN MUSTARD, ETHYLENE-IMINOPYRIMIDINE, ASPERGILLUS NIDULAN (1653)*
1-PHENYL-3,3-DIMETHYLTRIAZENE, 1-PHENYL-3-MONO-METHYLTRIAZENE, NEUROSPORA CRASSA (2401)*
TEST EVALUATIONS, TOXICOLOGICAL TRIALS, MAMMALS (2409)*

TANT
ADENOVIRUS, RECOMBINATION, HAMSTER CELL (3820)
POLYOMA VIRUS, REVIEW (5026)
ROUS SARCOMA VIRUS, REVIEW (5003)
TEMPERATURE-SENSITIVE, HERPES SIMPLEX VIRUS, GLYCOPROTEIN SYNTHESIS DEFECT (1360)*

TATION
CANCER PATHOGENESIS, REVIEW (0925)*
IMMUNITY, NEOPLASM, CHEMOTHERAPY, REVIEW (1522)*
IMMUNOGLOBULIN PRODUCTION, MYELOMA, MOUSE (0180)*
LIVER TUMORIGENESIS, NEUTRON IRRADIATION, MOUSE (3732)
MAMMALIAN CELLS, N-ACETOXY-N-2-FLUORENYLACETAMIDE (3646)
N-METHYL-N'-NITRO-N-NITROSOGUANIDINE, CROWN-GALL TUMOR INDUCTION, AGROBACTERIUM TUMEFACIENS (4421)
4-NITROQUINOLINE-1-OXIDE, 4-HYDROXYAMINOQUINOLINE-1-OXIDE, NEUROSPORA CRASSA (2445)*
NITROSAMIDE-INDUCED, PH, TEMPERATURE, E. COLI (2451)*
NITROSOGUANIDINE-INDUCED, TRANSFORMATION, HAEMOPHILUS INFLUENZAE (3657)
PURPLE ADENINE MUTANTS, DIETHYLNITROSAMINE-INDUCED, GENETIC CHARACTERIZATION, NEUROSPORA CRASSA (4483)*
RETINOBLASTOMA, HUMAN (0528)*
ROUS SARCOMA VIRUS, ADENOSINE 3',5'-MONOPHOSPHATE, TRANSFORMATION CONTROL (1737)
SUPPRESSOR, 4-NITROQUINOLINE 1-OXIDE, 4-HYDROXYAMINOQUINOLINE 1-OXIDE, E. COLI (4482)*
SV40 TEMPERATURE SENSITIVE MUTANT, TRANSFORMATION, T ANTIGEN SYNTHESIS, MOUSE (4526)
TEMPERATURE-SENSITIVE, SV40, MONKEY CELL (4542)
TEMPERATURE-SENSITIVE EXPRESSION, CELL TRANSFORMATION, SV40, MOUSE (3055)
TEMPERATURE-SENSITIVE MUTANT, KIRSTEN MURINE SARCOMA VIRUS, MOUSE (4535)
TEMPERATURE-SENSITIVITY, MURINE SARCOMA VIRUS, ISOLATION (5232)

ASTHENIA GRAVIS
THYECTOMY, TUMOR INCIDENCE, HUMAN (3189)

MYCOBACTERIUM BOVIS
BACILLUS CALMETTE-GUERIN, CELL WALL, OIL DROPLET, TUMOR SUPPRESSION, HEPATOMA, GUINEA PIG (3877)
VACCINE, HEPATOCELLULAR CARCINOMA, IMMUNITY, GUINEA PIG (4655)
MYCOBACTERIUM BUTYRICUM
TRANSPLANTATION IMMUNITY, ENHANCEMENT & MOUSE (3904)
MYCOPLASMA
NEOPLASM, HUMAN (2857)
MYCOTOXIN
AFLATOXIN B, OXYGEN, PROTOZOANS (0373)*
KIDNEY, LIVER, LUNG, CYTOMORPHOLOGICAL CHANGE, RAT (1282)*
LUTEOSKYRIN, CYCLOCHLOROTINE, LIVER TOXICITY, HEPATOMA, RICE, MOUSE (2354)
NEOPLASIA, ETIOLOGY, ANIMALS, MAN (4446)
ONCOGENESIS, BLOOD DISEASE (1539)
MYELOBLASTOMA
GRANULAR CELL, CASE REPORT (5548)*
MYELOCYTES
CELL PROLIFERATION, HUMAN (1975)
MYELOID
TUMOR (GRAFFI)
ACID-SOLUBLE NUCLEOTIDES, CONCENTRATION AND SYNTHESIS, LIVER, MOUSE (5500)*
32P-PHOSPHATE INCORPORATION, ACID-SOLUBLE AND RNA MONO-NUCLEOTIDES, MOUSE (5499)*
MYELOID LEUKEMIA
CRISIS, HUMAN (2143)*
GAUCHER CELLS, ULTRASTRUCTURE, CYTOCHEMISTRY (6139)*
MYELOMA
ANTIBODY, PLAQUE FORMATION, SPLEEN, MOUSE (4704)
ASCITES, IMMUNOGLOBULIN SYNTHESIS, ZONAL CENTRIFUGATION, MOUSE (6343)*
BETA 1 A/C CONCENTRATION, SERUM, HUMAN (5354)
CELL
CULTURE CHARACTERISTICS, HUMAN (0230)
EGG SUBCLASS ASSEMBLY, MOUSE (1806)
IGE, SYNTHESIS, SECRETION, HUMAN (1809)
IGG-SPECIFIC RNA, MOUSE (4709)*
INTRANUCLEAR INCLUSION BODIES, ULTRASTRUCTURE, HUMAN (4740)*
CELL LINE, GROSS VIRUS, MURINE LEUKEMIA VIRUS, ANTIGENS, HISTOCOMPATIBILITY ANTIGENS, MOUSE (4615)
CHROMOSOME ABERRATION, HUMAN, CASE REPORT (0919)*
CRYOGLOBULIN, CRYSTAL, HUMAN (0170)*
CULTURED CELLS, GROWTH CHARACTERISTICS, MOUSE (3498)*
GAMMA A PROTEIN, STRUCTURE, HUMAN (0771)*
GROWTH, AUTOMATIC MONITORING, TISSUE CULTURE CELLS, MOUSE (5550)*
IGA, PROTEIN, STRUCTURAL CHARACTERISTICS, MOUSE (1866)*
IGA IMMUNOGLOBULIN, CASE REPORT (0778)*
IGA PRECIPITATION (2046)*
IGA PROTEIN, PLASMA CELL TUMOR, MOUSE

(5314)
 IGE, PROTEIN, HUMAN (0748)
 IGE SYNTHESIS, TUMOR CELL NUMBER,
 DNA SYNTHESIS, HUMAN (0516)
 IMMUNOCYTOLOGY, GROWTH REQUIREMENT,
 PHAGOCYTIC CELL FACTOR, MOUSE (5302)
 IMMUNOGLOBULIN A, INTERCHAIN DISULFIDE
 BOND FORMATION, MOUSE (5374)*
 IMMUNOGLOBULIN BIOSYNTHESIS, MOUSE
 (0783)*
 IMMUNOGLOBULIN-PRODUCING, CYTOPLASMIC
 RNA (4247)*
 IMMUNOGLOBULIN SECRETION, HEAVY CHAIN
 IGA VARIANT, MOUSE (6023)*
 IMMUNOGLOBULINS
 KAHLER'S DISEASE, REVIEW (2233)*
 MUTATION, MOUSE (0180)*
 IMMUNOLOGICAL ASPECTS (0489)*
 LIGHT CHAIN SYNTHESIS, MRNA,
 PROPERTIES (3845)
 LONG TERM CELL CULTURE, MORPHOLOGIC
 AND FUNCTIONAL CHARACTERISTICS,
 MOUSE (4951)*
 MALIGNANT DYSGAMMAGLOBULINEMIA, REVIEW
 (1222)*
 MULTIPLE
 ANTI-IMMUNOGLOBULINS, HUMAN
 (4776)*
 BONE MARROW, CYTOLOGY, IMMUNOLOGY,
 HUMAN (5390)*
 CHROMOSOMES, ABNORMALITIES, HUMAN
 (2730)*
 ELECTRON MICROSCOPY, PLASMA CELL
 LEUKEMIA (0597)*
 HODGKIN'S DISEASE, HL-A ANTIGEN,
 ANALYSIS (3222)*
 HYPOSENSITISATION, HUMAN (3520)*
 INCIDENCE, ATLANTA, GEORGIA
 (6090)*
 LEUKEMIC PLASMA CELLS, ULTRA-
 STRUCTURE, CASE REPORT (6346)*
 LYMPHOGRANULOMATOSIS, HL-A ANTIGEN
 CLINICAL STUDY (6040)*
 MURINE VIRUS ANTIGEN, CELLULAR
 ANTIGEN, LEUKEMIA CELL, MOUSE (4555)
 POLYPEPTIDE CHAINS, DETECTION, HUMAN
 (2090)*
 POLYRIBOSOME DISAGGREGATION, PROTEIN
 SYNTHESIS, MOUSE (4238)*
 PROTEIN
 GAMMA G IMMUNOGLOBULIN, CATA-
 BOLISM, HUMAN, MONKEY (4699)
 IGG, ANTIBODY SPECIFICITY, HUMAN
 (1838)
 IMMUNE REACTION, CELL SURFACE,
 MOUSE (4702)
 IMMUNOGLOBULIN IGG, SPECIFIC
 ANTIGENIC DETERMINANT, HUMAN
 (2611)
 LIGAND BINDING SITES, AUTO-IMMUNE-
 LIKE ANTIBODIES, MOUSE (3158)
 MERCURY DERIVATIVES, HUMAN (2810)
 PHOSPHORYLCHOLINE, AFFINITY,
 LABELING, MOUSE (1870)*
 TUMOR-SPECIFIC TRANSPLANTATION
 ANTIGEN, MOUSE (4677)
 PROTEIN LABELING, 2,4-DINITROPHENYL,
 MOUSE (0665)*
 RIBOSOME, DISSOCIATION, MOUSE (0860)*
 RNA METABOLISM, MOUSE (1121)
 RNA POLYMERASE B, TEMPLATE SPECIFICITY
 MOUSE (6120)
 SERUM, ANTIBODY ACTIVITY, HUMAN
 (0784)*
 SERUM LACTIC DEHYDROGENASE, LEUKEMIA,
 ANEMIA, HUMAN (1191)*
 TRANSFER RNA, AMINOACYL PROFILE, HUMAN
 (0543)
 TUMOR, IMMUNITY, BALB/C MICE (4751)*
 ULTRASTRUCTURE, IRRADIATION, HUMAN
 (2028)*
 MYELOPROLIFERATIVE DISEASE
 CYTOGENETICS, BONE MARROW, SIDEROBLAS-
 TIC ANEMIA, CASE REPORT (4241)*
 LEUKEMIA, SERUM MURAMIDASE, CASE
 REPORTS (3233)
 MONOCYTIC LEUKEMIA, MYELOID LEUKEMIA,
 CHILDREN, CASE REPORT (4176)*
 PLATELET AGGREGATION, PLASMA, HUMAN
 (4242)*
 PRE-LEUKEMIC STATE, CHILDHOOD, MISSING
 BONE MARROW C CHROMOSOME, CASE
 REPORT (3232)
 MYELOPROLIFERATIVE DISORDER
 HEMATOLOGY, SERUM LYSOZYME, B12,
 BINDING CAPACITY (1966)
 PLATELET FUNCTION ABNORMALITIES,
 CLINICAL STUDY (6299)*
 PLATELET KINETICS, FIBRINOGEN KINETICS
 CLINICAL STUDY (6338)*
 MYELOSIS
 DI GUGLIELMO'S ERYTHREMIA, CELL-FREE
 FILTRATE, LEUKEMOGENICITY, MOUSE
 (5943)*
 THOROTRAST RADIATION, CASE REPORT
 (0678)*
 MYOBLASTOMA
 ELECTRON MICROSCOPY (2010)
 GRANULAR CELL, ULTRASTRUCTURE, HUMAN
 (3468)*
 MULTILocal, FAMILIAL, HUMAN (2136)*
 ORIGIN, HUMAN (1088)
 MYOSARCOMA
 HISTOLOGY, HUMAN (2092)*
 MYOSITIS
 CHRONIC MUCOCUTANEOUS CANDIDIASIS,
 THYMOMA, CASE REPORT (6283)*
 MYXOMA
 INTRACARDIAC, FAMILIAL, HUMAN (3445)*
 MYXOMATOSIS
 CALIFORNIA MYXOMA VIRUS, TUMOR
 INFECTIVITY, RABBIT, MOSQUITO
 (1425)*
 NAPHTHYLAMINE
 OXIDATION PRODUCTS, CARCINOGENICITY,
 RAT (1248)
 1-NAPHTHYLAMINE
 2-NAPHTHYLAMINE, CYTOCHROME OXIDASE,
 HISTAMINASE, RAT (0366)*
 2-NAPHTHYLAMINE
 URINARY BLADDER TUMORS, DOSE-RESPONSE
 RELATIONSHIPS, DOG (4469)*
 BETA-NAPHTHYLAMINE
 HAPTENE, CARCINOGENESIS, DOG (5291)
 NAPHTYRIDINE
 POLYCYCLIC, SYNTHESIS, ULLMANN-
 FETVADJIAN CONDENSATION (0387)*
 NARCOTIC
 ABUSE, LUNG, FOREIGN BODY, GRANULOMA,
 JAPAN, CASE REPORT (1489)*
 NASAL CAVITY
 HEMANGIOPERICYTOMA, CASE REPORT,
 NIGERIA (4876)*
 PAPILLOMATOSIS, PARANASAL SINUSES,
 CLINICOPATHOLOGIC STUDY (5508)*
 PARANASAL SINUSES, CANCER, CLINICAL
 STUDY (5642)*
 NASOPHARYNGEAL CANCER

EPIDEMIOLOGY, ETIOLOGY, INTERNATIONAL
 (4832)*
 SOPHARYNGEAL CARCINOMA
 BURKITT'S LYMPHOMA, IMMUNOGLOBULIN
 (1052)
 CHINESE, SOUTH EAST ASIA, AFRICA
 (3619)
 EPSTEIN-BARR VIRUS, IGM, HUMAN (5977)
 HERPESVIRUS ANTIBODY, INCIDENCE, HUMAN
 (3747)
 HISTOLOGICAL FEATURES, INCIDENCE,
 UGANDA (4818)
 HUMAN, REVIEW (4356)*
 IMMUNOLOGICAL ASPECTS, HUMAN, REVIEW
 (3609)
 PATHOLOGIC CLASSIFICATION, FINE
 STRUCTURE, HUMAN (4954)*
 ULTRASTRUCTURE, CELL CULTURES, HUMAN
 (3402)*
 SOPHARYNX
 BURKITT'S LYMPHOMA, HUMAN, REVIEW
 (4332)*
 CANCER
 CHROMOSOME, HUMAN (2021)
 ETIOLOGY, HUMAN, REVIEW (0929)*
 CARCINOMA
 N-ANTIGEN, ANTIBODY, HUMAN (2609)
 HERPES-TYPE VIRUS, TRANSFORMATION,
 HUMAN (1021)
 HERPESVIRUS, CELL ULTRASTRUCTURE,
 REVIEW (1431)
 HISTOGENESIS, ULTRASTRUCTURE
 (1087)
 INCIDENCE, HONG KONG (0822)*
 MORTALITY, TAIWAN (1927)
 SEROEPIDEMIOLOGY, HUMAN (1049)
 SERUM, ANTINUCLEAR ANTIBODY, HUMAN
 (1382)
 TUMOR CELL ANTIGEN, HUMAN (0468)
 TWIN, CASE REPORT (0535)
 VIRUS ANTIBODY, HUMAN, TAIWAN
 (1383)
 EPSTEIN-BARR VIRUS, ANTIBODY (0161)
 TUMORS, INCIDENCE, PHILIPPINES (2762)
 ECK
 BRONCHIOGENIC CYST, METASTASIS, CASE
 REPORT (6254)*
 EONATAL ONCOLOGY
 DIAGNOSIS, TREATMENT, HISTOLOGICAL
 FINDINGS (5442)
 EOPLASIA
 ANTIGENIC CONSTITUTION, HUMAN,
 EXPERIMENTAL, REVIEW (0602)
 BREAST, OSTEOCHONDROID STRUCTURES,
 HUMAN (6178)*
 CHROMOSOMAL ANOMALIES, HUMAN (6380)*
 CUTANEOUS TUMOR IRREVERSIBILITY, HUMAN
 REVIEW (5037)*
 EPIDEMIOLOGY, REVIEW (1530)*
 EPITHELIUM, RIBOFLAVIN DEFICIENCY,
 ARYL HYDROCARBON HYDROXYLASE, MOUSE
 (3668)
 GASTRIC CARCINOSARCOMA, CASE REPORT
 (5496)*
 GLIA, IN VITRO GROWTH, ULTRASTRUCTURE
 (6216)*
 GROWTH, INHIBITION, TRACE ELEMENTS,
 REVIEW (3648)
 IMMUNITY, HUMAN, REVIEW (2290)*
 IMMUNOLOGIC ASPECTS, REVIEW (0601)
 IMMUNOLOGY, HUMAN, EXPERIMENTAL,
 REVIEW (0606)
 INCIDENCE, CHILDREN, INDIA (6200)*
 INHIBITION, ANTIGENIC CARCINOGEN
 PROTEIN CONJUGATE, RAT (3981)*
 KARYOTYPE ANALYSIS, GRAFT-VERSUS-HOST
 REACTION, MOUSE (4658)
 LARYNX, EPIDEMIOLOGY, UKRAINE (0531)*
 LYMPHOID, PATHOGENESIS, IMMUNOLOGIC
 CELL PATHWAYS, CAT (4788)
 MAMMARY GLAND, 7,12-DIMETHYLBENZ(A)
 ANTHRACENE, X-RAY, RAT (2309)
 MULTIPLE PRIMARY MALIGNANT,
 EPIDEMIOLOGY, ITALY (3978)*
 PRIMARY, MULTIPLE, HUMAN (3345)*
 PROTEOLYTIC ENZYMES, INHIBITORS, HUMAN
 (5450)
 STOMACH, MUCOSAL CELL EXFOLIATION,
 CHRONIC ATROPHIC GASTRITIS, DNA,
 MAN (0496)*
 TROPHOBLASTIC, TISSUE CULTURE, HUMAN
 (5645)*
 URETERAL STUMP, PARTIAL NEPHRO-
 URETERECTOMY, CASE REPORT (5661)*
 VIRUS, HUMAN, REVIEW (5052)*
 NEOPLASM
 ADVANCED MALIGNANCY, LYMPHOCYTE
 SENSITIZATION, HUMAN (4734)*
 ANTIGEN, HAPTEN ISOLATION, RABBIT
 (3850)
 ARGININE, ALBUMIN FRACTION, HUMAN
 (3471)*
 BONE, URINARY HYDROXYPROLINE, SERUM
 ALKALINE PHOSPHATASE, CALCIUM,
 PHOSPHORUS, HUMAN (4251)*
 CENTRAL NERVOUS SYSTEM
 EPIDEMIOLOGY, MINNESOTA (4820)
 FAMILIAL OCCURRENCE, POLAND (4815)
 COLLAGENOLYTIC ENZYMES, HUMAN (3990)
 CYTOGENETICS, CLINICAL STUDIES, HUMAN,
 REVIEW (5723)*
 EPIDEMIOLOGIC STUDY, INCIDENCE,
 SARDINIA (3285)*
 GALLBLADDER, INCIDENCE, IMMIGRANT
 PATTERNS (1919)
 GONADAL, GONADOBLASTOMA-RELATED,
 CASE REPORT (4935)*
 HEMATOPOIETIC CELLS, BONE MARROW,
 INHIBITION, MOUSE (2077)*
 HEMATOLOGIC, CYTOPLASMIC BUDS, BONE
 MARROW, HUMAN (4917)*
 HEMATOPOIETIC, LIZARD (3513)*
 ISOENZYMES, HEMOBLASTOSIS, HUMAN
 (2155)*
 LACTATE DEHYDROGENASE, ISOENZYME
 PATTERN, HUMAN SERUM (2885)*
 LIVER
 GLYCOGEN METABOLISM, RAT, MOUSE
 (3996)
 OPISTHOCHOSIS, INCIDENCE, RUSSIA
 (1925)
 LYMPHOCYTE, ACTIVITY, HUMAN (2126)*
 LYSINE-RICH HISTONE, MOUSE (1189)*
 MALIGNANT
 MORTALITY, U.S.S.R. (3279)*
 SEX, AGE, GLOBAL MORBIDITY
 STATISTICS (0222)*
 MALIGNANT AND BENIGN, FEMALE GENITAL
 ORGANS, ERYTHROCYTIC AND PLASMATIC
 POTASSIUM, AND SODIUM LEVELS (3578)*
 MAMMARY, RADIATION, NEUTRON, RAT
 (2454)
 MAMMARY GLAND
 HYPOXIA, PATHOGENESIS, CLINICAL
 STUDY (6053)
 PROGESTOGENS, DOG (4193)*
 MAST CELLS
 CAT (1992)

- GLYCOSPHINGOLIPIDS, AMINES MOUSE (3424)*
- MEDIASTINAL ENDOCRINE
CARCINOID TUMOR, HUMAN (3525)*
MULTIPLE ADENOMATOSIS, CASE REPORT (3521)*
MULTIPLE ENDOCRINE ADENOMATOSIS, CASE REPORTS (5576)*
MESENCHYMAL, OYSTER (3397)*
METASTASES, BONE, SCAN, HUMAN (2071)*
METHYLCHOLANTHRENE, GUNIEA PIGS (2394)*
MULTIPLE PRIMARY MALIGNANT, RELATED PROBLEMS, STATISTICS, AUTOPSY STUDY, JAPAN (4811)
MURINE SARCOMA VIRUS, RAT, MOUSE (5904)
MUTATION, IMMUNITY, CHEMOTHERAPY, REVIEW (1522)*
MYCOPLASMAS, HUMAN (2857)
MYXOMATOUS, GROWTH, HUMAN (6190)*
PLASMA, L-HYDROXYPROLINE, CHICKEN (1188)*
PRIMARY, CHROMOSOME, HAMSTER (1913)*
PRIMARY MALIGNANT, LYMPH NODE, PATHOLOGY, CASE REPORT (4203)*
PRIMARY MEDIASTINAL ENDOCRINE, CLINICAL STUDY (5575)*
PRIMARY PAPILLOMA OF CEREBELLOPONTINE ANGLE WITH METASTASES TO CEREBRAL HEMISPHERE, FREQUENCY, PATHOLOGICAL CHARACTERISTICS (3599)*
SPONTANEOUS
INCIDENCE, MOUSE (5254)
MICE (2012)
TRIPLE PRIMARY MALIGNANT, UTERUS, CAECUM, STOMACH, CASE REPORT (5460)*
UROTHELIUM, PATHOLOGY, HUMAN (4269)*
VIRAL AND IMMUNOLOGIC STUDIES, HUMAN (3797)
- NEOPLASTIC
HEMOBLASTOSIS, LACTATE DEHYDROGENASE, HUMAN (2042)*
- NEPHROBLASTOMA
HISTOCHEMISTRY, ULTRASTRUCTURE, AUTORADIOGRAPHICAL INVESTIGATIONS (3724)*
HISTOENZYMOLGY, COMPARISON WITH FETAL KIDNEY, CHILDREN (6232)*
HISTOLOGY, HUMAN (3454)*
WILM'S TUMOR, RAT (2134)*
WILM'S TUMOR, ULTRASTRUCTURE, HUMAN (4973)*
- NEPHROMA
CONGENITAL, RENAL STRUCTURE INDUCTION, HUMAN (1885)
- NEPHROTIC SYNDROME
MALIGNANT DISEASE (1500)*
- NERVE
BRAIN CELL, CYTOTOXICITY, ETHYLNITROSOUREA, METHYLNITROSOUREA, RAT (5078)
MALIGNANT NEOPLASIA,
3-METHYLCHOLANTHRENE, RAT (0380)*
MALIGNANT NEURINOMA
SCHWANN CELL, CLONAL LINE,
ETHYLNITROSOUREA, RAT (5167)
TRANSPLACENTAL INDUCTION, ETHYLNITROSOUREA, MORPHOLOGY, HAMSTER (5110)
NEURINOMA, IMMUNOLOGY, HUMAN (0774)*
NEUROBLASTOMA, DIBUTYRYL ADENOSINE 3,5-CYCLIC MONOPHOSPHATE, MOUSE (1246)
- PERIPHERAL
NEOPLASM, REVIEW (2225)*
SARCOMA, MORPHOLOGY, HUMAN (1156)*
TRANSPLANTED TUMOR, ENZYMES, RAT (4141)*
TUMOR, NERVOUS SYSTEM-SPECIFIC PROTEIN RAT (5363)
TUMOR TRANSPLANTATION, ENZYME HISTOCHEMISTRY, RAT (4102)*
- NERVOUS SYSTEM
AZOXYMETHANE, TUMORIGENICITY, RAT (5103)
CARCINOMA, INCIDENCE, SENEGAL (1945)*
EPENDYMOA, ULTRASTRUCTURE, HUMAN (3457)*
NEOPLASTIC AND PARANEOPLASTIC, PERIPHERAL DISEASES, HUMAN (3558)*
NEUROEPITHELIAL TUMORS, CYTOGENESIS, DIFFERENTIATION, REVIEW (3603)
NEUROGENIC TUMORS
N-BUTYL-NITROSOUREA, RAT (5144)
MEDIASTINUM, CLINICAL STUDY (5656)*
PERIPHERAL, N-METHYLNITROSOUREA, TUMORS, DOG (5088)
SYMPATHETIC, TUMORS, PATHOLOGY, CHILDREN (6239)*
TUMOR FORMATION, METHYLNITROSOUREA, RAT (5178)
TUMOR INDUCTION, PHENYL-DIMETHYL-TRIAZENE, RAT (5111)
TUMORS
N-ACETYL-L-ASPARTIC ACID CONTENT, HUMAN, BOVINE (3324)*
ETHYLNITROSOBIURET, TRANSPLACENTAL EFFECT, NEONATAL TREATMENT, RAT (0345)
ETHYLNITROSOUREA, RAT (1588)
INCIDENCE, ISRAEL (3260)
LACTATE DEHYDROGENASE ISOENZYMES, HUMAN (3425)*
METHYLNITROSOUREA, RAT (1589)
MORPHOLOGY, ALKYLATION, ANIMALS (5107)
TRANSPLACENTAL INDUCTION, METHYL-AND ETHYLNITROSOUREA, RAT (5830)*
- NEURAMINIDASE
BACILLUS CALMETTE-GUERIN, 3-METHYLCHOLANTHRENE, TUMOR REGRESSION, MOUSE (3199)
BCG, FIBROSARCOMA REGRESSION, MOUSE (5993)*
CELL AGGREGATION, POLYOMA VIRUS, HAMSTER (5905)
IMMUNOGENICITY, LEUKEMIA, MOUSE (4653)
LYMPHOID CELL, SURFACE ANTIGEN, HUMAN (3183)
TUMOR CELL TRANSPLANTABILITY, MOUSE, MAMMARY ADENOCARCINOMA (0746)
- NEURINOMA
ENZYMES, SERUM, DOPAMINE, MOUSE (2095)*
ETHYLNITROSOUREA, TISSUE CULTURE, RAT (3700)
ETHYLNITROSOUREA-INDUCED, HISTOCHEMISTRY, TISSUE CULTURE, RAT (4459)*
HISTOGENESIS, HUMAN (3243)*
IMMUNOLOGY, HUMAN (0774)*
MALIGNANT, TRANSPLACENTAL INDUCTION, ETHYLNITROSOUREA, MORPHOLOGY, HAMSTER (5110)
NEUROSARCOMA, CHROMOSOMES, HUMAN (4214)*

RETROPERITONEUM, MORPHOLOGY, CASE REPORT (4261)*
 TRAUMA, CASE REPORT (5869)*

EUROBLASTOMA
 ABDOMINAL TUMORS, CLINICAL STUDY, CHILDREN (5449)
 ACETYLCHOLINE, CELL MEMBRANE ELECTRICAL POTENTIAL, MOUSE (0595)*
 ACETYLCHOLINE ESTERASE, MOUSE (0881)*
 S-ADENOSYLMETHIONINE, HUMAN (1146)*
 BONE MARROW, HISTOLOGIC STUDY, CHILDREN (5598)*
 L CELL HYBRID, MEMBRANE ELECTRICAL POTENTIAL, NEURONAL DIFFERENTIATION, GENETICS (0540)
 CELL MEMBRANE, ELECTROGENESIS, MOUSE (0552)
 CELLS, ADENOSINE 3',5'-CYCLIC MONOPHOSPHATE, METABOLISM (2866)
 CONGENITAL, HYPERPLASIA, ISLETS OF LANGERHANS, INFANT, CASE REPORT (4959)*
 DIBUTYRYL ADENOSINE 3,5-CYCLIC MONOPHOSPHATE, DIFFERENTIATION, MOUSE (1246)
 MONOPHOSPHATE, X-IRRADIATION, DIFFERENTIATION, MOUSE (2924)
 DIFFERENTIATED FUNCTIONS, DIBUTYRYL-CYCLIC ADENOSINE MONOPHOSPHATE, MOUSE (2896)*
 DOPAMINE-B-HYDROXYLASE, MOUSE (4023)
 ENZYME REGULATION, CELLS, MOUSE (5627)*
 FAMILIAR OCCURRENCE, CASE REPORT (1939)*
 FINE STRUCTURE, CASE REPORT (2886)*
 GANGLIONEUROBLASTOMA, BIOCHEMISTRY, ULTRASTRUCTURE, HUMAN (1123)
 GANGLIONEUROMA, CATECHOLAMINE, CLINICAL STUDY (6035)*
 GLYCOSPHINGOLIPID, BIOSYNTHESIS (0237)
 GROWTH STIMULATION, DOPAMINE EFFECT REVERSAL, IPRONIAZID, MOUSE (1631)*
 IMMUNITY, LYMPHOCYTE, HUMAN (0010)*
 IMMUNOLOGY, HUMAN, REVIEW (0902)
 INDUCED DIFFERENTIATION, MOUSE (2725)*
 LYMPHOCYTIC INFILTRATION, SURVIVAL RATE, CHILDREN (6233)*
 MANDIBLE, METASTATIC, CASE REPORT (3419)*
 MEMBRANE CHANGES, CYCLIC AMP-INDUCED MORPHOLOGICAL DIFFERENTIATION, CELL CULTURE, MOUSE (4916)*
 NEURITE OUTGROWTH INHIBITION, COLLAGEN (4066)*
 PATHOLOGY, REVIEW (4321)
 SYMPATHETIC NERVOUS SYSTEM TUMORS, PATHOLOGY, CHILDREN (6239)*
 VITAMIN B12 DISTRIBUTION, INFANT (3503)*

EUROMA
 SUPERFICIAL AMPUTATION, ENUCLEATION, HUMAN (3549)*

EUROSARCOMA
 ESTABLISHMENT IN VITRO, ULTRASTRUCTURE HUMAN (3360)*
 INDUCTION, N-NITROSOBUTYLUREA, HAMSTER (1649)*

EVUS
 BALLOON CELL, ULTRASTRUCTURE, CASE REPORT (5572)*
 BLUE, MORPHOGENESIS, HISTOLOGICAL STRUCTURE (6057)*
 MELANOCYTIC MALIGNANT, HISTOPATHOLOGY, CASE REPORT (6247)*
 PIGMENTED, MALIGNANT MELANOMA, MORPHOLOGY, CASE REPORTS (4283)*

NICKEL
 CARCINOGENESIS, OCCUPATIONAL HAZARD, HUMAN, REVIEW (5009)
 MAGNESIUM, UTERINE CANCER, HUMAN (2389)*
 SOLUBILITY, SERUM, MUSCLE (4448)
 NICKEL CARBONYL
 CARCINOGENICITY, RAT (4377)
 NICKEL SULFIDE
 CARCINOGENESIS, BENZO(A)PYRENE, INTERACTION, RAT (5801)
 MUSCLE CARCINOGENESIS, HUMAN, REVIEW (4348)*

NICOTINAMIDE
 TRYPTOPHAN METABOLISM, VITAMIN B6 ADMINISTRATION, HODGKIN'S DISEASE PATIENTS (4921)*

NICOTINE
 ENZYME METABOLISM, LIVER, MOUSE (3660)

NITRITE
 LUNG ADENOMA INDUCTION, NITROSAMIDE FORMATION, MOUSE (2966)

NITROFURANS
 4-DIMETHYLAMINOAZOBENZENE, INDUCED CARCINOGENESIS, RAT (4369)

NITROGEN COMPOUNDS
 CARCINOGENICITY, BETA-CARBOLINES (2433)*
 PENTA- AND HEXACYCLIC, INDENOINDOLES, CARCINOGENICITY (2444)*
 SKRAUP REACTIONS, ANTI-MARCKWALD ORIENTATION (2373)*
 SKRAUP AND COMBES-BEYER REACTION, 3-AMINO CARBAZOLES, PYRIDO(3,2'-6) CARBAZOLES, STRUCTURE (2438)*

NITROGEN DIOXIDE
 LUNG, BENZO(A)PYRENE HYDROXYLASE, RABBIT (5803)

P-NITROPERBENZOIC ACID
 CARCINOGENESIS, ACTIVITY BIOASSAY, MOUSE (2981)

4-NITROQUINOLINE-1-OXIDE
 ACTIVATING ENZYME DETECTION, MICROBIAL ASSAY, SALMONELLA TYPHIMURIUM (4419)
 4-AMINOQUINOLINE-1-OXIDE, NUCLEIC ACID, INTERACTION (0361)
 CARCINOGENESIS, PHOTODYNAMIC ACTION, LIVER CELLS, RAT (5796)
 CELL TRANSFORMATION, MAMMAL (1597)

DNA
 PROTEIN, SCISSION, REPAIR, MOUSE (2936)
 SCISSION, REPAIR, MOUSE (3005)
 DNA BINDING ABILITY, CARCINOGENIC ACTIVITY, EHRlich ASCITES CELLS (2983)
 DNA REPAIR, LYMPHOCYTE, HUMAN (4426)
 DNA REPAIR SYNTHESIS REDUCTION, XERODERMA PIGMENTOSUM (1596)
 IMMUNE RESPONSE DEPRESSION, SPLEEN CELL, MOUSE (3679)
 IMMUNE SUPPRESSION, MOUSE (2977)
 KIDNEY TUMOR, RAT (5183)
 LUNG CANCER
 LACTATE DEHYDROGENASE ACTIVITY, MOUSE (2982)
 RABBIT (3696)
 MALIGNANT TRANSFORMATION, PULMONARY AND EMBRYONIC CELLS, MOUSE (2985)
 MUTAGENICITY, BACTERIOPHAGE (1595)
 MUTATION SUPPRESSOR, E. COLI (4482)*

NUCLEIC ACID BINDING, PROTEIN BINDING,
 CELL PROLIFERATION, MOUSE (0360)
 NUCLEOLAR SEGREGATION, ULTRASTRUCTURE,
 CHANG LIVER CELL (0644)
 RELATED CARCINOGENS, DNA VISCOSITY,
 ELEVATED TEMPERATURES (4471)*
 NITROSAMIDES
 FORMATION, ALKYLUREAS, NITROSATION,
 STOMACH CARCINOGENESIS, HUMAN (0358)
 NITROSAMINE
 CARCINOGENICITY
 ENVIRONMENTAL HAZARD, ANIMAL,
 HUMAN, REVIEW (0303)
 FOOD, FISH (2319)
 CYTOPLASMIC ALTERATIONS, HEPATOCYTES,
 RAT (5855)*
 DIETHYL-, DIMETHYL-, MUTAGENICITY,
 HYDROXYLATION SYSTEM, SACCHAROMYCES
 (2325)
 DIMETHYLNITROSAMINE
 DIETHYLNITROSAMINE, METHYLNITRO-
 SOUREA, CARCINOGENESIS,
 HAMSTER (0070)
 IN VIVO PRODUCTION, AMINOPYRINE,
 NITRITE, RAT (3653)
 DISTILLED SPIRITS, ESOPHAGEAL
 CARCINOMA, EAST AFRICA (1583)
 FORMATION
 DRUG/NITRITE INTERACTION (3704)
 TERTIARY AMINES, NITRITES (5156)
 INDUCED TUMORS, ALKYLATION OF
 N-7 GUANINE, DIETHYLNITROSAMINE,
 N-ETHYL-N-NITROSOUREA, ETHYL
 METHANESULPHATE, RAT (2320)
 LIVER TUMOR INDUCTION, FISH (2324)
 LUNG ADENOMA INDUCTION, METHYLUREA,
 ETHYLUREA, NITRITE, MOUSE (2966)
 METABOLISM, RNA ACTIVITY, LIVER, RAT
 (5160)
 NITROSOPYRROLIDINE, NEOPLASMS, LIVER,
 GENITAL MESOTHELIUM, RAT (2951)
 NUCLEAR SIZE ALTERATIONS, LIVER, RAT
 (5856)*
 RESPIRATORY TRACT, CARCINOGENESIS
 (0026)*
 SYNTHESIS, BACTERIAN CULTURES (5852)*
 N-NITROSAMINE
 CHEMICAL CARCINOGEN, FOOD, REVIEW
 (2230)*
 CIGARETTES, SMOKE CONDENSATE (2954)
 PHOTOLYTIC DECOMPOSITION (1647)*
 NITROSO COMPOUNDS
 BIOCHEMISTRY, CARCINOGENESIS, REVIEW
 (5007)
 CARCINOGENESIS, STOMACH, RAT (2426)*
 FORMATION
 NITRITE REACTION, CREATINE,
 CREATININE (1544)
 STOMACH, ANIMALS (5188)*
 MUTAGEN ACTIVITY, HOST MEDIATED ASSAY,
 MOUSE (2410)*
 TRANSPLACENTAL BLASTOMOGENESIS, RAT
 (3618)
 TUMORS, ENDOGENOUS FORMATION, STOMACH,
 HUMAN, REVIEW (4302)
 N-NITROSO COMPOUNDS
 CARCINOGENIC PROPERTIES, IMMUNE
 REACTIONS, RAT (5294)
 FORMATION, NITROSATION INHIBITION,
 ASCORBATE (3690)
 N-NITROSOBUTYLUREA
 LEUKEMIA
 BIOLOGICAL PROPERTIES, RAT (1628)*
 MAMMARY TUMOR, RAT (5136)
 RAT, VIRUS (4505)
 MAMMARY TUMORIGENESIS, OVARIAN
 HORMONES, RAT (4382)
 NEUROSARCOMA INDUCTION, HAMSTER
 (1649)*
 TUMOR INDUCTION, BRAIN, KIDNEY, RAT
 (4422)
 N-NITROSODIBUTYLAMINE
 TRYPTOPHAN, URINARY BLADDER
 TUMORIGENESIS, RAT (0947)
 N-NITROSODIETHYLAMINE
 HEPATOMA, TRNA METHYLASE, MONKEY
 (0631)
 NUCLEIC ACID ALKYLATION, LIVER, LUNG,
 RAT (0946)
 TRANSPLACENTAL TREATMENT, ITERATIVE
 ADMINISTRATION, MOUSE (0357)
 NITROSODIMETHYLAMINE
 METHYLATION, MITOCHONDRIAL DNA, RAT,
 HAMSTER (2618)
 N-NITROSODIMETHYLAMINE
 FORMATION, AMMONIUM COMPOUNDS,
 TERTIARY AMINES, FOOD (2321)
 KIDNEY TUMOR, RAT (5183)
 NITROSOETHYLUREA
 CARCINOGENESIS, ALKYLATION, NUCLEIC
 ACIDS, LIVER, RAT (3708)
 2-NITROSOFLUORENE
 METABOLISM, OXIDATION, CARCINOGEN
 (0343)
 NITROSOGUANIDINE
 KINETICS OF DECOMPOSITION (5137)
 SINGLE STRAND DNA BREAKS, HAEMOPHILUS
 INFLUENZAE (1540)
 N-NITROSOHEPTAMETHYLENEIMINE
 LUNG CANCER, INDUCTION, RAT (5113)
 NITROSOMETHYLUREA
 CARCINOGENESIS, ALKYLATION, NUCLEIC
 ACIDS, LIVER, RAT (3708)
 DIMETHYLNITROSAMINE, LUNG, HYPERPLASIA
 MOUSE (0650)*
 LEUKEMOGENESIS, IMMUNODEPRESSION,
 MOUSE (1610)*
 PRETUMOR CHANGES OF EPITHELIUM,
 EMBRYONAL LUNG TISSUE, MOUSE (4438)
 TRANSPLACENTAL ACTION, RAT (2417)*
 TRANSPLACENTAL BLASTOMOGENESIS, MOUSE
 (1607)*
 N-NITROSOMETHYLUREA
 CANCER INDUCING EFFECT, HORMONAL
 CONTRACEPTIVE ADMINISTRATION, RAT
 (5146)
 +RNA METHYLASE ACTIVITY, CELLS,
 HAMSTER (3009)
 N-NITROSO-N-METHYLURETHANE
 INDUCED LESIONS, ULTRASTRUCTURE,
 CRYSTALLINE CELLULAR INCLUSIONS,
 LUNG, MOUSE (5101)
 NITROSOMORPHOLINE
 HEPATOCARCINOGENESIS, KARYOKINESIS AND
 NUCLEAR STRUCTURE, HEPATOCYTES, RAT
 (4472)*
 LIVER, CHOLANGIOCELLULAR TUMORS, RATS
 (2406)*
 N-NITROSOMORPHOLINE
 MUTAGENESIS, HOST MEDIATION,
 SALMONELLA TYPHIMURIUM (0636)
 URINARY 7-METHYL GUANINE EXCRETION,
 RAT (5076)
 NITROSOPIPERAZINE
 MUTAGENICITY, SALMONELLA TYPHIMURIUM,
 HOST-MEDIATED ASSAY, MOUSE (4381)
 NITROSOPIPERIDINE
 SYNTHESIS, GASTROINTESTINAL TRACT,

RAT (0378)*
 NITROSOPIPERIDINE
 ESOPHAGEAL TUMORS, HISTOPATHOLOGY,
 ULTRASTRUCTURE, RAT (4385)
 SYNTHESIS, PRECURSORS, STOMACH,
 INTESTINE, RAT (0071)
 TROSOQUINOLINE
 GRANULOMA, MACROPHAGE, GIANT CELL,
 RAT (5097)
 TROSOUREA
 BRAIN TUMORS, GLIOMAS, PATHOGENESIS,
 RAT (3014)*
 DECOMPOSITION, EFFECTS OF CYSTEINE
 (2368)*
 RNA POLYMERASE, POLYCYTIDYLATE
 TEMPLATES (4460)*, (5138)
 OULE
 HYPERPLASTIC ALVEOLAR, MAMMARY TUMOR,
 INHIBITION, PHENYLALANINE
 DEFICIENCY, MOUSE (1243)
 REPINEPHRINE
 GLUCOSE METABOLISM, GLIOBLASTOMA CELLS
 NEUROBLASTOMA CELLS, RAT (5558)*
 SE
 ADENOCARCINOMA, COLONIC CARCINOMA,
 COMPARATIVE PATHOLOGY, HUMAN (0880)*
 CARCINOMA, FURNITURE MAKING, DENMARK
 (0089)*
 PARANASAL ASPERGILLOMA, ASPERGILLUS
 FLAVUS, AFLATOXIN, HUMAN (0085)*
 PARANASAL ASPERGILLOMA, ASPERGILLUS
 FLAVUS, AFLATOXIN, SUDAN (0655)*
 CLEAR PROTEIN
 CHEMICAL CARCINOGENS, BINDING, LIVER,
 RAT (4375)
 SYNTHESIS, LIVER, BERYLLIUM, RAT
 (1538)
 CLEIC ACID
 ALKYLATION
 ETHYLNITROSUREA, DIETHYLNITRO-
 SAMINE, LIVER, EMBRYO, RAT
 (5854)*
 N-NITROSODIETHYLAMINE, LIVER,
 LUNG, RAT (0946)
 BENZO(A)PYRENE
 7,12-DIMETHYLBENZ(A)ANTHRACENE
 INTERACTION, RAT (1261)
 3-METHYLCHOLANTHRENE, NUCLEIC
 ACIDS, MOLECULAR CHARACTERISTICS
 (0639)
 BINDING, 4-NITROQUINOLINE-1-OXIDE,
 CELL PROLIFERATION (0360)
 CELLULAR MEMBRANE INTERACTION,
 B-PROPIOLACTONE (4481)*
 COPPER LEVELS, MANGANESE LEVELS, ACUTE
 LEUKOSIS, RAT (5873)*
 CYTOPHOTOMETRY, TUMOR CELL, LUNG
 CANCER, STOMACH CANCER (1162)*
 (3H)ETHYL CARBAMATE, INTERACTION,
 LIVER REGENERATION, MOUSE (2436)*
 ETHYLNITROSUREA, ETHYLATION, FETUS,
 ADULT, RAT (5172)
 HARDING-PASSEY MELANOMA, KIDNEY TUMOR,
 CYTOCHEMISTRY, MOUSE, HAMSTER
 (5457)*
 HUMAN TUMOR CELL, CARCINOGENICITY,
 MOUSE (3829)*
 KINETICS, CANCER CELLS, HUMAN (3305)
 LIVER
 2-ACETYLAMINOFLUORENE BINDING,
 3-METHYLCHOLANTHRENE, DIET, RAT
 (1283)*
 URETHANE EFFECT, MOUSE (2329)
 LIVER MITOCHONDRIA, LEUKEMIA, MOUSE
 (5439)
 LYMPH NODE CONTENT AND SYNTHESIS,
 SPLEEN, THYMUS, MURINE ADENO-
 CARCINOMA, MOUSE (0760)
 METABOLISM
 CELL CYCLE, CELLULAR PROLIFERATION
 NORMAL TISSUES, MALIGNANT TISSUE
 HUMAN (6077)
 ENZYME ACTIVITY, GENETIC EXPRESS-
 ION REGULATION, CANCER CELL
 DETECTION (6141)*
 MURINE CARCINOMA, GROWTH STAGES,
 MOUSE (4068)*
 POLYOMA, ROUS SARCOMA VIRUS,
 EMBRYO CELL CULTURES, MOUSE,
 CHICKEN (5274)
 TUMOR AND NORMAL TISSUES, LIVER,
 RAT (4880)*
 URETHANE, MOUSE (0667)*
 NUCLEOSIDE TRANSPORT, KINETIC ANALYSIS
 NOVIKOFF HEPATOMA, RAT (0550)
 PRECURSOR INCORPORATION, TUMOR TISSUE,
 NORMAL TISSUE, IN VITRO (6395)*
 PROTEIN, CYTOCHEMISTRY, HARDING-PASSEY
 MELANOMA, HORNING-MITCHELY KIDNEY
 TUMOR (1470)*
 SMALL MOLECULES, INTERACTION,
 CIRCULAR DICHROISM (1549)
 RADIOACTIVE IODINE, MOLECULAR
 HYBRIDIZATION TECHNIQUES (6375)*
 RNA, AVIAN MYELOBLASTOSIS VIRUS,
 TUSSUE DISTRIBUTION, CHICKEN (5215)
 SYNTHESIS
 ACUTE LYMPHOBLASTIC LEUKEMIA,
 L-ASPARAGINASE, HUMAN (4026)
 ADENOVIRUS TYPE 10, INFECTED CELL,
 HELA (1019)
 LIVER
 AGING, CAFFEINE, RADIATION,
 MOUSE (1639)*
 KIDNEY, DIMETHYLNITROSAMINE,
 RAT (1587)
 PYRIMIDINE UTILIZATION, CATABOLISM
 (3540)*
 REVERSIBLE ALTERATION, THERMAL
 BURN, HUMAN (1683)*
 NUCLEOLUS
 CYTOPLASMIC FIBRILLAR BODIES, HEPATO-
 CELLULAR CARCINOMA, ULTRASTRUCTURE,
 HUMAN (3358)*
 MODIFICATION, AFLATOXIN B1, FISH LIVER
 SNAIL (5116)
 NUCLEOLINI, NEOPLASTIC CELL, HUMAN
 (0555)
 PROTEIN METABOLISM, ACTINOMYCIN D,
 HELA CELL (1127)
 PROTEIN SYNTHESIS, NOVIKOFF ASCITES
 TUMOR (4028)
 RIBONUCLEOPROTEIN, LIVER, RAT,
 THIOACETAMIDE, BIOCHEMISTRY,
 ULTRASTRUCTURE (1249)
 SEGREGATION, 4-NITROQUINOLINE-1-OXIDE,
 ULTRASTRUCTURE, CHANG LIVER CELL
 (0644)
 NUCLEOPROTEIN
 ONCOGENIC INFECTIOUS, STAGES OF
 CANCERIZATION, UTERINE CERVIX, HUMAN
 (1894)
 UTERINE CERVIX CARCINOMA, CHORIO-
 ALLANTOIS MEMBRANE, EMBRYONIC
 CHICKEN EGG (6065)*
 NUCLEOTIDE
 ACID-SOLUBLE, CONCENTRATION AND
 SYNTHESIS, MYELOID TUMOR, LIVER,

- MOUSE (5500)*
 AVIAN TUMOR VIRUS SPECIFIC SEQUENCES,
 DETECTION, AVIAN CELL DNA (3778)
 ENZYME, ROUS SARCOMA VIRUS (1345)
 PURINE, CATABOLISM, EHRlich ASCITES
 TUMOR (0850)
 PYRIDINE, ADRENAL TUMOR CELL CULTURES,
 MOUSE (4913)*
 RNA, FELINE LEUKEMIA VIRUS, CAT, HUMAN
 (5247)
 TERMINAL, AVIAN MYELOBLASTOSIS VIRUS
 RNA, RIBOSOMAL RNA, CHICKEN LEUKEMIC
 MYELOBLASTS (5929)*
 TUMOR INDUCTION, MURINE SARCOMA VIRUS,
 MOUSE (5223)
- NUCLEUS
 ABERRATION, MALIGNANCY ASSOCIATED
 CHANGES, CLASSIFICATION, HUMAN
 (1891)
 ABNORMAL DIVISION, BONE MARROW,
 CARCINOMA, FEULGEN STAINING METHOD,
 HUMAN (0274)*
 BINUCLEATE CANCER CELL, IN VITRO
 (1460)*
 CHROMATIN FRACTION, IMMUNOSUPPRESSIVE
 ACTIVITY, EHRlich ASCITES TUMOR
 CELLS, MOUSE (5368)*
 CRYSTALLINE INCLUSION, ADENOVIRUS,
 KB CELL (1036)*
 INCLUSION, CYTOPLASMIC INCLUSION,
 LIVER CARCINOMA, HUMAN (1125)
 INTRANUCLEAR CANALICULUS COMPLEX,
 ULTRASTRUCTURE, EHRlich ASCITES
 TUMOR CELLS, MOUSE (6367)*
 IONIZING RADIATION, ULTRASTRUCTURE,
 MOUSE (5872)*
 LYMPH NODE LYMPHOCYTES, DNA CONTENT,
 METHYLCHOLANTHRENE-INDUCED
 CARCINOGENESIS, MOUSE (5785)
 MITOCHONDRIA, ADRENAL CORTICAL
 CARCINOMA, ULTRASTRUCTURE, HAMSTER
 (5837)*
 PROSTATE, DNA SYNTHESIS, PROTEIN
 SYNTHESIS (1476)*
 PROTEIN, ANDROGEN, CHANGE, PROSTATE
 (1299)*
- NUTRITION
 DEFICIENCY, TUMORIGENESIS, REVIEW
 (1502)
- OBESITY
 LIPID MOBILIZATION, TUMOR, MOUSE
 (1456)*
- OCCUPATIONAL HAZARD
 AMOSITE ASBESTOS, CARCINOGENICITY,
 REVIEW (3601)
 ANIMAL STUDIES, REVIEW (5021)
 AROMATIC AMINE, REVIEW (5012)
 ASBESTOS
 ASBESTOSIS, LUNG, REVIEW (0916)*
 INSULATION WORKER, CANCER
 MORTALITY, NORTHERN IRELAND
 (1103)
 LUNG ABNORMALITIES, INCIDENCE,
 BELFAST (1102)
 LUNG CANCER
 EPIDEMIOLOGY, REVIEW (4303)
 PLEURAL MESOTHELIOMA (0320)*
 PARTICULATE EXPOSURE, ELECTRO-
 MOTIVE PHENOMENON, CANCER
 OCCURRENCE (1458)*
 REVIEW (3616)
 ASBESTOS CANCER, MORTALITY, U.S.S.R.
 (6099)*
 ASBESTOS MINING
- CROCIDOLITE FIBER, DIAMETER
 (0385)*
 MESOTHELIOMA (0386)*
- BENZENE
 ACUTE LEUKEMIA, CASE REPORTS
 (2976)
 CHROMOSOME CHANGE, HUMAN (1288)*
 BITUMENS, CARCINOGENESIS, HUMAN,
 REVIEW (5027)
 CANCER
 CHEMICAL INDUSTRY, EPIDEMIOLOGIC
 STUDY, GERMANY (3284)*
 ENVIRONMENT, HUMAN, REVIEW (2279)*
 URINARY TRACT, INCIDENCE, U.S.
 (2763)
 CANCER MORTALITY, ENGLAND, REVIEW
 (4308)
 CARCINOGENIC AROMATIC AMINES, URINARY
 CYTOLOGY (2987)
 CHEMICAL CARCINOGEN
 ANIMAL STUDY, REVIEW (4304)
 HUMAN, REVIEW (0617)*
 PROTECTION (0991)*
 CHLOROPRENE, LUNG CANCER (5768)
 CHROMIUM AND NICKEL, CARCINOGENESIS,
 HUMAN, REVIEW (5009)
 COAL BRIQUETTE PRODUCTION, PREVENTIVE
 MEASURES, RUSSIA (3021)*
 COAL MINER, ORAL NEOPLASIA, TOBACCO
 CHEWING, ENGLAND, REVIEW (1232)*
 CUTTING OIL
 CARCINOGENESIS (0086)*
 CARCINOMA, HUMAN (0524)*
 HUMAN, REVIEW (1506)
 ENVIRONMENT, CARCINOGENESIS, MODEL
 SYSTEM (0310)*
 ETHMOID ADENOCARCINOMA, WOODWORKERS
 (3247)
 FLOOR-TILE INSTALLATION, ASBESTOS,
 LUNG, HUMAN (0983)*
 GAMMA IRRADIATION, BLOOD CELL,
 CHROMOSOMAL ABERRATION, HUMAN
 (0389)
 HERPES-LIKE SIMIAN VIRUS, REVIEW
 (3605)
 IRON MINING, LUNG CANCER MORPHOLOGY
 (0970)*
 JOINER, ASBESTOS, PLEURAL PLAQUE,
 INCIDENCE (1111)*
 LUNG, ASBESTOS, RADIOLOGY, HUMAN
 (0977)*
 LUNG CANCER
 AIR POLLUTION, SMOKING, REVIEW
 (5018)
 BRONCHITIS, MORTALITY, NEWSPAPER
 WORKERS, ENGLAND (2754)
 INCIDENCE, STEEL INDUSTRY, CANADA
 (4823)
 LUNG CARCINOMA, RADON IRRADIATION
 (1691)*
 METAL CARBONYLS, SAFETY LEVELS, HUMAN
 (2404)*
 METHYLENE-BIS-ORTHO-CHLOROANILINE
 (1543)
 NASAL CARCINOMA, FURNITURE MAKING,
 DENMARK (0089)*
 OIL, SCROTUM CARCINOMA, HUMAN (0645)*
 OIL EXPLOITATION, BENZO(A)PYRENE
 (0368)*
 OIL MIST POLLUTION, REVIEW (5750)*
 PARA-AMINOBIIPHENYL, BLADDER CANCER,
 HUMAN (0982)*
 PHYSICIAN, REVIEW (1239)*
 SUNLIGHT EXPOSURE, MALIGNANT MELANOMA

INCIDENCE, ENGLAND, SWEDEN (3252)
 URANIUM RADIATION, MINE WORKERS
 (5866)*
 WOOD DUST, CANCER, BOOT AND SHOE
 INDUSTRY, REVIEW (4360)*

CUTTING
 OCCUPATIONAL HAZARD
 CARCINOGENESIS (0086)*
 CARCINOMA, HUMAN (0524)*
 HUMAN, REVIEW (1506)
 EXPLOITATION, BENZO(A)PYRENE,
 OCCUPATIONAL HAZARDS (0368)*
 OVERHEATED COOKING, CARCINOGENICITY,
 BENZO(A)PYRENE, RAT (5159)
 PENTAERYTHRITE ESTER, DIETHYLENE
 GLYCOL, LEUKEMIA, MOUSE (5106)
 SCROTAL CANCER
 HUMAN (0645)*
 PROPHYLACTIC CONSIDERATIONS,
 CASE REPORT (4475)*

OCYTOMA
 CYTOCHROME OXIDASE, ULTRASTRUCTURE,
 CASE REPORT (6322)*
 PAROTID GLAND, BENIGN, MALIGNANT,
 CASE REPORTS (6157)*

OGENESIS
 CHILDHOOD, HEREDITY, BRITISH (0816)*
 GOITROGENESIS, METHYLTHIOURACIL, MOUSE
 (2359)
 6-HYDROXYTESTOSTERONE,
 DELTA 3,5-CHOLESTADIENE-7-ONE,
 DELTA 4-CHOLESTENE-3,6-DIONE, MOUSE
 (1545)
 IMMUNOLOGIC MECHANISMS, HUMAN, REVIEW
 (3608)
 INITIATION MECHANISM HYPOTHESIS,
 RESONANT TRANSFER OF ENERGY (5476)*
 LEUKEMOGENESIS, MAGNESIUM DEFICIENCY,
 BIOGENOSIS (0018)*
 MARKER, GLUCOSE TRANSPORT, RNA VIRUS
 (1114)
 MYCOTOXIN, BLOOD DISEASE (1539)
 NEOPLASTIC PROCESSES
 BIOLOGY, REVIEW (5752)*
 GENERAL CLASSIFICATION, REVIEW
 (5751)*
 POLYOMA VIRUS, RAT (5266)
 RNA VIRUSES, HOST GENOME, REVIEW
 (4309)
 VIRUS THEORIES, REVIEW (3615)
 OGENICITY
 IMMUNOSUPPRESSIVE DRUGS, MOUSE (2367)*
 OLOGY
 EMERGENCIES, ETIOLOGY, PATHOLOGY,
 HUMAN, REVIEW (2280)*
 IMMUNOLOGICAL PROBLEMS, REVIEW (2903)
 PROGESTINS, REVIEW (3635)*
 C NERVE
 TUMORS, HISTOPATHOLOGY (4881)*
 CAVITY
 CANCER, EPIDEMIOLOGY, INDIA (4834)*
 MUCOSA
 STOMATITIS, CARCINOMA, REVERSE
 SMOKING, HUMAN (0098)*
 TOBACCO, ULTRASTRUCTURE, HUMAN
 (0096)*
 REVERSE SMOKING, INDIA (0200)
 CONTRACEPTIVE
 ADENOCARCINOMA, MAMMARY GLAND, MONKEY
 (3669)
 BREAST
 PATHOLOGICAL CHANGES (3240)
 REPRODUCTIVE SYSTEM, PATHOLOGY,

REVIEW (0922)*
 BREAST TUMOR, INCIDENCE, UNITED STATES
 (1922)
 CANCER, RAT, MOUSE (5775)
 CARCINOGENICITY, RAT, MOUSE, REVIEW
 (5056)*
 CARCINOMA OF CERVIX, INCIDENCE, HUMAN
 (5794)
 CERVIX CARCINOMA, REVIEW (1225)*
 MAMMARY CANCER (1600)
 MAMMARY CARCINOGENESIS, HUMAN (0604)
 VAGINA, CERVIX, CYTOLOGY, HISTOLOGY,
 HUMAN (0971)*

ORAL MUCOSA
 CARCINOMA, VINCENT'S ULCEROUS NECROTIC
 GINGIVITIS, STOMATITIS, CYTOLOGICAL
 STUDIES, HUMAN (3483)*

ORCHIOBLASTOMA
 HISTOPATHOLOGY, HISTOGENESIS, HUMAN
 (6060)*

ORGAN TRANSPLANT
 IMMUNOSUPPRESSION, CANCER, REVIEW
 (0914)*
 KIDNEY, LIP CARCINOMA, CASE REPORT
 (1078)*

OROPHARYNX
 MULTIPLE PRIMARY TUMORS, CLINICAL
 STUDY (4795)*

OSTEOBLASTOCLASTOMA
 MALIGNANT, RADIATION THERAPY, CASE
 REPORT (5870)*

OSTEOBLASTOMA
 MANDIBLE, CASE REPORTS (5566)*

OSTEOOMA
 SKIN, CHILD, CASE REPORT (6209)*

OSTEOSARCOMA
 CELL LINE DERIVATION, CHROMOSOMAL
 ABERRATIONS, HUMAN (4151)*
 FBJ VIRUS TUMOR INDUCTION, HISTO-
 PATHOLOGY, HUMAN, MOUSE (3071)
 GROWTH RATE, RADIONUCLIDE, BEAGLE
 (1104)
 IMMUNOFLUORESCENCE REACTIVITY, HUMAN
 (0158)
 INDUCTION, MOUSE (3765)
 IRRADIATION, HEREDITY, TRANSMISSION,
 REVIEW (1518)*
 MURINE SARCOMA VIRUS, VIRUS-PERSISTENT
 CELL LINE, RAT (5204)
 PHENOTYPES, TUMOR, SYNOVIAL SARCOMA
 (1952)
 PRIMARY, HEART, CASE REPORT (5466)*
 PU239-INDUCED, GROWTH, RAT (5865)*
 PULMONARY METASTASIS, GROWTH RATE,
 HUMAN (2842)
 RADIATION, IMMUNOGENICITY, MOUSE
 (3896)
 VIRAL ETIOLOGY
 IMMUNOLOGICAL EVIDENCE, HUMAN
 (4515)
 REVIEW (2905)

OTORHINOLARYNGOLOGY
 CANCER RISK, REVIEW (2268)*

OVARIAN
 SARCOMA, HUMAN (2153)*
 TUMOR, ELECTROPHORESIS, PROTEINS,
 HUMAN (2107)*

OVARIECTOMY
 MAMMARY TUMOR,
 7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT
 (1546)

OVARY
 ADENOCARCINOMA, HL-A ANTIGENIC LOSS,
 CASE REPORT (4722)*

ANDROBLASTOMA, RADIATION-INDUCED,
 MOUSE (5201)
 ASCITIC TUMOR, RADIORESISTANT CELL
 POPULATION, RAT (6185)*
 BILATERAL FIBROSARCOMA, HYSTERECTOMY,
 CASE REPORT (5622)*
 BRENNER TUMOR
 LEYDIG CELL HYPERPLASIA, CASE
 REPORT (5611)*
 PROLIFERATIVE, MALIGNANT, CLINICAL
 STUDY (5569)*
 CANCER
 CYTOGENETICS, HUMAN (6219)*
 TUMOR ANTIGENS, HUMAN (6045)*
 TUMOR CELL GROWTH, CYTO-
 MORPHOLOGICAL CHARACTERISTICS,
 HUMAN (6192)*
 CARCINOMA
 CELL-MEDIATED IMMUNITY, HUMAN
 (1401)
 CHROMATIN BODIES, HUMAN (2065)*
 EPIDEMIOLOGY, BULGARIA (5423)
 MULTIPLE MALIGNANT TUMORS, HUMAN
 (2820)
 CLEAR CELL CARCINOMA, ENDOMETRIOSIS,
 HUMAN (4226)*
 CYSTIC GRANULOSA, HEMOPERITONEUM,
 HUMAN (2041)*
 CYSTOADENOFIBROMA, HISTOLOGY, CASE
 REPORT (4287)*
 DYSGERMINOMA, LEUKEMIA, SIMULTANEOUS
 OCCURRENCE, CASE REPORT (6230)*
 EPITHELIAL TUMORS, CHILDREN,
 ADOLESCENTS, CLINICAL STUDY (5687)*
 FEMINIZING GONADAL TUMOR, GRANULOSA-
 THECA TUMOR, TUMOR REGISTRY ANALYSIS
 (1445)*
 FEMINIZING TUMORS, CHILDHOOD (6202)*
 GRANULAR CELL TUMORS, MOUSE (6058)*
 GRANULOSA CELL TUMOR, PREGNANCY, CASE
 REPORT (1463)*
 HILAR CELL TUMOR, ULTRASTRUCTURE,
 HUMAN (1134)*
 HYPERPLASIA, ADENOMA, DEVELOPMENT,
 MOUSE (3943)
 LYMPHOMA, CASE REPORT, INDIA (0728)*
 MALIGNANT TUMOR INDUCTION,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 RAT (5858)*
 METASTASES, HUMAN (2187)*
 METASTATIC TUMORS, OVARIA CARCINOMA,
 HISTOPATHOLOGY, HUMAN (6263)*
 MUCINOUS CYSTADENOMA, INTESTINAL
 ANTIGENICITY, HUMAN (1846)*
 MURINE OVARIAN CARCINOMA, LYMPHATIC
 OBSTRUCTION, ASCITES FORMATION,
 MOUSE (3963)*
 NEOPLASMS, INFANTS AND CHILDREN,
 INCIDENCE, FINLAND AND SWEDEN (2854)
 OOPHORECTOMY,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 MAMMARY TUMOR, BIOCHEMICAL CHANGE,
 RAT (0959)
 PERSISTENT ESTRUS, HORMONAL SHIFTS,
 TUMOR LOCALIZATION, RAT (5822)*
 POLYOVARULAR FOLLICLE,
 DIETHYLSTILBESTROL, MONKEY (1620)*
 PRENEOPLASTIC STATE, RNA POLYMERASE,
 ESTRADIOL, MOUSE (0190)
 PRIMARY CARCINOMA, CASE REPORT (5590)*
 RETICULUM CELL SARCOMA, HISTOPATHOLOGY
 CASE REPORT (6252)*
 TERATOMA, ROSENTHAL FIBERS, HUMAN
 (6204)*

TUMOR
 CHILDREN (6199)*
 FREQUENCY, CHILDREN, ADOLESCENT
 (5453)
 GROWTH, MALIGNANCY, PREGNANCY,
 HUMAN (2727)*
 HISTOLOGY, HUMAN (4121)*
 HUMAN (3499)*
 HUMAN, REVIEW (5036)*
 INCIDENCE, PATHOLOGY, CALCUTTA
 (4267)*
 PERITONEAL FLUID, X-IRRADIATION,
 MOUSE (0392)
 PEUTZ-JEGHERS SYNDROME, CASE
 REPORT (4044)
 POST-MENOPAUSAL WOMEN, ENDOCRINE
 STUDY (6111)
 PREGNANCY, INCIDENCE, SINGAPORE-
 MALAYSIA (1424)*
 STROMAL CELL, ENZYME ACTIVITY,
 HUMAN (1153)*
 TUMOR DEVELOPMENT, DYSGENESIS,
 NEONATALLY THYMECTOMIZED, MOUSE
 (2700)*
 TUMOR INDUCTION, 7,12-DIMETHYLBENZ(A)
 ANTHRACENE, HAMSTER (2307)
 TUMOROGENIC, MICE (1158)*
 OVULATION
 URETHANE, RAT (5196)*
 OXYGEN
 CONSUMPTION, GLUCOSE INCORPORATION,
 ATMOSPHERIC MICROCONSTITUENT
 INOCULATION, BUCCAL CELL CULTURES,
 CALF (5179)
 TENSION, MALIGNANT TUMORS, HUMAN
 (6323)*
 OXYMETHOLONE
 ANEMIA, LEUKEMIA, HUMAN (0082)*
 OXYPHENBUTAZONE
 WALKER 256 CARCINOMA, GROWTH,
 SEROMUCOID FRACTION, RAT (1626)*
 OZONE
 LUNG, BENZO(A)PYRENE HYDROXYLASE,
 RABBIT (5803)
 PAGET'S DISEASE
 EXTRAMAMMARY, HISTOCHEMISTRY,
 ULTRASTRUCTURE, CASE REPORT (5685)*
 FAMILIAL OCCURRENCE, SCLEROSIS, CASE
 REPORT (1490)*
 INVASIVE VULVAR, ULTRASTRUCTURE, CASE
 REPORTS (6324)*
 MALE BREAST, CASE REPORT (4979)*
 PERIANAL, ULTRASTRUCTURE, HUMAN
 (3413)*
 SACRUM, SARCOMATOUS DEGENERATION,
 CASE REPORT, REVIEW (2912)*
 VULVA, CASE REPORT (1413)
 VULVA, CHROMOSOME, HUMAN (3940)
 PALATE
 CARCINOMA
 DNA VALUES (1477)*
 EPITHELIAL ATYPIA, HISTOCYTOLOGIC
 STUDY, REVERSE SMOKERS, INDIA
 (4407)
 INCIDENCE, SMOKING, INDIA (0820)*
 REVERSE SMOKING, INDIA (5193)*
 DUCT ALTERATIONS, REVERSE SMOKERS,
 INDIA (5191)*
 PAPILLARY HYPERPLASIA, ENZYME
 HISTOCHEMISTRY, HUMAN (1193)*
 SQUAMOUS CELL CARCINOMAS, HISTOLOGICAL
 STUDY (5581)*
 PANCREAS
 ACINAR CELLS, 4-ACETYLAMINOFLUORENE,

RAT (5169)
 ADENOACANTHOMA, HUMAN (3412)*
 C-TYPE VIRUS, NORMAL MOUSE (4569)
 CANCER
 KARYOLOGIC STUDY, HISTOLOGIC STUDY (6132)*
 MUCOPOLYSACCHARIDE CONTENT, HUMAN (3488)*
 STOMACH, HUMAN, REVIEW (2273)*
 CARCINOID-ISLET CELL TUMOR, AVASCULAR NECROSIS OF BONE, CUSHING'S SYNDROME CASE REPORT (4893)*
 CARCINOMA
 INCIDENCE
 CALIFORNIA (0219)*
 UNITED STATES (1933)*
 ISOANTIGENS, HUMAN (1056)
 PATHOLOGY, HUMAN, REVIEW (1215)*
 THOROTRAST RADIATION, CASE REPORT (0679)*
 UNCINATE PROCESS REGION, CASE REPORTS (4892)*
 DEOXYRIBONUCLEASE, AFLATOXIN, CHEMICAL STRUCTURE, COW (1254)
 EXOCRINE FUNCTION, LEUKEMIA, HUMAN (4107)*
 NON BETA ISLET CELL CARCINOMA, PATHOGENESIS, TREATMENT, HUMAN (4798)*
 NON-G CELL GASTRIN-PRODUCING TUMORS, HUMAN (5618)*
 PANCREATIC ISLET CELLS, BETA CELL TUMORS, ULTRASTRUCTURE, HUMAN (3442)*
 TUMOR
 AMYLOID STROMA, A CELL ADENOMAS, CASE REPORT (4295)*
 INSULIN, HEPATIC LIPOGENESIS, HUMAN (2101)*
 TUMOR INDUCTION
 4-HYDROXYAMINOQUINOLINE-1-OXIDE, RAT (2350)
 URETHANE NARCOSIS, HUMAN (2383)*
 PAIN
 P-DIMETHYLAMINOAZOBENZENE, LIVER TUMORIGENESIS, RAT (4432)
 PILLARY ADENOMA
 NIPPLE, CLINICOPATHOLOGIC STUDY, HUMAN (3524)*
 THYROID, CERVICAL LYMPH NODES, HUMAN, REVIEW (2275)*
 PILLOMA
 CHOROID PLEXUS, ULTRASTRUCTURE, CASE REPORTS (5469)*
 CUTANEOUS, PAPOVA VIRUS, OPOSSUM (3749)
 EPIDERMAL, QUININE-SULFATE TREATMENT, REVERSION OF GROWTH, EEL (3362)*
 INDUCTION
 7,12-DIMETHYLBENZ(A)ANTHRACENE, MOUSE (0350)
 3-METHYLCHOLANTHRENE, NONIMMUNE REGRESSION, MOUSE (1381)
 SHOPE VIRUS, DNA REPLICATION, MOLECULAR HYBRIDIZATION, RABBIT (5881)
 SPONTANEOUS, SHOPE PAPILLOMA VIRUS, RABBIT KIDNEY VACUOLATING, RABBIT (5259)
 PILLOMATOSIS
 NASAL CAVITY, PARANASAL SINUSES, CLINICOPATHOLOGIC STUDY (5508)*
 RA-AMINOBIIPHENYL
 BLADDER CANCER, OCCUPATIONAL HAZARD, HUMAN (0982)*
 PARAFFIN
 POLYMER, ENDOMETRIUM, SQUAMOUS CELL CARCINOMA, RAT (0948)
 PARAPROTEINEMIA
 IMMUNOGLOBULIN DETERMINATION, HUMAN (1857)*
 PARASITE
 CARCINOGENESIS, MAN (0313)*
 TRICHINELLA, MUSCLE TUMOR, RAT (0594)*
 PARASITISM
 GROWTH, TUMOR CELLS, HAMSTER, RAT (5301)
 PARATHYROID
 ADENOMA, HYPERPLASIA, ULTRASTRUCTURE, MAN (0539)
 PAROTID
 ANGIOMA, CASE REPORTS (3565)*
 GLYCOGEN-RICH ADENOMA, CASE REPORT (4898)*
 LIPOMA, CASE REPORT (3564)*
 MOUTH, MUCOEPIDERMOID TUMOR, HISTOCHEMISTRY, HUMAN (6228)*
 PAROTID GLAND
 ADENOID CYSTIC CARCINOMA, ULTRASTRUCTURE (0228)
 ANAPLASTIC CARCINOMA, MORPHOLOGY, INCIDENCE, ALASKA (4232)*
 CARCINOMA, ACINIC CELL, ULTRASTRUCTURE HUMAN (2135)*
 EPITHELIOMA, PATHOLOGICAL ANATOMY, CASE REPORT (4208)*
 MENGIOMA, CASE REPORT (1091)*
 ONCOCYTOMA, BENIGN, MALIGNANT, CASE REPORTS (6157)*
 PASTEUR EFFECT
 ASCITES TUMOR CELL (1466)*
 PATHOGENESIS
 CARCINOMA LOBULARE IN SITU, NOSOLOGY, HUMAN (3956)*
 ENVIRONMENTAL FACTOR, HUMAN TUMORS, CIGARETTE SMOKING, REVIEW (0625)*
 GASTRIC CARCINOMA, LYMPHOCYTIC LEUKEMIA (1907)*
 HODGKIN'S DISEASE, HYPOTHESIS, VIRAL INFECTION, HOST IMMUNITY (3237)
 LEUKEMIA, REGULATORY ABNORMALITY, REVIEW (1529)*
 LUNG CARCINOMA, CHRONIC FIBROSIS, HUMAN (0497)*
 MALIGNANT LYMPHOMA, CHRONIC ANTIGENIC STIMULATION (0322)*
 MAREK'S DISEASE, CHICKEN, IMMUNO-FLUORESCENT ANTIGEN, LYMPHOID LESION (0786)
 MUTATION, REVIEW (0925)*
 PRECANCEROUS CHANGES, IMMUNE MECHANISMS, HUMAN, REVIEW (2267)*
 PATHOLOGY
 ACUTE LEUKEMIA, STATISTICS, HUMAN (4286)*
 GIANT CELL TUMORS, SKULL, HUMAN (4290)*
 GROWTH RATE, HUMAN TUMORS (0493)
 HEPATIC HEMANGIOENDOTHELIOMA, HUMAN (4244)*
 HODGKIN'S DISEASE, IDIOPATHIC THROMBOCYTOPENIC PURPURA, HUMAN (4061)*
 KAPOSI'S SARCOMA, PATHOLOGY, IMMUNOLOGY, CHILDREN (4199)*
 KAPOSI'S SARCOMA, UGANDA, CLINICAL CLASSIFICATION (0891)*
 MALIGNANT GIANT CELL TUMOR, SOFT PARTS

- HUMAN (4219)*
 MIDLINE MALIGNANT RETICULOSIS, CASE REPORTS (4064)*
 MULTIPLE PRIMARY MALIGNANCIES, COLON, CASE REPORT (4192)*
 OCCULT SEMINOMA, CASE REPORTS (4085)*
 OVARIAN TUMORS, INCIDENCE, CALCUTTA (4267)*
 PLASMACYTOMA, UPPER RESPIRATORY AND DIGESTIVE TRACT, HUMAN (4094)*
 PNEUMATOSIS CYSTOIDES INTESTINALIS, ACUTE LEUKEMIA, CASE REPORTS (4060)*
 TUMOR, IMMUNOLOGY, REVIEW (2295)*
 UROTHELIAL NEOPLASM, MORPHOLOGY, HUMAN (4269)*
 PELGER-HUET ANOMALY
 FAMILIAL LEUKEMIA, CHROMOSOME, ICELAND (6117)
 PELVIS
 CARCINOMA, PHENACETIN, CASE REPORTS (5134)
 PENICILLIN
 CARCINOGENICITY, MECHANISM, ALKYLATION PROCESS (0076)
 PENICILLIUM
 CARCINOGENICITY, RAT (1550)
 PENIS
 CANCER, METASTASIS TO THUMB, CASE REPORT (5674)*
 CARCINOMA
 INCIDENCE
 GERMANY (6100)*
 UGANDA (0211)*
 MALIGNANT MELANOMA, CASE REPORT (4144)*
 PERICARDIUM
 TUMOR, RADIOLOGY, RAT (0494)*
 PERIPHERAL NERVOUS SYSTEM
 N-METHYLNITROSUREA, TUMORS, DOG (5088)
 PERITONEAL
 METASTASIS, CERVIX, REVIEW (1524)*
 PERITONEAL CAVITY
 LYMPHOCYTE, CYTOTOXICITY, LEUKEMIA, MOUSE (5307)
 PERITONEUM
 PHYTOHEMAGGLUTININ, CELL PROLIFERATION RAT (0777)*
 TUMOR, ADENOVIRUS TYPE 12, TRANSFORMATION, HAMSTER (3078)
 PERMEABILITY
 HEPATOMA CELLS, JUNCTIONS (1985)
 PESTICIDE
 CARCINOGENICITY, GOVERNMENT REPORT (1599)
 LEUKEMIA, ENVIRONMENTAL HAZARD, POLAND (5417)
 PET
 EXPOSURE, LEUKEMIA, INCIDENCE (6084)
 PHAGOCYTE
 ALKALINE PHOSPHATASE
 CHRONIC MYELOID LEUKEMIA, REVIEW (1213)*
 LEUKEMIA, HUMAN (1495)*
 PHAGOCYTOSIS
 BLAST CELLS, MATURATION, AUTORADIOGRAPHY, HUMAN (2123)*
 CYTOCHEMISTRY, ULTRASTRUCTURE, MESOTHELIAL CELLS, TUMOR CELLS, HUMAN (2083)*
 IMMUNE, MALIGNANT MELANOMA CELLS, HUMAN (6038)*
 LIVER, KUPFFER CELL, HUMORAL RECOGNITION FACTOR, LEUKEMIA, RAT (5298)
 OPSONIN CHANGES, CELLULAR INFLUENCES, TRANSPLANTABLE TUMOR GROWTH, RAT (3192)
 PHARMACOLOGY
 ENDOCRINE DISORDER, GROSS, PROGNOSIS, REVIEW (1527)*
 PHARYNX
 CANCER
 INCIDENCE, INDIA (1226)*
 PATTERN OF LYMPHATIC SPREAD, HUMAN (3395)*
 CARCINOMA, CIGARETTE SMOKING, HUMAN (1272)
 EPIDERMAL CARCINOMA, HUMAN, REVIEW (4327)*
 LARYNX
 CARCINOMA, RADIATION, HUMAN (0027)*
 PRECANCEROUS CONDITION, HUMAN (0498)*
 MALIGNANT TUMOR, INCIDENCE, POLAND (1938)*
 MENINGIOMA, CASE REPORT (1090)*
 PHENACETIN
 ABUSE, RENAL PELVIC CARCINOMA, HUMAN (0973)*
 PELVIC CARCINOMA, CASE REPORTS (5134)
 1,10-PHENANTHROLINE
 PATHOLOGIC CHANGES, LIVER, ETHIONINE FED RATS (4461)*
 PHENETHYL NITROGEN MUSTARD
 MUTAGENIC EFFECT, ASPERGILLUS NIDULANS (1653)*
 PHENMETRAZINE
 CONVERSION, N-NITROSO DERIVATIVE, RABBIT (2978)
 PHENOBARBITAL
 2-ACETYLAMINOFLUORENE, LIVER TUMOR, RAT (5084)
 GROWTH, ALLOGENEIC SARCOMA, RAT (4167)*
 LIVER, ENDOPLASMIC RETICULUM, PROLIFERATION, ULTRASTRUCTURE, RAT (1655)*
 LIVER BINDING, RAT (5127)
 LIVER CARCINOMA, 2-ACETYLAMINOFLUORENE RAT (1244)
 LIVER MICROSOMAL AZOREDUCTASE, 2,4-DICHLORO-6-PHENOXYETHYLAMINE, BETA-DIETHYLAMINOETHYL DIPHENYL-PROPYLACETATE, RAT (1627)*
 LUNG, LIVER, METAL DISTRIBUTION, MICROSOMAL ENZYMES, RAT (4403)
 MICROSOME, DRUG METABOLIZING ENZYME, INDUCTION, REPRESSION, THEORETICAL MODEL (1578)
 TUMOR PROMOTION, ACETYLAMINOFLUORENE, RAT (0934)
 PHENOBARBITONE
 AFLATOXIN, REDUCED CARCINOGENICITY, RAT (0084)*
 PHENOTYPES
 TUMOR, OSTEOSARCOMA, SYNOVIAL SARCOMA (1952)
 PHENYL-DIMETHYL-TRIAZENE
 NERVOUS SYSTEM TUMORS, INDUCTION, RAT (5111)
 PHENYLALANINE
 DEFICIENCY
 HYPERPLASTIC ALVEOLAR NODULE, MAMMARY TUMOR, INHIBITION, MOUSE (1243)
 MAMMARY TUMOR VIRUS ACTIVITY,

MOUSE (4606)*
 MAMMARY TUMORIGENESIS, PITUITARY
 ISOGRAFT, MOUSE (2932)
 LEUKEMIC CELL, PROTEIN SYNTHESIS
 INHIBITION, E. COLI, MOUSE (1624)*
 ENYLBUTAZONE
 BONE MARROW, HAMSTER (1654)*
 CHROMOSOME DAMAGE, LEUKEMIA, CASE
 REPORT (1292)*
 PHENYL-3,3-DIMETHYLTRIAZENE
 MUTAGENICITY, NEUROSPORA CRASSA
 (2401)*
 PHENYL-3-MONO-METHYLTRIAZENE
 MUTAGENICITY, NEUROSPORA CRASSA
 (2401)*
 ENYTOIN
 CARCINOGENICITY, MOUSE (2376)*
 ECHROMOCYTOMA
 ADRENAL AND EXTRA-ADRENAL,
 BIOCHEMISTRY, ULTRASTRUCTURE, CASE
 REPORTS (3372)*
 ATYPICAL, HUMAN (3482)*
 BENIGN, MALIGNANT, DNA CONTENT,
 CYTOPHOTOMETRIC STUDY (3291)
 MEDULLARY THYROID CARCINOMA, SIPPLE'S
 SYNDROME, FAMILIAL OCCURRENCE (1443)
 URINARY CATECHOLAMINES, CLINICAL STUDY
 (4995)*
 PHILADELPHIA CHROMOSOME
 ORIGIN, MYELOID LEUKEMIA, HUMAN
 (0273)*
 ORBOL
 DERIVATIVES, INFLAMMATORY ACTION,
 COCARCINOGENIC ACTION, RELATIONSHIP
 (5853)*
 DIESTERS, PRECURSOR INCORPORATION,
 DNA, RNA, PROTEIN, EPIDERMIS, MOUSE
 (1245)
 DIMETHYLNITROSAMINE, LUNG CARCINO-
 GENESIS, HEPATOMA, MOUSE (4392)
 ESTER, CROTON OIL, COCARCINOGENESIS
 (0619)*
 SKIN, TUMOR PROMOTION, MOUSE (0653)*
 ORBOL ESTER
 CARCINOGENESIS PROMOTION, BETA
 IRRADIATION, MOUSE (0993)
 COCARCINOGENESIS, ACTION MECHANISMS
 (5857)*
 SKIN, TUMORIGENESIS, MOUSE (2927)
 TUMOR PROMOTION, SKIN, MOUSE (3680)
 ORBOL MYRISTATE ACETATE
 TUMOR PRODUCTION, CELLULAR INTER-
 ACTIONS, MOUSE (2418)*
 OSPHATE
 INCREASE IN TUMORS, VITAMIN K1,
 SYNTHETIC SUBSTITUTES (4485)*
 OSPHATIDYLCHOLINE
 SYNTHESIS, MEMBRANE PROLIFERATION,
 MAMMARY GLAND TISSUES, MOUSE (6052)
 OSPHOLIPID
 ACYL GROUP CHANGE, TRANSFORMED CELL,
 ROUS SARCOMA VIRUS, CHICKEN (5248)
 OSPHOROUS
 CALCIUM, MAGNESIUM, TUMOR, HUMAN,
 ANIMAL (0538)
 OTOCARCINOGENICITY
 BENZO(A)PYRENE, ANTIOXIDANTS,
 PROTECTION, RAT (0352)
 OTOLYSIS
 DECOMPOSITION, N-NITROSAMINES (1647)*
 THIAZID
 CARCINOGENESIS, MOUSE (5821)*
 TUBAZID, CARCINOGENESIS, MOUSE (5096)
 YSOSTIGMINE

METHYLZOXYMETHANOL ACETATE, ACTIVA-
 TION, SERUM FACTOR, HELA CELLS
 (4411)
 PHYTOAGGLUTININ
 CYTOTOXICITY, YOSHIDA SARCOMA CELLS
 (6006)*
 PHYTOHEMAGGLUTININ
 ACUTE LEUKEMIA, CELL TYPE, HUMAN,
 REVIEW (4357)*
 ARYL HYDROCARBON HYDROXYLASE,
 3-METHYLCHOLANTHRENE, LEUKOCYTE,
 HUMAN (5121)
 BLASTIC STIMULATION, ROSSETTE TEST,
 CANCER PATIENTS (5961)
 BLASTIC TRANSFORMATION, LYMPH NODE
 CELLS, HODGKIN'S DISEASE PATIENTS
 (6030)*
 BLASTOGENIC EFFECT, MURINE LYMPHOCYTES
 MOUSE (2098)*
 CELL PROLIFERATION, PERITONEUM, RAT
 (0777)*
 IMMUNE RESPONSE SUPPRESSION, GUINEA
 PIG (3907)
 INHIBITION, LYMPHOCYTE, TRANSFORMATION
 SERUM (0454)
 LEUKEMIC LYMPHOCYTES, IMMUNE
 REACTIVITY, METABOLISM, LEUKEMIA
 PATIENTS (5975)
 LYMPHOCYTE STIMULATION, CHRONIC
 LYMPHOCYTIC LEUKEMIA, HUMAN (5811)
 LYMPHOCYTE TRANSFORMATION
 LYMPHOPROLIFERATIVE DISEASE
 PATIENTS (6032)*
 LYSOSOME FORMATION, ENDOCYTOSIS
 (3435)*
 LYMPHOCYTES, PROTEIN SYNTHESIS,
 IN VITRO, HUMAN (0840)
 LYMPHOMA, DNA SYNTHESIS, AGGLUTINATION
 MOUSE (4646)
 ORNITHINE DECARBOXYLASE INDUCTION,
 CULTURED LYMPHOCYTES, HUMAN (6294)*
 POKEWEED MITOGEN, CHRONIC LYMPHOCYTIC
 LEUKEMIA PATIENTS (6005)*
 RESPONSE IMPAIRMENT, SPLEEN LYMPHOCYTE
 MAREK'S DISEASE, CHICKEN (4672)
 TOTAL BODY IRRADIATION, CULTURED BONE
 MARROW CELLS, HUMAN CHROMOSOMAL
 ABERRATION (0103)
 TRANSFORMATION, LYMPHOCYTE, INFANT
 (0873)*
 PINEAL GLAND
 DEGENERATION, CANCER PATIENTS (4006)
 TUMOR, LIPID CONTENT, RAT (2858)
 PITUITARY
 ACIDOPHIL ADENOMAS, INTRACYTOPLASMIC
 FILAMENTOUS AGGREGATES, ULTRASTRUCTURE,
 HUMAN (5694)*
 ADENOMA, ULTRASTRUCTURE, PROLACTIN
 CELLS, HUMAN (0573)*
 ISOGRAFT, MAMMARY TUMORIGENESIS, MOUSE
 (4846)
 LESIONS, HYPOTHALAMUS, MICE (2004)
 LYMPHOID SYSTEM, IMMUNODEFICIENCY,
 DWARF MOUSE, AMES (3229)*
 SPONTANEOUS RUMORS, CHARACTERIZATION,
 INCIDENCE, RAT (4965)*
 TRANSPLANTABLE THYROTROPIC TUMOR,
 ULTRASTRUCTURE, MOUSE (2900)*
 TUMOR
 CAPILLARY BED, ULTRASTRUCTURAL
 CHANGES, HUMAN (5528)*
 ESTROGEN INDUCED, CELL CHANGES,
 RAT (2416)*
 GRAFT, DIETHYLSYLBESTEROL, RAT

- (2344)
 GROWTH HORMONE, HUMAN (1135)*
 HIGH PLASMA THYROTROPHIN LEVELS,
 CASE REPORTS (5614)*
 INCIDENCE, UGANDA (0212)*
 MAMMOTROPIC HORMONE
 SOMATOTROPIC HORMONE, RAT
 (0586)*
 SOMATOTROPIC HORMONE, SERUM,
 RAT (0587)*
 TRANSPLANTATION, METASTASIS,
 OVARY, BONE, RAT (0998)*
 PITUITARY GLAND
 ISOGRAFT, MAMMARY TUMORIGENESIS,
 PHENYLALANINE DEFICIENCY, MOUSE
 (2932)
 PLACENTA
 ANTIGEN, MALIGNANT TUMOR, HUMAN (5318)
 IMPENETRABILITY TO MATERNAL LEUKEMIA
 CELLS, MOUSE (2643)
 PLANT
 EDIBLE, CARCINOGENICITY, RAT (3707)
 EXTRACTS, ESOPHAGEAL CANCER,
 TUMORIGENESIS, CURACAO (0079)
 PLAQUE-FORMING CELL RESPONSE
 SPLEEN, GRAFT-VERSUS-HOST REACTION,
 SHEEP RED BLOOD CELL, RAT (1790)
 PLASMA
 AMINO ACID, ACUTE LEUKEMIA, HUMAN
 (0646)*
 AMINO ACID ANALYSIS, ABNORMAL OROSOMU-
 COID, ACUTE LEUKEMIA PATIENTS
 (5511)*
 COPPER LEVELS, MORRIS HEPATOMA GROWTH,
 RAT (6243)*
 ERYTHROPOISES (2000)
 LYMPHOCYTE INHIBITION, CARCINO-
 EMBRYONIC ANTIGEN, SERUM ALPHA-
 GLOBULIN, COLON CANCER, HUMAN (3181)
 MEMBRANE
 ADENYL CYCLASE, HEPATOMA,
 HORMONE, RAT (1128)
 HEXOKINASE ACTIVITY, MORRIS
 HEPATOMA, MOUSE (1137)*
 PLATELET AGGREGATION, MYELOPROLIFERA-
 TIVE DISEASE, HUMAN (4242)*
 PROLIFERATION, CHEDIAK-HIGASHI'S
 SYNDROME, ALEUTIAN DISEASE, MINK
 (1433)
 PROTEIN SYNTHESIS, HEPATOCELLULAR
 CARCINOMAS, HEPATIC NODULES,
 N-2-FLUORENYLACETAMIDE, LIVER, RAT
 (4402)
 RAUSCHER VIRUS, ULTRACENTRIFUGATION
 STUDY, MOUSE (1769)*
 TUMOR, L-HYDROXYPROLINE, CHICKEN
 (1188)*
 PLASMA CELL
 LEUKEMIC, ULTRASTRUCTURE, MULTIPLE
 MYELOMA, CASE REPORT (6346)*
 PROLIFERATION, CAVERNOUS HEMANGIOMA,
 CASE REPORT (6359)*
 TUMORS
 ANTIBODIES, MOUSE (6022)*
 PLOIDY FLUCTUATION, TRANS-
 PLANTATION, MOUSE (2015)
 PLASMA CELL TUMOR
 IGA MYELOMA PROTEIN, MOUSE (5314)
 PLASMA MEMBRANE
 ALKALINE PHOSPHATASE ACTIVITY, LIVER,
 RAT (3450)*
 CHEMICAL COMPOSITION, HEPATOMAS, LIVER
 MOUSE, RAT (6112)
 ELECTROCONDUCTIVITY CHANGES, EHRLICH
 ASCITES TUMOR CELLS, MITOTIC CYCLE,
 MOUSE (4866)
 ERYTHROCYTES, REPLICATION OF FELINE
 C-TYPE VIRUS (4608)*
 ISOLATION, CHARACTERIZATION,
 CARBOHYDRATE COMPOSITION, ONCOGENIC
 RNA VIRUS-CONVERTED, CHICK EMBRYO
 FIBROBLASTS (4557)
 ISOLATION, CHARACTERIZATION, LEUKEMIA
 CELLS (2172)*
 LIPID COMPOSITION, HEPATOMA, RAT,
 MOUSE (6115)
 LIVER, ASCITES HEPATOMA, SURFACE
 STRUCTURE, RAT (2016)
 STRUCTURAL COMPONENTS, NORMAL CELLS,
 TUMOR CELLS, RAT (6182)*
 PLASMACYTOMA
 ASCORBIC ACID, CULTURE REQUIREMENT,
 RAT (1448)*
 BENGE-JONES TYPE LIGHT CHAIN,
 SECRETION, MOUSE (4707)*
 CELL-FREE TRANSMISSION, MOUSE (3780)
 CELL LINE, CULTIVATION IN SERUM-
 DEPRIVED MEDIA (6372)*
 CELL-MEDIATED IMMUNITY, MACROPHAGE
 MIGRATION INHIBITION, MOUSE (3893)
 COLON, MORPHOLOGY, CASE REPORT (4059)*
 GROWTH, PERITONEUM, MINERAL-OIL
 CONDITIONING, MOUSE (3946)
 GROWTH QUANTITATION, PARAPROTEIN
 IMMUNOASSAY, MOUSE (5312)
 HIPA, TRANSPLANTATION INHIBITION,
 SPLEEN CELL, MOUSE (5902)
 IMMUNOGLOBULIN CONTENT (2661)*
 IMMUNOGLOBULIN CONTROL MECHANISMS,
 CLINICAL STUDY (6044)*
 B LYMPHOCYTE, IMMUNOGLOBULIN RECEPTOR,
 MOUSE (3853)
 MEMBRANE ANTIGEN, IMMUNOCHEMISTRY,
 MOUSE (1859)*
 POLYMER FORMATION, J CHAIN SYNTHESIS,
 MOUSE (4760)*
 PYRROLIDONECARBOXYLIC ACID DECYCLASE,
 PROTEIN BIOSYNTHESIS, HUMAN (0890)*
 RNA, SURFACE IMMUNOGLOBULINS,
 LYMPHOCYTES, MOUSE (4766)*
 TRANSPLANTABLE, GROWTH, DIFFERENTIA-
 TION, MOUSE (1905)*
 UPPER RESPIRATORY AND DIGESTIVE TRACT,
 PATHOLOGY, HUMAN (4094)*
 PLEURA
 MALIGNANT FIBROUS MESOTHELIOMA,
 ULTRASTRUCTURE, CASE REPORT (5475)*
 MESOTHELIOMA, ASBESTOS, FIBROUS GLASS,
 RAT (3676)
 PLURONIC-F68
 METASTASIS, RAT (2356)
 PLUTONIUM
 RADIATION, BONE, RAT (5198)
 PNEUMONIA
 PNEUMOCYSTIS CARINII, MALIGNANT
 DISEASE, CHILDREN (3387)*
 PNEUMOSCLEROSES
 PULMONARY CARCINOMA, HUMAN (1899)*
 POKEWEE MITOGEN
 LYMPHOCYTE STIMULATION, CHRONIC *
 LYMPHOCYTIC LEUKEMIA, HUMAN (5811)
 POLIO
 IMMUNIZATION, SV40, ANTIBODY, SERUM,
 HUMAN (1039)*
 POLLUTION
 OIL MIST, OCCUPATIONAL HAZARD,
 ENVIRONMENTAL HAZARD, REVIEW (5750)*
 OZONE, NITROGEN DIOXIDE, LUNG.

BENZO(A)PYRENE HYDROXYLASE, RABBIT (5803)

PARTICULATE POLLUTANTS, CARCINOGENICITY, NEW YORK CITY, MOUSE (4366)

PETROLEUM, CONTAMINATED FISH, ANALYSIS, JAPAN (1618)*

SMOG RESIDUE, BENZO(A)PYRENE, RAUSCHER LEUKEMIA VIRUS, TRANSFORMATION, RAT, HAMSTER (0059)

SOOT, ARENES, LIGHT RADIATION (0097)*

YADENYLIC ACID

CHEMICAL, PHOTOCHEMICAL AND PHYSICAL PROPERTIES, N-ACETOXY-2-ACETYLAMINO-FLUORENE TREATMENT (2994)

YAMINE

CONTENT, HEPATOMA, RAT (5620)*

GROWTH REGULATION, MENINGIOMA (1451)*

YCATION

CHITOSAN, LEUKEMIC CELL AGGREGATION, MOUSE (0829)

MYXOMA VIRUS INFECTION, RESTRICTION, RABBIT (3143)

YCYCLIC AMINES

SKRAUP REACTIONS, ANTI-MARCKWALD ORIENTATION (2373)*

YCYCLIC AROMATIC HYDROCARBON

METABOLISM, PROSTATE CELL, MOUSE (4424)

TRANSFORMATION, MICROSOMAL MIXED-FUNCTION OXIDASE, INDUCTION, MOUSE PROSTATE CELL (5173)

YCYCLIC HYDROCARBON

AROMATIC, BINDING, DNA, RNA AND PROTEIN, TRANSFORMED CELLS, HAMSTER (3672)

ARYL HYDROCARBON HYDROXYLASE

CYCLOHEXIMIDE, ACTINOMYCIN D, RAT LIVER (1241)

STIMULATION, LIVER CELL, RAT (1252)

ENZYME INDUCTION, METABOLISM, PREGNANT AND FETAL RATS (5133)

EPOXIDES

FRAMESHIFT MUTAGENS, SALMONELLA (2984)

MALIGNANT CELLULAR TRANSFORMATION, PROSTATE, MOUSE (2304)

TRANSFORMATION, HAMSTER CELL (4445)

METABOLISM, LIVER, EPOXIDES, RAT (1533)

MICROSOME, DRUG METABOLIZING ENZYME, INDUCTION, REPRESSION, THEORETICAL MODEL (1578)

MOLECULAR MECHANISMS, K AND L REGIONS (5147)

NEOPLASTIC TRANSFORMATION, CLONED CELL LINES, MOUSE (5770)

TOBACCO CONDENSATES, ESTERASE ACTIVITY EFFECT, SEBACEOUS GLANDS, MOUSE (2331)

TRANSFORMATION, HAMSTER (1535)

LYCYTHEMIA

CHROMOSOME, LEUKEMIA, MYELOIC FIBROSIS HUMAN (0562)*

PRIMARY, CHROMOSOME ABERRATION, BONE MARROW CELL, HUMAN (1122)

LYCYTHEMIA VERA

ACUTE ERYTHROCYTIC LEUKEMIA, CASE REPORT (4148)*

BONE MARROW, ERYTHROPOIETIN, HUMAN (4039)

LYELECTROLYTE FILM

IMPLANTATION, CARCINOGENESIS, RAT (0038)

POLYINOSINIC-POLYCYTIDYLIC ACID

ANTIBODY, HERPESVIRUS SAIMIRI, GOAT (0491)*

IMMUNE RESPONSE, MOUSE (2637)

IMMUNOSUPPRESSION, GROSS LEUKEMIA VIRUS, MOUSE (1853)*

INTERFERON INDUCTION, CARCINOMA (0021)*

3-METHYLCHOLANTHRENE, TUMORIGENESIS, INHIBITION, MOUSE (0066)

MOLONEY MURINE SARCOMA VIRUS, TUMOR INDUCTION, MOUSE (0417)

MURINE LEUKEMIA VIRUS, MURINE SARCOMA VIRUS, TUMORIGENESIS, MOUSE (0123)

TUMOR GROWTH, INHIBITION MECHANISM, IMMUNITY, RAT (5350)

POLYLYSINE

RESTRICTION OF MYXOMA VIRUS INFECTION, RABBIT (3143)

POLYMER

ORGANIC, BIOCOMPATIBILITY, TOXICOLOGY, REVIEW (3642)*

PARAFFIN, ENDOMETRIUM, SQUAMOUS CELL CARCINOMA, RAT (0948)

POLYNUCLEAR HYDROCARBON

ANTHANRENE, SKIN CARCINOGENESIS, MOUSE (5142)

POLYNUCLEOTIDE

CHEMICAL CARCINOGEN, AROMATIC HYDROCARBON, FREE RADICAL, COVALENT BONDING (0354)

POLYNUCLEOTIDE LIGASE

DNA SYNTHESIS, ASCITES HEPATOMA, RAT (4043)

POLYORNITHINE

RESTRICTION OF MYXOMA VIRUS INFECTION, RABBIT (3143)

POLYPEPTIDE

SV40, DEOXYRIBONUCLEOPROTEIN COMPLEX (4516)

SYNTHESIS

MURINE SARCOMA-LEUKEMIA VIRUS, IMMUNOLOGICAL STUDIES, RAT CELLS (5347)

80 S RIBOSOMES, ASCITES TUMOR CELL (6284)*

POLYPEPTIDE CHAINS

DETECTION, MYELOMA, HUMAN (2090)*

C-R POLYPHOSPHATES

ACTION, NORMAL AND TUMOR BEARING MICE (2883)*

POLYPROPYLENE

CARCINOGENICITY, MOUSE (0037)

POLYPS

ADENOMATOUS, COLON, RECTUM, CARCINOMA, EPIDEMIOLOGY (0023)*

CARCINOMA, 2-3'-DIMETHYL-4-AMINO-BIPHENYL, COLON, RAT (0336)

COLON

EPITHELIAL GROWTH, CARCINOMA, PATHOGENESIS, HUMAN (0504)*

IMMUNOFLUORESCENCE, HUMAN (4624)

MUCOSAL DIFFERENTIATION, HUMAN (0197)*

NOSOLOGY (0195)*

RECTUM

MALIGNANT TRANSFORMATION, HUMAN, REVIEW (0629)*

OCCURRENCE, ADULT (0801)*

COLON POLYPOSIS, HEREDITY, CLINICAL COURSE, HUMAN (1147)*

COLONIC CARCINOMA, MALIGNANT CHANGE,

HUMAN (0495)*
 POLYPOSIS, COLON, RECTUM, REVIEW
 (0804)*
 RECTUM
 COLON
 HUMAN, REVIEW (0628)*
 PATHOLOGY (0802)*
 POLYRIBOADENYLIC ACID
 RNA TUMOR VIRUSES (3802)
 POLYRIBOINOSINIC-POLYRIBOCYTIDYLIC ACID
 MURINE SARCOMA VIRUS, TUMOR INDUCTION,
 MOUSE (3764)
 POLYRIBOSOME
 RAT LIVER, BENZENE (0943)
 POLYSACCHARIDE
 MUCO, PROTEIN, ISOLATION, CHONDRO-
 SARCOMA RAT (0293)*
 MUCOSUBSTANCES CONTENT, SILICONE-
 INDUCED TUMORS, RAT (2443)*
 POLYSOME
 CELL-SPECIFIC, INHIBITION, HERPESVIRUS
 (1717)
 DISAGGREGATION, LIVER, DIMETHYL-
 NITROSAMINE, LASIOCARPINE,
 2-DIETHYLAMINOETHYL-2,2-DIPHENYL-
 VALERATE, MOUSE (1652)*
 POLYTHENE IMINE
 FRIEND VIRUS DEVELOPMENT, MOUSE
 (1770)*
 POPULATION DENSITY
 ASCITES TUMOR DEVELOPMENT, MOUSE
 (1469)*
 PORPHYRIN
 ORGAN CONTENTS, KIDNEY, LEAD ACETATE,
 RAT (5085)
 PRECANCEROUS CONDITION
 CERVIX, CARCINOMA IN SITU, HERPESVIRUS
 HOMINIS ANTIBODY, HUMAN (0462)
 DUBREUILH MELANOSIS, MUCOUS MEMBRANE,
 ULTRASTRUCTURE, HISTOLOGY (3235)
 HORMONE DISTURBANCES, WOMEN (3236)
 IMMUNOLOGY, MORPHOLOGY, GROWTH, REVIEW
 (1512)
 LARYNX, PHARYNX, HUMAN (0498)*
 LEUKEMIA, VIRUS, ANTIGEN (0014)*
 MAMMARY GLAND, NEOPLASIA, DNA
 DISTRIBUTION, HUMAN (0788)
 MORPHOLOGY, METAPLASIA, HUMAN (1889)
 SKIN, DNA (1900)*
 PRECANCEROUS LESIONS
 LARYNX, MORPHOLOGY, HISTOLOGY (1908)*
 STOMACH CANCER, PATHOLOGY, CHILE
 (1892)
 PREDNISONE
 SARCOMA GROWTH, 3-METHYLCHOLANTHRA-
 CENE (1604)*
 PREGNANCY
 CHORIOEPITHELIOMA, ALGERIAN WOMEN,
 INCIDENCE (1421)*
 CYCLAMATE, TISSUE DISTRIBUTION, RAT
 (0951)
 GRANULOSA CELL TUMOR, OVARY, CASE
 REPORT (1463)*
 HODGKIN'S DISEASE, HUMAN (6387)*
 LEUKEMIA, SERUM PROTEIN RESPONSE,
 MOUSE (4046)
 MAMMARY TUMORIGENESIS, MOUSE (4846)
 OVARIAN TUMOR, INCIDENCE, SINGAPORE-
 MALAYSIA (1424)*
 TROPHOBLASTIC TUMOR, HOST CONDITIONS,
 HUMAN (1812)
 TUMOR, COINCIDENCE (0862)*
 VIRILIZING LUTEOMA
 STEROID HORMONE CONTENT, HUMAN
 (1140)*, (1177)*
 PREGNANEDIOL
 LIVER CANCER, P-DIMETHYLAMINOAZO-
 BENZENE, RAT (5769)
 PREINVASIVE
 CHROMOSOMES, INVASIVE CERVICAL
 CARCINOMA (1950)
 PRENEOPLASTIC CELL
 DEVELOPMENT, FOREIGN BODY
 TUMORIGENESIS, MOUSE (0995)
 PRIMARY
 TUMORS, MALIGNANT, SIMULTANEOUS, HUMAN
 (2074)*
 PRIMATE
 VIROLOGY, REVIEW (1212)*
 PROADIFEN
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 BLOOD CHANGES, RAT (1571)
 PROCARBAZINE HYDROCHLORIDE
 LEUKEMIA, MONKEY (0035)
 PROGESTERONE
 CARCINOGENESIS
 DNA SYNTHESIS, MAMMARY GLAND, RAT
 (4364)
 MAMMARY TUMOR, PROLACTIN,
 PITUITARY, MOUSE (2950)
 ESTRADIOL BENZOATE, METHYLCHOLANTHRENE
 CERVICAL CARCINOGENESIS, MONKEY
 (0095)*
 MAMMARY TUMOR,
 7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT
 (1546)
 PROGNOSIS
 PHARMACOLOGY, ENDOCRINE DISORDER,
 GROSS, REVIEW (1527)*
 PROLACTIN
 CARCINOGENESIS, MAMMARY TUMOR, MOUSE
 (2942)
 EFFECT ON DNA SYNTHESIS, INDUCED
 MAMMARY TUMOR, RAT (2306)
 ESTROGEN INHIBITION, MAMMARY TUMOR
 GROWTH, RAT (0830)
 PITUITARY, ADENOMA, ULTRASTRUCTURE,
 HUMAN (0573)*
 PROLIFERATION
 ANTIBODY-FORMING CELL, LYMPH, SHEEP
 (1874)*
 BILE-DUCT CELLS,
 2,7-FLUORENYLBISACETAMIDE, FEMALE
 MICE (4453)*
 BLAST CELL, CHROMOSOMAL TRANSLOCATION,
 PERINATAL LEUKEMIA, CASE REPORT
 (5477)*
 BONE MARROW, BLOOD CELL, LEUKEMIA,
 REVIEW (2224)*
 CELL
 ACUTE LEUKEMIA, HUMAN (2860)
 NUCLEAR ACIDIC PROTEIN, REVIEW
 (1209)
 PANCREATIC ACINAR EPITHELIA,
 AUTORADIOGRAPHIC STUDIES,
 3H-THYMIDINE, RAT (3242)*
 CELLULAR
 ACUTE LEUKEMIA, PRELEUKEMIC STATE,
 CYTOPHOTOMETRY, AUTORADIOGRAPHY,
 CASE REPORT (3964)*
 CAPILLARY ENDOTHELIUM, MOUSE
 (2719)
 EHRICH ASCITES TUMOR, GROWTH,
 INTERFEROMETIC MEASUREMENTS
 (6107)*
 GLOBULIN SYNTHESIS, RABBIT (5985)*
 NUCLEIC ACID METABOLISM, CELL
 CYCLE, NORMAL TISSUES, MALIGNANT

TISSUES, HUMAN (6077)
 NUCLEAR ACIDIC PROTEINS, MAMMALIAN
 CELLS (6319)*
 "CROWN-GALL" TUMOR, INHIBITION, CELL
 CULTURE (2895)*
 FETAL AND ADULT HEMATOPOIETIC CELLS,
 LETHALLY IRRADIATED MICE (4501)*
 FIBROBLASTS, ADENOSINE 3'-5'-CYCLIC
 MONOPHOSPHATE, HUMAN (6303)*
 GLIA-LIKE CELLS, HUMAN (3420)*
 GRANULOCYTE, LEUKEMIA, HUMAN (4033)
 KIDNEY CELL, LEAD ACETATE INDUCED,
 EFFECTS OF UNINEPHRECTOMY, RAT
 (2446)*
 LEUKOCYTES, HUMAN (3843)
 MAST-CELL, UREMIA, SPLEEN, HUMAN
 (4801)*
 MEMBRANE, PHOSPHATIDYLCHOLINE
 SYNTHESIS, MAMMARY GLAND TISSUES,
 MOUSE (6052)
 MESOTHELIAL CELLS, INTRAPERITONEAL
 ENDOTOXIN INJECTION, RAT (3535)*
 NEOPLASTIC CELLS, ACTINOMYCIN D,
 FLAVONOID COMPOUNDS (3366)*
 PLASMA CELL, CAVERNOUS HEMANGIOMA,
 CASE REPORT (6359)*
 SPLEEN CELLS, INHIBITION, SPECIFIC
 ANTIBODY, CHICKEN (4756)*
 TUMOR, CELLS (1999)
 TUMOR CELLS, GLUCOSE, IN VITRO (0570)*
 PROLIFERATIVE DISEASE
 ANTIBODY, ASPERGILLUS FLAVUS, HUMAN
 (1076)*
 PROLIFERATIVE ENDOMETRIAL RESPONSE
 THECA-GRANULOSA CELL TUMOR, HUMAN
 (1896)
 PROMOTION
 TUMOR, CHEMICAL CARCINOGEN, SKIN
 (0088)*
 PROPHAGE
 INDUCTION, 1-ALKYL-3-NITRO-1-NITROSO-
 GUANIDINE, MUTAGEN (1278)*
 B-PROPIOLACTONE
 NUCLEIC ACIDS, CELLULAR MEMBRANES,
 INTERACTION (4481)*
 PROPIONITRIL
 DUODENAL ULCERS, RAT (5194)*
 PROSTAGLANDIN
 INDUCED DIFFERENTIATION, NEURO-
 BLASTOMA CELLS, MOUSE (2362)
 PRODUCTION
 INHIBITION, FIBROSARCOMA CELLS,
 MOUSE (3351)*
 TUMOR, MOUSE (4024)
 PROSTATA
 ADENOMA, EPITHELIAL GROWTH IN VITRO,
 HUMAN (4155)*
 CANCER, OSTEOLYTIC METASTASES, HUMAN
 (4136)*
 PROSTATE
 ADENOMA
 TESTOSTERONE METABOLISM, CARCINOMA
 TISSUE (6169)*
 TUMOR INDUCTION, HUMAN, HAMSTER
 (0832)
 CANCER, GLYCOLYSIS, HUMAN (4298)*
 CARCINOMA
 5 ALPHA-DIHYDROTESTOSTERONE
 METABOLISM, ESTROGEN, HUMAN
 (4854)
 ARGENTAFFIN CELLS, DIFFERENTIATION
 LIPO FUSCIN, MELANIN, PROSTATIC
 EPITHELIUM (1883)
 ATOMIC BOMB SURVIVORS, JAPAN
 (1657)
 CYTOLOGY, HUMAN (6394)*
 IGG ANTIBODY, LIVER, RABBIT,
 HUMAN (1377)
 IMMUNOGLOBULIN LEVELS, HUMAN
 (2626)
 INCIDENCE
 HUMAN (0512)
 SEXUAL INTERCOURSE (0514)
 UNITED STATES (4831)*
 LACTATE DEHYDROGENASE, ENZYME
 (0503)*
 LYMPHOCYTE, ANTIBODY, HUMAN
 (1865)*
 PROSTATECTOMY, CLINICAL STUDY
 (6172)*
 SERUM ALPHA, FETOGLOBULIN, CASE
 REPORT (2635)
 MALIGNANT, NORMAL, ANTIGENIC
 DEFICIENCY, HUMAN (3187)
 MALIGNANT AND NON-MALIGNANT TISSUE,
 LIPOFUSCIN, HUMAN (3476)*
 NUCLEAR PROTEIN, ANDROGEN, CHANGES
 (1299)*
 NUCLEUS, DNA SYNTHESIS, PROTEIN
 SYNTHESIS (1476)*
 SARCOMA, CLINICAL STUDY (5650)*
 TRANSFORMED CELL, ANTIGEN, MOUSE
 (3881)
 TUMOR, REVIEW (2258)*
 PROSTATIC
 ADENOCARCINOMA, METASTASIS, TEMPORAL
 BONE (3575)*
 LOCALIZATION, CARCINOMA (1526)*
 PROSTHESIS
 ARTERIAL GRAFT, FIBROSARCOMA, CASE
 REPORT (1690)*
 POLYMER, METAL, TISSUE, MALIGNANT
 REACTION, HUMAN (0029)*
 PROTAMINE
 RAUSCHER LEUKEMIA VIRUS, MORTALITY,
 MOUSE (0113)
 PROTEIN
 ACETYLATION, CHROMATIN, HEPATOMA, RAT
 (0588)*
 ADENOVIRUS 12, TUMOR INHIBITION,
 MATERNAL IMMUNIZATION, HAMSTER
 (1805)
 ALBUMIN SYNTHESIS, RAT HEPATOMA-MOUSE
 FIBROBLAST, HYBRID CELLS (4259)*
 ALPHA FETOPROTEIN
 CANCER PATIENT, HEPATOMA, TERATOMA
 CHILDREN, BLOOD TEST (0551)
 HEPATOCELLULAR CARCINOMA,
 DIAGNOSIS, UGANDAN PATIENTS
 (4644)
 ISOLATION, LIVER CARCINOMA, HUMAN
 (1079)*
 LOCALIZATION, HEPATOMA TISSUES,
 IMMUNOFLOUORESCENCE (2627)
 SYNTHESIS, INHIBITION, LIVER, RAT
 (5300)
 ALPHA-FETOPROTEIN SYNTHESIS, LIVER,
 YOLK SAC, GASTROINTESTINAL TRACT,
 HUMAN EMBRYO (2640)
 AMINO ACID INCORPORATION, INHIBITION,
 MALIGNANT MELANOMA, HAMSTER (0270)*
 AMINO-AZO-DYE, BINDING, LIVER, RAT
 (0977)*
 AMINO AZO DYE BINDING,
 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE,
 LIVER, RAT (1256)
 ANTIGEN
 DETECTION IN URINE, IMMUNO-

- DUFFUSION, HUMAN (3912)*
 FELINE LEUKEMIA VIRUS, MURINE
 LEUKEMIA VIRUS, ASSAY (5358)
 AVIAN LEUKEMIA-SARCOMA VIRUS,
 CHROMATOGRAPHIC SEPARATION,
 ANTIGENIC ANALYSIS (1708)
 BENCE-JONES, KAPPA CHAIN, PURIFICATION
 CHEMICAL CHARACTERIZATION, RAT
 (6010)*
 BINDING, CELL PROLIFERATION,
 CARCINOGEN (0360)
 BIOSYNTHESIS
 AUTORADIOGRAPHY STUDY, HERPES
 SIMPLEX VIRUS-INDUCED CELLS
 (2598)*
 PYRROLIDONECARBOXYLIC ACID
 DECYCLASE, PLASMACYTOMA, HUMAN
 (0890)*
 BLOOD SERUM
 ISOLATION, REGENERATING LIVER AND
 HEPATOMA, RAT (5393)*
 MALIGNANT LYMPHOGRANULOMATOSIS,
 IMMUNOELECTROPHORETIC STUDIES,
 HUMAN (3217)*
 BLOOD SERUM FRACTIONS, PROPERDIN TITER
 GASTROINTESTINAL CANCER, HUMAN
 (3553)*
 BRAIN, LYMPHOCYTE SENSITIZATION,
 CARCINOMA, HUMAN (1187)*
 BRAIN SPECIFIC, TUMOR, N-METHYLNITRO-
 SOUREA, RAT (4258)*
 CAPSID, IMMUNOLOGY, ADENOVIRUS, HUMAN,
 MONKEY (1070)*
 CARBOHYDRATE, DIET,
 DIMETHYLNITROSAMINE METABOLISM, RAT
 (0965)
 CARCINOGEN CONJUGATE, N,N-DIMETHYL-4-
 AMINOAZOBENZENE, AZODYE-BINDING,
 LIVER (0050)
 CEREBROSPINAL FLUID, BRAIN TUMORS,
 HUMAN (4118)*
 CHARACTERIZATION, P815 CELLS, MOUSE
 (2371)*
 CODING, MESSENGER RNA, L-CELL (1118)
 COMPONENT, POLYOMA VIRUS (1033)
 CORE, STRUCTURE, ADENOVIRUS TYPES 2
 AND 3, PROPERTIES (3095)
 DETECTION, 3'-METHYL-4-DIMETHYLAMINO-
 AZOBENZENE, LIVER, RAT (5807)
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 BENZO(A)PYRENE, INTERACTION, RAT
 (1261)
 DISTRIBUTION, LIVER, 3'-METHYL-4-
 DIMETHYLAMINOAZOBENZENE, RAT (5100)
 DNA, SCISSION, REPAIR,
 4-NITROQUINOLINE-1-OXIDE, MOUSE
 (2936)
 DNA SUPERCOILING, POLYOMA VIRUS, MOUSE
 EMBRYO (2482)
 DYE-BINDING PATTERNS,
 2-METHYL-4-DIMETHYLAMINOAZOBENZENE,
 3'-METHYL-4-DIMETHYLAMINOAZOBENZENE,
 LIVER, RAT (4415)
 ENDOPLASMIC RETICULUM, 3-METHYL-
 CHOLANTHRENE, RAT (1579)
 F1 HISTONE, MOLECULAR NATURE, PHOS-
 PHORYLATION, CULTURED HEPATOMA CELLS
 (5506)*
 FETAL ALPHA-GLOBULIN, ISOLATION,
 CHARACTERIZATION, HUMAN (3849)
 H FRACTION, LIVER, CARCINOGEN
 SUSCEPTIBILITY, RAT, MOUSE, GUINEA
 PIG, RABBIT, HAMSTER (5082)
 FRACTIONS, AMINO ACIDS, UTERINE TUMOR,
 HUMAN (0559)*
 PROTEIN - CONTINUED
 GAMMA A MYELOMA, STRUCTURE, HUMAN
 (0771)*
 GLYCOPROTEIN, GASTRIC CARCINOMA,
 ELECTROPHORESIS (2711)*
 SH-GROUPS, LARYNGEAL EPITHELIUM,
 HYPERPLASIA, TUMOR (4108)*
 HERPES SIMPLEX VIRUS-SPECIFIC, PLASMA
 MEMBRANE (3821)
 HISTONE TURNOVER, HEPATOMA TISSUE,
 CULTURE CELLS (5504)*
 IGA MYELOMA
 PLASMA CELL TUMOR, MOUSE (5314)
 STRUCTURAL CHARACTERISTICS,
 MOUSE (1866)*
 IMMUNOGLOBULINS, LEUKEMIC PATIENTS,
 CLINICAL STUDY (4708)*
 LABELING
 2,4-DINITROPHENYL, MYELOMA, MOUSE
 (0665)*
 LIVER, DIMETHYLNITROSAMINE,
 3-METHYLCHOLANTHRENE PRETREAT-
 MENT, RAT (1586)
 LEUCINE INCORPORATION, INHIBITION,
 TUMOR-BEARING BLOOD, RAT (5524)*
 LEUKEMIA, SERUM, HUMAN (0770)
 LEUKOCYTES, CATABOLISM, HUMAN (2124)*
 LIPOPROTEIN, LIVER CARCINOGENESIS,
 N-2-FLUORENYLACETAMIDE, RAT (0792)*
 LIVER, CARCINOGEN-TREATED, RAT (2366)*
 METABOLISM, NUCLEOLUS, ACTINOMYCIN D,
 HELA CELL (1127)
 METHYLASE, HEPATOMAS, RAT (3988)
 MICROSMAL SMOOTH MEMBRANE, ELECTRO-
 PHORETIC ANALYSIS, MORRIS HEPATOMA,
 LIVER, RAT (6292)*
 MONOCLONAL, IMMUNOCYTOMAS, RAT (6012)*
 MOUSE MAMMARY TUMOR VIRUS, STRUCTURAL
 COMPONENTS (1726)
 MYELOMA
 AFFINITY LABELING OF ACTIVE SITES,
 ANTIBODIES (2614)
 CELL SURFACE, IMMUNE REACTION,
 MOUSE (4702)
 CRYOGLOBULIN, CRYSTAL, HUMAN
 (0170)*
 ENVIRONMENTAL ANTIGEN, MOUSE
 (3190)
 GAMMA G IMMUNOGLOBULIN, CATABOLISM
 HUMAN, MONKEY (4699)
 HAPTEN-BINDING SITE, ANTI-
 IDIOTYPIC ANTIBODY, RABBIT
 (3175)
 IGG, ANTIBODY SPECIFICITY,
 HUMAN (1838)
 LIGAND BINDING SITES, AUTOIMMUNE-
 LIKE ANTIBODIES, MOUSE (3158)
 PEP SIN FRAGMENTS, HAPTEN BINDING,
 X-RAY CRYSTALLOGRAPHY, MOUSE
 (6021)*
 PHOSPHORYLCHOLINE, AFFINITY,
 LABELING, MOUSE (1870)*
 STRUCTURAL AND IMMUNOLOGICAL STUDY
 HUMAN (4767)*
 TUMOR-SPECIFIC TRANSPLANTATION
 ANTIGEN, MOUSE (4677)
 NERVOUS-TISSUE-SPECIFIC, BRAIN TUMOR,
 PERIPHERAL NERVOUS SYSTEM, RAT
 (5363)
 9S IGG PARAPROTEIN, MULTIPLE MYELOMA,
 CARCINOMA, PROSTATE, HUMAN (3928)*
 NONHISTONE CHROMOSOMAL, HELA CELL
 (6124)

NONSPECIFIC MYELOMA, IMMUNOGLOBULIN
 IGG, SPECIFIC ANTIGENIC DETERMINANT
 HUMAN (2611)
 NUCLEAR, ANDROGEN, CHANGE, PROSTATE
 (1299)*
 NUCLEAR ACIDIC
 BINDING, 2-ACETAMIDOFLUORENE, RAT
 (0936)
 CELL PROLIFERATION
 MAMMALIAN CELLS (6319)*
 REVIEW (1209)
 CYTOCHEMISTRY, HARDING-PASSEY
 MELANOMA, HORNING-MITCHELY
 KIDNEY TUMOR (1470)*
 NUCLEOPROTEIN COMPLEX, SV40 INFECTION,
 MONKEY (1348)
 NUCLEUS, METHYLATION,
 DIMETHYLNITROSAMINE, METHIONINE, RAT
 (0966)
 PARENCHYMA, MAMMARY GLAND,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 BINDING, RAT (1564)
 PHOSPHATE ACCEPTOR, KINASE, RAUSCHER
 MURINE LEUKEMIA VIRUS (1016)
 POLYOMA VIRUS, DISRUPTION (5275)
 PRECURSOR INCORPORATION, PHORBOL,
 EPIDERMIS, MOUSE (1245)
 RD-114 VIRUS, PURIFICATION,
 IMMUNOLOGICAL CHARACTERIZATION
 (2592)*
 PROTEIN - CONTINUED
 RIBOSOMAL, PHOSPHORYLATION, SARCOMA
 180 TUMOR CELLS, MOUSE (4994)*
 RIBOSOME, KREBS ASCITES CARCINOMA,
 MOUSE (1494)*
 RNA, STAINING, LIVER,
 4-DIMETHYLAMINOAZOBENZENE, RAT
 (0370)*
 ROUS SARCOMA VIRUS, BRYAN STRAIN
 (3743)
 SEQUENCING, CARCINOEMBRYONIC ANTIGEN,
 COLONIC CANCER, HUMAN (5976)
 SERUM
 ARGININE, GUERIN TUMOR, RAT
 (0859)*
 CANCER ASSOCIATED (5367)*
 EHRlich TUMOR, MOUSE (3915)*
 HODGKIN'S DISEASE, ACUTE MYELOID
 LEUKEMIA, IMMUNOELECTROPHORETIC
 INVESTIGATIONS, PATIENTS (5378)*
 IMMUNOELECTROPHORESIS, EHRlich
 ASCITES TUMOR, MOUSE (4119)*
 JAAGSIEKTE, SHEEP (4634)
 LEUKEMIA, HUMAN (3918)*
 LEUKEMIA, TRANSCOBALAMIN, HUMAN
 (0878)*
 LIVER CARCINOMA, HUMAN (0473)
 MALIGNANT LYMPHOMA, SYSTEMIC MAST
 CELL DISEASE, CASE REPORT
 (4239)*
 SOLUBLE, HEPATOCARCINOGENESIS,
 ELECTROPHORETIC ANALYSIS, MOUSE
 (1893)
 SULFHYDRYL GROUPS, TUMOR-BEARING
 RATS (0572)*
 UROGENITAL TUMOR, CLINICAL STUDY,
 HUMAN (3544)*
 SERUM ALPHA-FETOGLOBULIN, CANCER,
 HUMAN (3926)*
 SERUM ALPHA1-GLOBULIN, EPITHELIOMA,
 HUMAN (0576)*
 SERUM GLYCOPROTEIN LEVELS, ASCITES
 HEPATOMA 109A, RAT (5385)*
 SERUM AND URINARY, RENAL FUNCTION,

CHRONIC MYELOGENOUS LEUKEMIA
 PATIENTS (4905)*
 SKIN, TUMOR, MAN (0232)
 SPIKE, IDENTIFICATION, ROUS SARCOMA
 VIRUS (1747)
 STRUCTURAL
 ADENOVIRUS-ASSOCIATED TYPE 3 (4525)
 RAUSCHER LEUKEMIA VIRUS, HARVEY
 SARCOMA VIRUS (1710)
 SV40, PHOSPHOPROTEINS (5230)
 STRUCTURE, UTERINE CERVIX CARCINOMA,
 IMMUNOLOGY, HUMAN (5295)
 SV40, REVIEW (4335)*
 SV40-INDUCED, CV-1 CELLS (3038)
 SV40-SPECIFIC, SYNTHESIS AND VIRAL
 INCORPORATION (3768)
 SYNTHESIS
 ABERRANT RECOVERY, IRRADIATION,
 PEANUT PLANT (1684)*
 ADENOVIRUS, KB CELL (1332)
 ADRENAL GLAND, DIMETHYLNITROSAMINE
 RAT (5171)
 CANINE HERPESVIRUS REPLICATION,
 TEMPERATURE SUPPRESSION (1720)
 DNA SYNTHESIS, PROSTATE NUCLEI
 (1476)*
 DRUG METABOLISM, LIVER, METHYL-
 AZOXYMETHANOL (1280)*
 MITOCHONDRIA, MOUSE (5947)*
 NUCLEAR CHANGE, SKIN, ULTRAVIOLET,
 HUMAN (1668)
 NUCLEOLUS, NOVIKOFF ASCITES TUMOR
 (4028)
 RETICULOCYTE INITIATION FACTORS,
 CELL-FREE SYSTEM, KREBS II
 ASCITES CELLS (5651)*
 RIBOSOME ASSEMBLY, HELA CELLS
 (2893)*
 RIBOSOMES, BLOOD LYMPHOCYTE
 LEUKEMIA PATIENTS (6016)*
 RNA SYNTHESIS, COMPARATIVE STUDY,
 LIVER AND LUNG, RAT (5192)*
 SERUM-MEDIATED STIMULATION,
 EHRlich ASCITES TUMOR CELLS
 (4992)*
 SUBCELLULAR FRACTIONS, UTERINE
 CERVIX, MALIGNANT NEOPLASM,
 HUMAN (4229)*
 SV40-INFECTED CELL, MONKEY (5263)
 SV40 INFECTION, CELLS, MONKEY
 (3140)
 PROTEIN - CONTINUED
 SYNTHESIS AND TRANSPORT, ADENOVIRUS
 TYPE 2, SV40, ABORTIVE INFECTION,
 MONKEY (0709)
 SYNTHESIS INHIBITION, PHENYLALANINE,
 TRYPTOPHAN, E. COLI, LEUKEMIC CELL,
 MOUSE (1624)*
 SYNTHESIS REQUIREMENT, CELL PROLIFERA-
 TION, GENE ACTIVATION, HUMAN FIBRO-
 BLAST (1884)
 SYNTHESIS STIMULATION, SERUM,
 HEPATECTOMY, LIVER CELL, RAT (1791)
 UTERUS-SPECIFIC, MOUSE (2391)*
 PROTEIN KINASE
 HEPATOMA CELL LINE, BINDING ACTIVITY
 (2168)*
 PROTOZOAN
 INFECTION, GROSS LEUKEMIA VIRUS,
 MORTALITY, MOUSE (0698)
 TOXOPLASMA GONDII, BESNOITIA
 JELLISONI, TUMOR RESISTANCE, MOUSE
 (1799)
 PROVIRUS THEORY

ROUS SARCOMA VIRUS, VIRAL GENOME
 COPIES, TRANSFORMATION (4554)
 PSEUDOTUMOR
 MELANOTIC, JUVENILE HORMONE, DROSOPHILA (6118)
 PULMONARY
 TUMOR
 CYTOPLASMIC INCLUSIONS, HUMAN (2200)*
 NECROSIS, CIRCULATION (1988)
 PULMONARY METASTASIS
 PRIMARY LUNG NEOPLASIA (3592)*
 PURINE
 BIOSYNTHESIS
 BURKITT LYMPHOMA CELLS, SPLEEN, HUMAN (4907)*
 REPRESSION, DEREPRESSION, MAMMALIAN HEPATOMA CELLS (4993)*
 PUROMYCIN
 CELL CYCLE PHASE PROGRESSION, LEUKEMIC CELL, MOUSE (1630)*
 PYRAN COPOLYMER
 TUMORIGENESIS INHIBITION, POLYOMA VIRUS, RAUSCHER LEUKEMIA VIRUS, IMMUNOSUPPRESSION, MOUSE (3686)
 1-PYRIDYL-3,3-DIETHYL-TRIAZENE
 CARDIAC TUMORS
 ORAL ADMINISTRATION, RAT (5162)
 RAT (5108)
 PYRROLIZIDINE ALKALOIDS
 ALPHA,BETA-UNSATURATED ALDEHYDES, HISTOPATHOLOGY, KIDNEY, RAT (1542)
 QUINOLINE
 DNA INTERACTION, CHARGE TRANSFER (5776)
 MUTAGENICITY, YEAST (0073)
 RACE
 COLON CANCER SURVIVAL, SOCIOECONOMIC FACTOR, HUMAN (6080)
 NONWHITE, WHITE, CANCER MORTALITY, UNITED STATES (5413)
 RADIATION
 ALPHA, DNA BREAKAGE, E.COLI (2464)*
 ANTIBODY FORMATION, BONE MARROW, THYMUS, MOUSE (0750)
 ATOMIC BOMB
 CANCER MORTALITY, JAPAN (1687)*
 HIROSHIMA, NAGASAKI, LIVER, HUMAN (2455)
 LUNG CARCINOMA, HUMAN, REVIEW (2219)
 LYMPHOMA, LEUKEMIA, PATHOGENESIS, REVIEW (5013)
 PROSTATE CARCINOMA, JAPAN (1657)
 SALIVARY GLAND TUMOR, JAPAN (1660)
 TUMOR, INCIDENCE, HUMAN, REVIEW (3027)
 ATOMIC BOMB SURVIVOR
 CANCER (3032)*
 HUMAN (2481)*
 MORTALITY (1662)
 LEUKEMIA (1663)
 MALIGNANT LYMPHOMA INCIDENCE, JAPAN (1656)
 ATOMIC ENERGY LEVEL CHANGES, 40 K, CARCINOGENESIS, REVIEW (2904)
 AVIAN SARCOMA VIRUS, PRODUCTION, TUMOR CELL, RAT (0737)*
 AVIAN TUMOR VIRUS INDUCTION, NORMAL CHICK CELL (1707)
 BETA, CARCINOGENESIS, PHORBOL ESTER PROMOTION, MOUSE (0993)
 BONE MARROW STEM CELLS, CELL CYCLE, MOUSE (3734)*

BONE SARCOMA, HUMAN (1303)
 CALCIUM, STRONTIUM, BARIUM, RADIUM, KINETICS, RABBIT (0999)*
 CARCINOGENESIS, HUMAN (0031)*
 CHEMICAL CARCINOGEN
 GASTRIC ADENOCARCINOMA, REVIEW (1201)
 VIRUS, CELL CULTURE (0022)*
 CHROMOSOME
 BONE MARROW, ABNORMALITY, HUMAN (0103)
 HUMAN (1658)
 LEUKEMOGENIC RESPONSE, MOUSE (1665)
 COBALT, LUNG METASTASIS VOLUME, DAMAGE REPAIR, HUMAN (3725)
 CONTAMINATION, HAZARD, SKIN (2466)*
 DIAGNOSTIC LEUKEMIA RISK, HUMAN (3968)
 DISEASE
 SEQUELAE
 ATOMIC BOMB EXPLOSION (0332)*, (0334)*
 DNA, SINGLE-STRAND BREAK REJOINING, EHRLICH TUMOR, MOUSE (5863)
 DNA BREAKAGE, REPAIR, MAMMALIAN CELL (4494)
 DOSE FRACTIONATION, AGE, TUMORIGENESIS MOUSE (4492)
 E. COLI, BENZO(A)PYRENE, SURVIVAL (1289)*
 EFFECT, LYMPHOCYTE, HUMAN (1677)*
 ELECTROMAGNETIC, LYMPHOCYTE, MITOTIC POTENTIAL, MONKEY (3726)
 FAST NEUTRON, TUMOR INCIDENCE, AGE, RAT (4491)
 FISSION NEUTRON IRRADIATION, 3-METHYLCHOLANTHRENE, MAMMARY CARCINOGENESIS, RAT (2317)
 GALLIUM, LEUKEMIA, MOUSE (0282)*
 GAMMA
 BLOOD CELL, CHROMOSOMAL ABERRATION
 OCCUPATIONAL HAZARD, HUMAN (0389)
 DNA, DNA-PROTEIN, LYMPH GLANDS (2462)*
 HUMAN CELL CULTURES, HERPES SIMPLEX VIRUS REPRODUCTION, IN VITRO (0136)*
 LEUKEMIA, LONGEVITY, MOUSE (0674)
 LYMPHOCYTES, MICE (2459)*
 MAMMARY TUMOR, VIRUS (2595)*
 RNA, ENZYMES (2465)*
 GAMMA-RAY
 BONE MARROW, ULTRASTRUCTURE, DOG (1000)*
 BONE MARROW CHANGES, GUINEA PIG (1671)*
 CARCINOMA INDUCTION, RAT (1302)
 SPECIFIC IMMUNITY, DOG (2663)*
 GRENZ, 7,12-DIMETHYLBENZ(A)ANTHRACENE, CARCINOGENESIS, SKIN, MOUSE (5862)
 GROWTH KINETICS, TUMOR CELL, REVIEW (0301)
 IMMUNE RESPONSE, BONE MARROW, MOUSE (0780)*
 IMMUNITY TRANSFER, BESNOITIA JELLISONI HAMSTER (3729)
 IMMUNOGENICITY, TUMOR GROWTH RATE, H-2 ANTIGEN, MOUSE (3894)
 INDUCED ANDROBLASTOMAS, OVARIES, MOUSE (5201)
 INDUCED CANCER, HUMAN, REVIEW (4329)*
 INDUCED FIBROEPITHELIOMA, GROIN, CASE REPORT (2452)

INTERNAL EMITTER, TUMOR INCIDENCE,
EVALUATION (1686)*

INTESTINAL MUCOSA, REGENERATION,
POPULATION DETERMINATION (0106)*

IODINE

THERAPY

BLOOD, BONE MARROW, HUMAN (1666)

LEUKEMIA INCIDENCE, HUMAN (1667)

IONIZING

CARCINOGENIC ACTION, DOSE, REVIEW
(5703)

DNA-MEMBRANE COMPLEX, BACTERIA
(2480)*

MITOCHONDRIA, NUCLEUS, ULTRASTRUCTURE,
MOUSE (5872)*

PATHOLOGIC EFFECTS (1682)*

SARCOMA, HUMAN (2468)*

THYROID FUNCTION, RAT (0394)

RADIATION - CONTINUED

LARYNX

CARCINOMA, HUMAN (1308)*

PHARYNX, CARCINOMA, HUMAN (0027)*

LEUKEMIA, GUINEA PIG (5202)

LEUKEMIA INCIDENCE, MORTALITY, REVIEW
(2203)

LEUKEMIA VIRUS, ANTISERUM, ANTIBODIES,
MOUSE (0768)

LIVER CELLS, OXYGEN CONSUMPTION,
RESPIRATORY CONTROL, RAT (3030)*

LONG-LIVED LYMPHOCYTE, RECOVERY, RAT
(1679)*

LOW-LEVEL GAMMA, L-M CELLS, GROWTH
ALTERATIONS, VIRUS SENSITIVITY
(2476)*

MALIGNANT TRANSFORMATION, PROPHYLAXIS,

CERVICAL AND FACIAL DERMATITIS,
HUMAN (2475)*

MELANOMA, EPITHELIOMA, INCIDENCE,
AUSTRIA (1307)

METASTASIS, SARCOMA, RAT (0523)*

NEUTRON

LIVER TUMOR, MUTATION, MOUSE
(3732)

MAMMARY NEOPLASM, RAT (2454)

NUCLEIC ACID SYNTHESIS, LIVER, MOUSE
(1639)*

OBSTETRIC RADIOGRAPHY, CHILDHOOD
CANCER (2471)*

OSTEOGENIC SARCOMA, HEAD AND NECK,
CASE REPORTS (3736)*

PLUTONIUM, BONE, RAT (5198)

PROTEIN SYNTHESIS, ABERRANT RECOVERY,
PEANUT PLANT (1684)*

PROTON, FIBROSARCOMA, BRAIN TUMOR,
MONKEY (0390)

RADIO IODINE THERAPY, THYROID
CARCINOMA, CASE REPORT (1673)*

RADON

LUNG CARCINOMA, OCCUPATIONAL
HAZARD (1691)*

SKIN CANCER (1681)*

RENAL DAMAGE, DOG (5868)*

RESPONSE

FIBROSARCOMA, IMMUNE RESPONSE,
VITAMIN A, MOUSE (3730)

MAMMARY CARCINOMA, TRANSPLANTATION
MOUSE (4493)

RUTHENIUM, RETENTION, RAT, MONKEY, DOG
(0997)*

SARCOMA, METASTASES, RAT (6336)*

SKIN, SWEAT GLAND CARCINOMA, HUMAN
(3031)*

SKIN TUMOR FORMATION, HAIR-FOLLICLE

DAMAGE, MOUSE, RAT (5200)

STRONTIUM, RETENTION, SOFT TISSUES,
MOUSE (1001)*

STRONTIUM 90

BONE CONTENT, HUMAN (0105)*

CHLOROLEUKEMIA, CYTOPLASMIC DNA,
RAT (0673)

OSTEOSARCOMA, IMMUNOGENICITY,
MOUSE (3896)

SUNLIGHT, MELANOMA, HUMAN (1310)*

TANTALUM, METABOLISM, RAT (0996)*

THERAPEUTIC

GOITER, THYROID CARCINOMA, CASE
REPORT (0676)*

LEUKOCYTE, CHROMOSOME, ABNORMALITY
HUMAN (5454)

THERAPY

ACUTE MYELOGENOUS LEUKEMIA, HUMAN
(1664)

CERVICAL CARCINOMA

BLADDER TUMOR, HUMAN (0393)

LEUKEMIA, SURVIVAL, HUMAN (1304)

PROTON, NECK, LUNG, ABDOMEN,

RABBIT (0109)*

RETICULUM CELL SARCOMA, REVIEW
(2246)*

SODIUM IODIDE IRRADIATION,
THYROID CARCINOMA, CASE REPORT
(1688)*

THROAT CARCINOMAS, CASE REPORTS
(3728)

THYROID CARCINOMA

HODGKIN'S DISEASE, HUMAN (0104)*

PREDISPOSITION, CASE REPORT
(1689)*

THORIUM

BREAST CARCINOMA, HUMAN (2460)*

CHOLANGIOSARCOMA, CASE REPORT
(2473)*

THOROTRAST

INJURY, REVIEW (0915)*

LEUKEMIA, HEMANGIOENDOTHELIOMA,
PORTUGAL (4490)

MYELOSIS, CASE REPORT (0678)*

PANCREATIC CARCINOMA, CASE REPORT
(0679)*

RETENTION, HUMAN (0108)*

THRESHOLD, BONE, HUMAN (0107)*

TRITON X-100, ACID PHOSPHATASE, BRAIN
TUMORS, RAT (3376)*

210 PO, GAMMA, HEPATOMA, SUBCUTANEOUS
TISSUE, DOG (0100)

RADIATION - CONTINUED

ULTRAVIOLET

ADENOVIRUS, TYPE 12 INFECTION,
FIBROBLASTS, RAT (5874)*

CELL TRANSFORMATION, HERPES
SIMPLEX VIRUS TYPE 2, HAMSTER
(0710)

7,12-DIMETHYLBENZ(A)ANTHRACENE,
SKIN, MOUSE (3719)*

DNA CHAIN ELONGATION, XERODERMA
PIGMENTOSUM, HUMAN (4496)*

DNA REPAIR, SKIN CARCINOMA, HUMAN
(1305)

DNA SYNTHESIS

GERM CELL, HUMAN (1301)

LYMPHOCYTES, HUMAN (2467)*

GAMMA-RAY, MACROMOLECULAR
SYNTHESIS, SYNCHRONIZED CELL
SYSTEM, MOUSE (0837)

HUMAN ADENOVIRUS TYPE-12, SIMIAN
VIRUS 40 (2529)

HYDROXYUREA, DNA SYNTHESIS INDUC-
TION, HELA CELL (1676)*

- INACTIVATION OF MOLONEY LEUKEMIA VIRUS, REPLICATION, ABILITY TO RESCUE MSV (3111)
 NASCENT DNA SYNTHESIS, L-CELL (1685)*
 RNA SYNTHESIS, PROTEIN SYNTHESIS, NUCLEAR CHANGE, SKIN, HUMAN (1668)
 SKIN, NEOPLASIA, MAN (0102)
 SKIN CANCER
 GEOGRAPHIC DISTRIBUTION, HUMAN (4812)
 SUNLIGHT, HUMAN, REVIEW (5019)
 SV40, TUMORIGENIC ACTIVITY, HAMSTER (3092)
 SYNERGISTIC EFFECT, ALKYLATING AGENTS, E. COLI (2456)
 UMBILICAL CORD LEUKOCYTE, CULTURE, CHEMICAL CARCINOGEN, VIRUS, HUMAN (0719)
 URANIUM, OCCUPATIONAL HAZARD, MINE WORKERS (5866)*
 WHOLE-BODY IONIZING, IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY, MOUSE (5968)
 WHOLE BODY IRRADIATION, IMMUNOLOGICAL TOLERANCE, GAMMA-GLOBULIN, MOUSE (4497)*
 X-IRRADIATION
 ARACHIS HYPOGEA, PROTEIN SYNTHESIS CELL CULTURE (2458)
 CANCER, THORACIC ESOPHAGUS, CASE REPORT, HUMAN (2469)*
 CELL, CYCLE (2463)*
 CHROMOSOME ABNORMALITIES, LEUKEMIC CELLS, MOUSE (6123)
 HUMAN MYELOMA, IMMUNOGLOBULINS (2656)*
 KIDNEY CHANGES, HISTOLOGY (2474)*
 LEUKOCYTES, HUMAN, MARMOSET (2477)*
 LYMPHOMA, THYMUS REGENERATION, SPLEEN CELL, BONE MARROW CELL, MOUSE (0472)
 3-METHYLCHOLANTHRENE, LEUKEMIA INDUCTION, RAT (0068)
 OSTEOGENIC SARCOMA, HUMAN (2470)*
 OVARIAN TUMOR, PERITONEAL FLUID, MOUSE (0392)
 RADIOSENSITIZATION, 5-BROMODEOXY-URIDINE, CELL CYCLE, HAMSTER (1309)*
 SARCOMA, RAT (2457)
 SCALP, CYLINDROMA, CASE REPORT (0675)*
 THYMIDINE INCORPORATION, THYMUS DNA, RAT (1670)*
 TUMOR, GERM-FREE RAT (0099)
 URETHANE, ADDITIVE LEUKEMOGENICITY MOUSE (2328)
 UV RADIATION, DNA SYNTHESIS, MOUSE (2461)*
 X-RAY
 BLOOD, BONE MARROW, LYMPHOCYTE COUNT, RAT (1672)*
 CANCER, 2-BETA-AMINOETHYL-ISOTHIOURONIUM, RAT (1674)*
 CARCINOGENESIS, LOW DOSE, RAT (3029)
 CHROMOSOMAL ALTERATIONS, RAT (0391)
 CHROMOSOME ABERRATION, EMBRYO, RAT (1678)*
 7,12-DIMETHYLBENZ(A)ANTHRACENE, MAMMARY NEOPLASIA, RAT (2309)
 N,N'-2,7-FLUORENYLENEBISACETAMIDE, ADENOCARCINOMA, STOMACH, RAT (2960)
 GASTROINTESTINAL TUMOR, ANTIGENIC CHANGE, RODENT (1659)
 HISTOFORMATION, HELA CELL (1675)*
 LUNG TUMOR INCIDENCE, MOUSE (4413)
 MECHANICAL IRRITATION, COCARCINOGENIC ACTION, INTRAMANDIBULAR TISSUE, MOUSE (4489)
 MYELOGENOUS LEUKEMIA, ANEMIC STRESS, RAT (1669)
 NEOPLASMS, ULTRASTRUCTURE, MOUSE (5833)*
 NEUROBLASTOMA, DIFFERENTIATION, MOUSE (2924)
 SINGLE STRAND DNA BREAK FORMATION (2453)
 THRESHOLD DOSE, REVIEW (2210)
 TRANSFORMATION ENHANCEMENT, BENZO(A)PYRENE, HAMSTER (1661)
 TUMOR INDUCTION, SMALL ANIMALS (5851)*
 URETHANE, TUMOR-RESISTANT MOUSE (5792)
 RADIATION - CONTINUED
 X-RAY CYTOLYSIS, IMMUNE CYTOLYSIS, HAMSTER CELL (5864)
 RADIONUCLIDE
 OSTEOSARCOMA, GROWTH RATE, BEAGLE (1104)
 SINUS CARCINOMA INDUCTION (1680)*
 RADIUM
 RADIATION, KINETICS, RABBIT (0999)*
 RADON
 BRONCOPULMONARY CARCINOMA, INHALATION, RAT (5197)
 RECKLINGHAUSEN'S DISEASE
 LEUKEMIA, CASE REPORTS, CHILDREN (6142)*
 RECTUM
 CANCER
 REVIEW (2229)*
 TUMOR CELLS, BLOOD, CLINICAL STUDY (6148)*
 VENOUS WALL CHANGES, METASTASIS, LIVER, CLINICAL STUDY (6150)*
 CARCINOID TUMOR, HUMAN, REVIEW (2920)*
 CARCINOMA
 ADENOMATOUS POLYPS, BIOPSY, ORGAN TISSUE CULTURE, HUMAN (5470)*
 COLON, HUMAN, REVIEW (2276)*
 HISTOLOGY, HISTOGENESIS, HUMAN (6069)*
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE, RAT (0949)
 COLON
 ADENOMATOUS POLYPS, CARCINOMA
 EPIDEMIOLOGY (0023)*
 CARCINOMA
 EPIDEMIOLOGY (0509)
 INCIDENCE, DIET, HUMAN (0533)*
 INCIDENCE, GERMANY (3282)*
 POLYP, OCCURRENCE, ADULT (0801)*
 NEOPLASIA, HIGH-RISK GROUP, REVIEW (1233)*
 TUMOR, TUMOR CELL, BLOOD, HUMAN (1161)*
 RECURRING
 ENDOMETRIAL CARCINOMA, RECURRING (1954)
 REGENERATION
 INTEGUMENT, FLATWORM (0268)*

INTESTINAL CELL (0289)*
 LIVER
 AFLATOXIN, RAT (1557)
 DIETHYLNITROSAMINE, HEPATECTOMY,
 RAT (1633)*
 METABOLIC ALTERATIONS, ENHANCED
 DNA SYNTHESIS, 5-AZACYTIDINE-
 TREATED RAT (4466)*
 NUCLEIC ACID
 (3H)ETHYL CARBAMATE INTERACTION,
 MOUSE (2436)*
 URETHANE BINDING, MOUSE (2933)
 THYMUS, X-IRRADIATION, LYMPHOMA,
 SPLEEN CELL, BONE MARROW CELL, MOUSE
 (0472)
 EGRESSION
 BURKITT'S LYMPHOMA, MEASLES & HUMAN
 (0781)*
 FRIEND VIRUS, AGE, MOUSE (0743)*
 LYMPHOMA, MOUSE (4444)
 MAMMARY TUMOR
 ERGOT DRUGS, RAT (1951)
 LYSOSOMAL ENZYME ACTIVITY, RAT
 (6290)*
 METHYLCHOLANTHRENE FIBROSARCOMA,
 NEURAMINIDASE, BCG, MOUSE (5993)*
 NONIMMUNE, PAPILLOMA, 3-METHYL-
 CHOLANTHRENE, MOUSE (1381)
 SPONTANEOUS
 CANCER, AUTOPSY STUDY (6024)*
 MALIGNANT TUMORS
 CASE REPORTS (5379)*
 HUMAN, REVIEW (4345)*
 TUMOR, 3-METHYLCHOLANTHRENE, NEUR-
 AMINIDASE, BACILLUS CALMETTE-GUERIN,
 MOUSE (3199)
 REGULATORY ABNORMALITY
 LEUKEMIA, PATHOGENESIS, REVIEW
 (1529)*
 REJECTION
 TUMOR ALLOGRAFTS, ANTISTREPTOLYSINE
 O LEVEL, SERUM, MOUSE (6034)*
 RENAL
 CARCINOMA, FAMILIAL, HUMAN (2166)*
 REPLICATION
 DNA
 MOUSE (1965)
 MURINE LYMPHOMA (4035)
 HERPESVIRUS, TURKEY (5284)*
 ROUS SARCOMA VIRUS, INHIBITORS OF
 MITOCHONDRIAL FUNCTION, CHICK
 EMBRYO CULTURE (3771)
 REPRODUCTIVE ORGANS
 ATOMIC BOMB RADIATION, TUMOR,
 INCIDENCE, HUMAN, REVIEW (3027)
 REPRODUCTIVE SYSTEM
 ORAL CONTRACEPTIVE, PATHOLOGY, REVIEW
 (0922)*
 RESCUE
 PSEUDOTYPE SARCOMA, MURINE SARCOMA
 VIRUS (5919)
 RESISTANCE
 AUTOCHTHONOUS TUMORS, METHYL-
 CHOLANTHRENE-INDUCED, CELL-MEDIATED,
 RAT (3868)
 FRIEND LEUKEMIA VIRUS, IMMUNOSUPPRESS-
 ION, MOUSE (5352)
 L5178Y MOUSE LEUKEMIA, METHOTREXATE
 (4168)*
 LYMPHOID LEUKEMIA, PROTOZOAN INFECTION
 MOUSE (0698)*
 MOLONEY SARCOMA VIRUS, MOUSE (5209)
 TOXIC ANTINEOPLASTIC AGENTS, NORMAL
 EMBRYONAL TISSUE, POLYOMA VIRUS
 TRANSFORMED CELLS, MOUSE, HAMSTER
 (3147)*
 TUMOR DEVELOPMENT, FREUND'S ADJUVANT
 PRETREATMENT, NEOPLASM, MOUSE (3839)
 TUMORS, ACTIVE IMMUNITY, CORYNE-
 BACTERIUM PARVUM TREATMENT, MOUSE
 (6015)*
 RESPIRATION
 BURKITT LYMPHOMA CELLS, MICRO-
 CARTESIAN DIVER TECHNIQUE (4133)*
 ENZYME CHANGES, MORRIS HEPATOMA,
 REVIEW (5011)
 MITOCHONDRIA, ISLET-CELL TUMOR,
 LIVER, HAMSTER (5640)*
 RESPIRATORY TRACT
 BRONCHIAL CANCER, TOBACCO SMOKING,
 HUMAN, REVIEW (5006)
 BRONCHIAL CARCINOMA, RISK POPULATIONS
 (6397)*
 CARCINOGENESIS, BENZO(A)PYRENE, FERRIC
 OXIDE, HAMSTER (5176)
 CARCINOMA
 INCIDENCE, SENEGAL (0824)*
 LYMPH NODE, METASTASIS DISTRIBU-
 TION, HUMAN (4029)
 ORAL CAVITY, ESOPHAGUS, EAR,
 CLINICAL STUDY, TUBERCULOSIS
 PATIENTS (5465)*
 7H-DIBENZO(C,G)CARBAZOLE, CARCINOGEN-
 ICITY, EPITHELIUM, HAMSTER (2940)
 DISEASES, BRONCOPULMONARY CANCER,
 HUMAN (2745)*
 GASTROINTESTINAL TRACT, MULTIPLE
 TUMORS (0329)*
 GLANDULAR TISSUE CYLINDROMA, HISTO-
 PATHOLOGY, HUMAN (6211)*
 3-METHYLCHOLANTHRENE, SQUAMOUS CELL
 CARCINOMA, MOUSE (1265)
 NITROSAMINE, CARCINOGENESIS (0026)*
 TOXICITY, CILIARY MOVEMENT, CIGARETTE
 SMOKE, CAT (2939)
 TUMOR, BENZO(A)PYRENE, FURFURAL,
 HAMSTER (1574)
 RETICULAR SYSTEM
 TUMOR, SELECTIVE METASTASIS, REVIEW
 (5017)
 RETICULOENDOTHELIAL SYSTEM
 ANEMIA, ERYTHROCYTES (1997)
 MALIGNANCY, LYMPHOCYTE, BLASTIC
 TRANSFORMATION, HUMAN (1862)*
 YOSHIDA SARCOMA
 SPLENOMEGALY, RAT (0194)*
 ULTRASTRUCTURE, RAT (6134)*
 RETICULOENDOTHELIAL TUMOR
 TRANSPLANTABLE, HISTOCHEMISTRY,
 ULTRASTRUCTURE, RAT (4941)*
 RETICULOENDOTHELIOSIS
 ACID PHOSPHATASE ACTIVITY, HAIRY
 CELLS, ULTRASTRUCTURE, LEUKEMIC
 PATIENTS (6332)*
 CHROMOSOMAL ABERRATION, HUMAN (0593)*
 HAIRY CELLS, ULTRASTRUCTURE, HUMAN
 (4950)*
 RETICULOSARCOMA
 AMYLOIDOSIS, SYNGENEIC CELL INOCULA-
 TION, MOUSE (4048)
 BLASTIC TRANSFORMATION, PHA-STIMULATED
 CULTURES, LYMPHOCYTES, HUMAN (4843)
 FREUND'S ADJUVANT, ONCOGENIC ALTERA-
 TIONS, RAT (5965)
 LYMPHOSARCOMA, TUMOR CELL KINETICS
 (3573)*
 OVARY, HISTOPATHOLOGY, CASE REPORT
 (6252)*

- STOMACH, EYE METASTASIS, CASE REPORT (4157)*
- RETICULOSIS
HL-A ANTIGENS, HUMAN, REVIEW (1229)*
SKIN, CANTHARIDIN, ASIATICOSIDE, 3-METHYLCHOLANTHRENE, MOUSE (4391)
- RETICULUM CELL SARCOMA
EYELID, VIRUS-LIKE PARTICLES, CASE REPORT (6166)*
LEUKEMIA, CELLULAR PROLIFERATION, HUMAN (1427)
ORBIT, CASE REPORT (6174)*
OSTEOMYELITIS, MANDIBLE, HUMAN (0191)*
PLACENTAL METASTASIS, CASE REPORT (3368)*
TRANSPLANT, METASTASES, HUMAN (2113)*
- RETICULUM CELL CARCINOMA
IMMUNOLOGICAL INDUCTION, VIRUS, MOUSE (5228)
- RETICULUM CELL SARCOMA
MURINE LEUKEMIA VIRUS, HAMSTER (5896)
- RETINOBLASTOMA
D-CHROMOSOME DELETIONS, HUMAN (6130)
GENETIC TRANSMISSION, REVIEW (5704)
INCIDENCE
AFRICA (3983)*
CHILDREN (0812)
NETHERLANDS (2760)
- IRIS NEOVASCULARIZATION, ULTRASTRUCTURE, HUMAN (3352)*
MORTALITY, NEGRO CHILDREN, WHITE CHILDREN, UNITED STATES (6089)*
MUTATION, HUMAN (0528)*
PROGNOSIS, INCIDENCE, HUMAN, REVIEW (2214)
ULTRASTRUCTURE, PATHOGENESIS, HUMAN (0506)*
- RETINOL
EPITHELIAL DIFFERENTIATION, RAT HAMSTER (5846)*
- REVERSION
TRANSFORMED CELL, CHROMOSOMAL MECHANISM, HAMSTER CELL (4038)
- RHABDOMYOMA
FETAL, ANALYSIS OF CASES (5571)*
- RHABDOMYOSARCOMA
C-TYPE VIRUS, CHROMOSOMES, HUMAN (3076)
7,12-DIMETHYLBENZ(A)ANTHRACENE, ULTRASTRUCTURE, HAMSTER (0987)*
EMBRYONAL, MIDDLE EAR, CASE REPORT, HUMAN (3386)*
HEART, CASE REPORT (4050)*
HUMAN, REVIEW (3637)*
METAL ION, SUBCELLULAR BINDING, RAT (3702)
3-METHYLCHOLANTHRENE-INDUCED, KARYOLOGY, RAT (5112)
TRANSPLANTATION, HUMAN, CAT (1002)
- RHINOPHARYNX
TUMORS, PULMONARY METASTASES, CASE REPORTS (5589)*
- RIBOFLAVIN
DEFICIENCY, EPITHELIAL NEOPLASIA, ARYL HYDROCARBON HYDROXYLASE, MOUSE (3668)
- RIBONUCLEASE
FOCAL LOSS OF ACTIVITY, PRENEOPLASTIC LIVER, RAT (4780)
LEUKEMIA, SERUM, URINE, HUMAN (2167)*
- RIBONUCLEOPROTEIN
HELA CELLS, MITOCHONDRIA (2189)*
ROUS SARCOMA VIRUS (5907)
- RIBONUCLEOTIDE REDUCTASE
DNA METABOLISM, LEUKEMIC CELLS, MOUSE LEUKEMIA, SPLEEN (0849)
- RIBOSOMAL PROTEINS
HEPATOMA, GEL ELECTROPHORESIS, RAT (2175)*
SARCOMA, METABOLISM, ELECTROPHORESIS (2182)*
- RIBOSOMAL RNA
LEUKEMIA, LYMPHOCYTES, CONTROL (1994)
- RIBOSOME
BINDING, RNA, RAUSCHER LEUKEMIA VIRUS (3738)
80 S, POLYPEPTIDE SYNTHESIS, ASCITES TUMOR CELLS (6284)*
HEPATOMA, FERRITIN, IRON, HUMAN (2043)*
ISOLATION, CHARACTERIZATION, LYMPHOMA CELLS, MOUSE (2864)
KREBS ASCITES CARCINOMA, PROTEIN CONTENT, MOUSE (1494)*
LEUKEMIC CELLS, LEUKOCYTE METABOLISM, MESSENGER RNA, RNA METABOLISM (0839)
MEMBRANE-BOUND, PROTEIN SYNTHESIS, MYELOMA CELLS, MOUSE (4238)*
MITOCHONDRIAL, EHRLICH ASCITES TUMOR CELLS, MOUSE (6371)*
MONOMER, LIVER, DIMETHYLNITROSAMINE, RAT (4393)
MYELOMA, DISSOCIATION, MOUSE (0860)*
PROTEIN CONTENT, BIOLOGICAL ACTIVITY, KREBS II ASCITES CARCINOMA CELLS (5440)
PROTEIN SYNTHESIS, BLOOD LYMPHOCYTES, LEUKEMIA PATIENTS (6016)*
RNA, AVIAN LEUKOSIS VIRUS, CHICK CELL (0404)
RNA SYNTHESIS, LEUKEMIC CELLS, HUMAN, METHYLATION (0834)
- RIFAMPICIN
FOCUS FORMATION, INHIBITION, FIBROBLASTS, CHICK (5533)*
INHIBITORY EFFECT, RAUSCHER-VIRUS-INDUCED LEUKEMIA, MOUSE (3136)
- RIFAMPIN
ONCOGENIC TRANSFORMATION, ROUS SARCOMA VIRUS (0422)
- RIFAMYCIN
DERIVATIVES, DNA POLYMERASE INHIBITION, RNA TUMOR VIRUS (1730)
MURINE LEUKEMIA VIRUS, RAUSCHER LEUKEMIA VIRUS, FOCUS-FORMATION, REVERSE TRANSCRIPTASE (3742)
MURINE SARCOMA VIRUS, REVERSE TRANSCRIPTASE INHIBITION, LEUKEMIA (3782)
RAUSCHER MURINE LEUKEMIA VIRUS, REVERSE TRANSCRIPTASE, DNA POLYMERASE, LEUKEMIA (3790)
ROUS SARCOMA VIRUS, SELECTIVE INHIBITION, TRANSFORMED FIBROBLASTS, CHICKEN (5946)*
- RNA
ACTIVITY, NORMAL AND TUMOR CELL FUNCTIONS, REVIEW (4341)*
ADENOVIRUS, INFECTION, NUCLEUS, CYTOPLASM, HUMAN (0706)
ADENOVIRUS TYPE 12 SPECIFIC, SYNTHESIS (3798)
ANTIBODY, IMMUNOGENICITY MECHANISM, IMMUNOLOGICAL TEMPLATE (1858)*

SPARTYL-RNA, ALTERATION, POLYOMA AND
 SV40-TRANSFORMED CELLS (4603)*
 AVIAN MYELOBLASTOSIS VIRUS
 IN VITRO PROTEIN SYNTHESIS, GEL
 ELECTROPHORESIS, RADIOIMMUNE
 ASSAY, FERRITIN, E. COLI (3068)
 TISSUE DISTRIBUTION, CHICKEN
 (5215)
 2 BACTERIOPHAGE, INTERFERON INDUCTION
 (1765)*
 IOSYNTHESIS, AUTORADIOGRAPHY STUDY,
 HERPES SIMPLEX VIRUS-INDUCED CELLS
 (2598)*
 SOUND TO NASCENT DNA, EHRlich ASCITES
 TUMOR CELLS (5545)*
 CANCER, REVIEW (2293)*
 CHANGES, ADENOVIRUS 2, CULTURED HUMAN
 CELLS (2531)
 CHARACTERIZATION, ADENOVIRUS, SV40,
 HYBRID (0707)
 CHROMATOGRAPHY, BURKITT LYMPHOMA,
 INFECTIOUS MONONUCLEOSIS, EPSTEIN-
 BARR VIRUS-TRANSFORMED LYMPHOBLASTS
 (4590)*
 CODING, HEPATOMA, RAT (1957)
 COMPLEMENTARITY, MESSENGER RNA,
 NUCLEAR RNA, HELA CELLS (4967)*
 COMPLEMENTARY RNAs, MURINE MYELOMA DNA
 TEMPLATES (3074)
 COMPONENTS, SMALL MOLECULAR WEIGHT,
 EHRlich ASCITES TUMOR CELLS (5436)
 DETECTION IN MILK PARTICLES, HUMAN
 (3804)
 DNA, ROUS SARCOMA VIRUS, HYBRIDIZATION
 CHICKEN (0423)
 DNA LINKAGE, AVIAN MYELOBLASTOSIS
 VIRUS, DNA POLYMERASE (5219)
 DOUBLE-STRANDED, INTERFERON RELEASE,
 MORPHOLOGICAL ALTERATION, INCREASE,
 HUMAN CELL (1872)*
 EHRlich ASCITES TUMOR, INHIBITION,
 MOUSE (4099)*
 ELECTROPHORETIC ANALYSIS, MOUSE
 LEUKEMIA VIRUS (4580)*
 EQUINE ABORTION VIRUS-SPECIFIC,
 HYBRIDIZATION, MOUSE (3087)
 FELINE LEUKEMIA VIRUS, NUCLEOTIDE
 COMPOSITION, CAT, HUMAN (5247)
 GENE DEREPRESSION, PRIMARY HEPATOMAS,
 RAT (4800)*
 HOMOLOGOUS, HUMAN BREAST CANCER,
 MOUSE MAMMARY TUMOR VIRUS (3774)
 HUMAN LEUKEMIC CELLS, MOUSE LEUKEMIA
 VIRUS, RELATIONSHIP (3131)
 HYBRIDIZATION, LEUKEMIA, MOUSE (0256)*
 HYBRIDIZATION CHARACTERISTICS, MURINE
 MYELOMA DNA TEMPLATES (3074)
 IG6-SPECIFIC, MYELOMA CELLS, MOUSE
 (4709)*
 IMMUNITY MEDIATION, TUMOR-SPECIFIC
 TRANSPLANTATION ANTIGEN, ISOGRAFT
 GROWTH, SPLEEN CELL, RAT (3160)
 ISOACCEPTING TRANSFER, AMINOACYL
 SYNTHETASES, LIVER REGENERATION, RAT
 (3359)*
 LEUKEMIC, NORMAL, HUMAN (2011)
 LIVER, URETHAN, MOUSE (0371)*
 LUNG TUMOR, RNA/DNA RATIO, HUMAN
 (0244)
 LYMPHOSARCOMA CELLS, LYMPHOCYTE
 INHIBITION, HUMAN (1800)
 MESSENGER
 ASCITES CELLS, TRANSLATION (3495)*
 CYTOPLASM, IMMUNOGLOBULIN SECRET-
 ING MYELOMA (4247)*
 FRIEND LEUKEMIA VIRUS, ERYTHROID
 DIFFERENTIATION, TRANSFORMED
 CELLS, MOUSE (5950)*
 INCREASED TRANSLATION EFFICIENCY,
 KREBS ASCITES CELL LYSATE, MOUSE
 RABBIT, HUMAN (4025)
 ISOLATION, AFFINITY CHROMATO-
 GRAPHY, KB-CELLS (6333)*
 MYELOMA LIGHT CHAIN, PROPERTIES
 (3845)
 PROTEIN CODING, L-CELL (1118)
 TRANSLATION, HISTONES, CELL-FREE
 EXTRACT, ASCITES TUMOR, MOUSE
 (4997)*
 TRANSLATION, IMMUNOGLOBULIN,
 CELL-FREE SYSTEM, KREBS II
 ASCITES (4189)*
 TRANSPORT, CELL NUCLEUS,
 ADENOVIRUS (1333)
 METABOLISM
 LEUKEMIC LEUKOCYTES, HUMAN
 (4194)*, (4198)*
 LEUKOCYTES, LEUKEMIA, HUMAN,
 RIBOSOMES (0839)
 LIVER, RAT (5630)*
 MYELOMA, MOUSE (1121)
 NEONATAL ADMINISTRATION, SEX
 HORMONES, LIVER, RAT (2347)
 RNA - CONTINUED
 METHYLASE
 AVIAN MYELOBLASTOSIS VIRUS (1709)
 KIDNEY, DIMETHYLNITROSAMINE, RAT
 (5123)
 METHYLASE ACTIVITY, NICOTINAMIDE,
 HUMAN (2022)
 METHYLATION
 HEPATOMA, N-NITROSODIETHYLAMINE,
 MONKEY (0631)
 LIVER, METHYL METHANE SULPHONATE,
 NN-DIMETHYLNITROSAMINE, RAT
 (5122)
 MITOCHONDRIAL, LENGTH MEASUREMENT,
 MOLECULAR WEIGHT, HELA CELL (1124)
 MOLONEY MURINE SARCOMA VIRUS,
 CHARACTERIZATION, MOUSE (0420)
 MOUSE MAMMARY TUMOR VIRUS, MAMMARY
 CARCINOMA, HUMAN (5926)
 MURINE LEUKEMIA VIRUS, STRUCTURE
 (1017)
 NOVIKOFF HEPATOMA, LIVER, RAT (6379)*
 NUCLEAR
 LOW MOLECULAR WEIGHT, LUNG TUMOR,
 HUMAN (1428)
 POLYRIBOSOMAL, POLYADENYLIC ACID
 SEQUENCES, HELA CELL (0542)
 NUCLEAR AND CYTOPLASMIC, METHYLATION,
 DIMETHYLNITROSAMINE-3H, LIVER,
 MOUSE (2322)
 NUCLEOTIDE SEQUENCE
 ADENOVIRUS 2, INFECTED CELL
 (1358)*
 NOVIKOFF HEPATOMA CELL NUCLEI
 (2875)
 OLIGONUCLEOTIDE MODIFICATION, CIRCULAR
 DICHROISM, PROTON MAGNETIC
 RESONANCE, N-2-ACETYLAMINOFLUORENE
 (3705)
 ONCOGENIC VIRUSES
 MALIGNANT TRANSFORMATION, REVIEW
 (5028)
 REVIEW (5748)*
 PARTIALLY DOUBLE STRANDED, SPLEEN
 CELLS, RAUSCHER VIRUS INFECTION

- MOUSE (3090)
POLYMERASE
ALPHA-AMANITIN-SENSITIVE FORMS,
EHRlich ASCITES TUMOR CELLS
(6289)*
CHROMATIN TEMPLATE ACTIVITY,
FIBROBLASTS, HUMAN (5535)*
DNA DEPENDENT, LIVER, GROWTH
HORMONE, RAT (1294)*
HEPATOMA, RAT (0589)*
NITROSOUREAS, POLYCYTIDYLATE
TEMPLATES (4460)*
OVARY, PRENEOPLASTIC STATE
ESTRADIOL, MOUSE (0190)
POLYCYTIDYLATE TEMPLATE,
NITROSOUREAS (5138)
REOVIRUS, ULTRASTRUCTURE (1364)*
RIFAMPICIN-INSENSITIVE, PURIFICA-
TION, EHRlich ASCITES TUMOR
CELLS (6349)*
SELECTIVE INHIBITION, AFLATOXIN B1
LIVER, RAT (5150)
TRANSCRIPTION, NUCLEOLUS, LIVER,
RAT (4925)*
TRANSPLANTABLE BRAIN TUMOR, MOUSE
(6345)*
POLYMERASE REGULATION, AMINO ACIDS,
EHRlich ASCITES TUMOR CELLS, MOUSE
(6109)
POLYMERASE SUPPRESSION,
4-DIMETHYLAMINOAZOBENZENE, LIVER
CARCINOGENESIS, NITROFURAN, RAT
(2946)
POLYOMA VIRUS INFECTION, MOUSE CELLS
(5903)
POLYRIBOSOMAL, ASCITES SARCOMA,
MOUSE (0286)*
PRECURSOR INCORPORATION, PHORBOL,
EPIDERMIS, MOUSE (1245)
PROTEIN, STAINING, LIVER,
4-DIMETHYLAMINOAZOBENZENE, RAT
(0370)*
PROTEIN SYNTHESIS, LIVER, REGENERATING
HEPATOMA, RAT (0223)
RADIOACTIVE IODINE, MOLECULAR
HYBRIDIZATION EXPERIMENTS (6375)*
RAPID HYBRIDIZING, HAMSTER (2812)
RAUSCHER LEUKEMIA VIRUS
RIBOSOME BINDING (3738)
SPLEEN, MOUSE (5887)
RAUSCHER MURINE LEUKEMIA VIRUS,
MOLECULAR WEIGHT, MOUSE (1354)*
REOVIRUS-SPECIFIC, POLYSOMES, INFECTED
L CELLS, MOUSE (3105)
RIBOSOMAL
AVIAN LEUKOSIS VIRUS, CHICK CELL
(0404)
AVIAN MYELOBLASTOSIS VIRUS,
TERMINAL NUCLEOTIDES, CHICKEN
LEUKEMIC MYELOGLASTS (5929)*
CYTOPLASM, HELA CELL (0844)
MATURATION PATHWAY, FINGER-PRINT-
ING, HELA CELL (4015)
NUCLEAR PRECURSORS, STRUCTURAL
ANALYSIS (2848)
OLIGONUCLEOTIDE SEQUENCES, LIVER,
HEPATOMA ASCITES CELLS, RAT
(5529)*
POLYPYRIMIDINE FRAGMENTS, NOVIKOFF
ASCITES HEPATOMA, LIVER, RAT
(4944)*
RIBOSOMAL SUBUNITS, REGULATED
TRANSPORT, CELL-FREE SYSTEM,
REGENERATING LIVER NUCLEI, RAT
(4943)*
RNA - CONTINUED
ROUS SARCOMA VIRUS
CELLULAR DNA, CHICKEN (5226)
INFECTED CELL, DNA CHICKEN (1326)
RAUSCHER MOUSE LEUKEMIA VIRUS,
ADENYLIC ACID-RICH SEQUENCE
(1740)
SACCHAROMYCES CEREVISIAE, COMPLEMENT
FIXATION, IMMUNO-ONCOLOGY, INFANTS
(5998)*
SEQUENCES, SV40, TRANSFORMED CELLS
(0430)
SIMIAN ADENOVIRUS 7, TRANSFORMED CELL,
HAMSTER (5251)
SINGLE-STRANDED, REOVIRUS, CELL-FREE
EXTRACTS, ASCITES TUMOR (4583)*
SUBUNIT, DNA POLYMERASE TEMPLATE,
ROUS SARCOMA VIRUS (5207)
SV40
ISOLATION, CHARACTERIZATION (4539)
MOLECULAR SIZE, MONKEY CELL (1346)
TRANSCRIPTION, STRAND ORIENTATION,
BSC-1 CELL (4541)
SYNTHESIS
ACTINOMYCIN D, INHIBITION,
LEUKEMIA, HUMAN (0226)
BACTERIOPHAGE (5229)
CELL NUCLEI, SARCOMA, LIVER, RAT
(4840)
CHROMOSOME PULVERIZATION (1475)*
DNA SEQUENCES, HYBRIDIZATION
PROPERTIES, L CELL (0851)
HELA CELL (1496)*
HEMOCYTOBLASTOSIS, HUMAN DIPLOID
CELLS (3760)
INFECTED CELL, ADENOVIRUS (0732)*
LEUKEMIA, MOUSE (0298)*
LEUKEMIC CELLS, RIBOSOMES, HUMAN,
METHYLATION (0834)
LEUKOCYTE, HUMAN (1464)*
LIVER, BERYLLIUM, RAT (1538)
NUCLEAR CHANGE, SKIN, ULTRAVIOLET
HUMAN (1668)
POLIFERATION, BLAST CELL, LEUKEMIA
CELL SIZE, HUMAN (0545)
POLYOMA VIRUS, MOUSE CELLS (5949)*
PROTEIN, COMPARATIVE STUDY, LIVER
AND LUNG, RAT (5192)*
REOVIRUS (1318)
RESTRICTED ADENOVIRUS INFECTION,
MONKEY CELLS (4527)
3H URIDINE AND 3H ADENINE
INCORPORATION, CELL CYCLE,
HAMSTER CELLS (5606)*
30-S NUCLEAR RIBONUCLEOPROTEIN
COMPLEXES, ASCITES CELLS, MOUSE
(4991)*
TOBACCO SMOKE CONDENSATE EFFECT,
SKIN, MOUSE (3012)
SYNTHESIS OF DNA COMPLEMENTS, GENERAL
APPROACH (3769)
SYNTHESIS INHIBITION
CYTOTOXICITY, MALIGNANT MELANOMA,
SERUM, HUMAN (3883)
EHRlich ASCITES TUMOR, 5-FLUOR-
OURACIL, MOUSE (2422)*
MASTOCYTOMA, DNA CONTENT (2020)
METHYLZOXYMETHANOL ACETATE,
TUMORIGENESIS, LIVER, RAT (5128)
3'-TERMINAL NUCLEOSIDES, AVIAN MYELO-
BLASTOSIS VIRUS (3788)
3' TERMINUS, CYTOPLASMIC POLYHOEIOSIS
VIRUS, WOUND TUMOR VIRUS, REOVIRUS

*INDICATES : PLAIN CITATION WITHOUT ACCOMPANYING ABSTRACT

(5217)

TRANSCRIPTION, SV40, INTERFERON,
MONKEY (0130)
TRANSFER

ALTERED PATTERNS, SV40 INFECTED
TRANSFORMED CELLS (3089)
BASE COMPOSITION, AVIAN MYELO-
BLASTOSIS VIRUS, HOST RNA (1705)
CHEMICAL COMPOSITION, GLIOBLASTOMA
MULTIFORME, HUMAN (0264)*
HYDROLASE ACTIVITY, HUMAN TUMORS,
RAT TISSUES (3986)
LYMPHOCYTE TRANSFORMATION, HUMAN
(1126)
METHIONINE-ACCEPTING, CELL-FREE
SYSTEMS, E.COLI, ASCITES TUMOR
CELLS, YEAST (5503)*
METHIONINE-ACCEPTING, PEPTIDE-
CHAIN ELONGATION, ASCITES TUMOR
CELLS, MOUSE (3534)*
METHYLASE, ETHIONINE, YEAST CELL
(5126)
METHYLATION
COLONIC TUMOR, 1,2-DIMETHYL-
HYDRAZINE, MOUSE (5093)
E.COLI-SPECIFIC NORMAL LIVER
AND PLASMACYTOMA, MOUSE
(5637)*
KIDNEY TUMOR, RAT (4002)
METHYLATION PATTERNS, ASCITES
HEPATOMAS, MOUSE (4003)
NOVIKOFF ASCITES HEPATOMA, SV40
TUMOR, HAMSTER (4083)*
NUCLEUS, CYTOPLASM, HUMAN, AUTO-
RADIOGRAPHY (0843)
SOLID TUMORS, BREAST, LIVER, HUMAN
(2832)
UPTAKE AND AMINO ACYLATION,
LEUKEMIA CELLS, MOUSE (5629)*

- CONTINUED

TRANSFER-LIKE, ONCORNAVIRUS (0690)
TRANSFER METHYLASE ACTIVITY, LEUKEMIC
CELLS, MOUSE (3155)*
TRANSFER RNA, AMINOACYL PROFILE,
MYELOMA, HUMAN (0543)
TRANSFER RNA METHYLASES, NOVIKOFF
ASCITES HEPATOMA CELLS, RAT (4005)
TRANSFORMATION, E.COLI, AGRO BACTERIUM
TUMEFACIENS (1882)
TRANSCRIPTS, BASE SEQUENCE, ADENO-
VIRUS (1714)
TRNA METHYLASE, INHIBITOR, TUMOR
(0225)
TUMOR IMMUNITY, TRANSFER, RAT (1389)
TUMOR VIRUS, ULTRASTRUCTURE,
MORPHOLOGY, REVIEW (4334)*
URIDINE-3H UPTAKE, HAMSTER CELLS
(3458)*
UPTAKE
EHRlich ASCITES CARCINOMA CELLS
(6344)*
NOVIKOFF HEPATOMA CELLS, IN VITRO
(4070)*
VIRAL SUBUNITS, MURINE SARCOMA
VIRUS-SPECIFIC, TRANSFORMED CELLS,
RAT, MOUSE, HAMSTER (3745)
VIRUS
ANTIGEN DETECTION, RAPID METHOD
METHOD ELECTROPHORESIS, FELINE
LEUKEMIA VIRUS (2336)
BIOCHEMISTRY, REVIEW (2201)
NUCLEASE ACTIVITY (2502)
VIRUS-SPECIFIC
ADENOVIRUS TYPE 2 INFECTION,

KB CELL (0683)

POLYOMA VIRUS-TRANSFORMED CELLS,
PROPERTIES, HAMSTER, MOUSE
(3109)
ROUS SARCOMA VIRUS CELLS, DETEC-
TION, CHARACTERIZATION (3115)

MRNA

ASCITES CELLS, POLYADENYLIC ACID,
MOUSE (1974)
ERYTHROBLASTS, PROTEINS, AVIAN (1991)
RNA DEPENDENT POLYMERASE
TISSUE CULTURE, ENZYMES (1958)
RNA POLYMERASE
INHIBITION, N-HYDROXY-2-FLUORENYL-
ACETAMIDE, LIVER, RAT (4380)
RUTHENIUM
RADIATION RETENTION, RAT, MONKEY, DOG
(0997)*
SALIVARY GLAND
ADENOMA, MORPHOLOGY, HUMAN (4062)*
ATOMIC BOMB RADIATION, TUMOR,
INCIDENCE, HUMAN, REVIEW (3027)
BASAL CELL ADENOMA, ULTRASTRUCTURE,
HUMAN (2019)
CARCINOMA, 7,12-DIMETHYLBENZ(A)
ANTHRACENE, HORMONE, SEX, RAT (0351)
LYMPHOMA, C-TYPE VIRUS PARTICLE, CAT
(0695)
MENGIOMA, CASE REPORT (1091)*
MUCOEPIDERMOID CARCINOMA, HUMAN
(3529)*
MUCOEPIDERMOID TUMOR, METASTASIS,
HUMAN (0568)*
OAT CELL CARCINOMA, CLINICAL STUDY
(5521)*
TUMOR

ATOMIC BOMB SURVIVOR
JAPAN (1660)
REVIEW (4337)*

HUMAN (2138)*
HUMAN, REVIEW (5054)*
INCIDENCE, MORPHOLOGY, CHILDREN
(4096)*
RECURRENCE, INCIDENCE, HUMAN
(5438)

SARCOIDOSIS

PATIENT SERUM, HERPESVIRUS ANTIBODY
(1848)*

SARCOLYSIN

IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY,
MOUSE (5968)

SARCOMA

ADENOVIRUS, HETEROGENIC TISSUE ANTIGEN
HAMSTER (5996)*
ALLOGENEIC, GROWTH, PHENOBARBITAL, RAT
(4167)*

ALVEOLAR SOFT-PART

CASE REPORT (4966)*

HISTOGENESIS, ULTRASTRUCTURE,
HUMAN (3948)

ANTIGEN-DEFICIENT CELL VARIANTS,
PRENEOPLASTIC FOREIGN BODY REACTION,
MOUSE (4790)

ANTIGENICITY ALTERATIONS, SPONTANEOUS
PULMONARY METASTASES, MOUSE (3935)*

ANTITUMOR ACTIVITY, LYMPH NODE,

METHYLCHOLANTHRENE, MOUSE (1826)
ASCITES, POLYRIBOSOMAL RNA, MOUSE
(0286)*

BONE

ELECTRON MICROSCOPE, HUMAN (2054)*

EWING'S, ULTRASTRUCTURE (2179)*

ULTRASTRUCTURE, HUMAN (2116)*

BORTRYOID, BLADDER, URINE CYTOLOGY,

DOG (6348)*
 CHIMERA, BONE MARROW, FIBROBLAST,
 DISK IMPLANT, MOUSE (1167)*
 CHOLANGIO-, THORIUM RADIATION, CASE
 REPORT (2473)*
 CHROMATINS, LIVER PYRUVATE KINASE
 ISOENZYMES, RAT (4223)*
 DEVELOPMENT, 3-METHYLCHOLANTHRENE,
 AGE FACTOR, MOUSE (5149)
 7,12-DIMETHYLBENZANTHRACENE, SKIN
 TRANSPLANTS, MOUSE (5270)
 DNA SYNTHESIS, STIMULATION,
 AUTOCHTHONOUS TUMOR CELL, BENIGN
 TUMOR, HUMAN (0156)
 ENDOMETRIUM, CELLULAR STROMA,
 HISTOLOGY, CLINICAL STUDY (6173)*
 EPITHELIOID
 CLINICAL, PATHOLOGIC STUDY
 (6155)*
 FIBROCYTIC DERIVATION, CASE
 REPORTS (5407)*
 ULTRASTRUCTURE, HUMAN (3958)*
 FIBROSARCOMA, HUMAN, REVIEW (3637)*
 GROWTH
 CHOLINESTERASE, RAT (0560)*
 GENOTYPE-DEPENDENT MODIFICATION,
 CASTRATED MICE (4836)*
 3-METHYLCHOLANTHRENE, PREDNISONE
 (1604)*
 GROWTH INHIBITION, REGIONAL LYMPH NODE
 AND SPLEEN CELL, MOUSE (4745)*
 HUMAN CELL LINES, ONCOGENIC PROPERTIES
 HAMSTER (6159)*
 INCIDENCE, ROUS SARCOMA VIRUS,
 VITAMIN A, CHICK CELLS (1774)*
 INDUCED, SUCCESSIVE TRANSPLANT
 GENERATIONS, RAT (3374)*
 INDUCTION, DEAE-DEXTRAN, ETHYL-
 NITROSOUREA, MOUSE (3001)
 JENSON'S, CARDOLIPINS, MITOCHONDRIA,
 MICROSOMES (5671)*
 KAPOSI'S
 EPIDEMIOLOGY, BANTU OF MOFAMBIQUE
 (3982)*
 LYMPHOCYTE TRANSFORMATION (6279)*
 POSTMORTEM FINDINGS, DISEASE
 PATTERNS, WOMEN (4890)*
 TISSUE CULTURE (5696)*
 KAPOSI'S ANGIOSARCOMA, HISTOCHEMISTRY,
 ULTRASTRUCTURE, HUMAN (0257)*
 LEIOMYOSARCOMA, HUMAN, REVIEW (3637)*
 LIPOSARCOMA, HUMAN, REVIEW (3637)*
 LYMPHOCYTE STIMULATION, DNA SYNTHESIS,
 INHIBITION, HUMAN (0482)
 LYMPHOCYTIC, VIRUS-LIKE PARTICLES,
 MOUSE (4594)*
 LYMPHORETICULAR, SMALL INTESTINE,
 CASE REPORT (3369)*
 MALIGNANT FIBROUS HISTIOCYTOMA, SOFT
 TISSUES, HUMAN (4053)*
 METACHRONOUS ANGIOPLASTIC, STEWART-
 TREVES SYNDROME, ETIOLOGY, CLINICAL
 SYMPTOMS, PREVENTION (3559)*
 METASTASES, ITERATED PASSAGING, RAT
 (4293)*
 METHYLCHOLANTHRENE-INDUCED, HOST
 IMMUNITY, GUINEA PIG (4703)
 MOLONEY, METHYLCHOLANTHRENE-INDUCED,
 ANTIBODY, ADSORPTION, ELUTION
 (0453)
 MOUSE, MOLONEY VIRUS, SERUM GROWTH
 FACTOR (0744)
 MURINE SARCOMA VIRUS INDUCTION,
 ENHANCEMENT BY INTERFERON INDUCERS,

MOUSE, RAT (4553)
 NEUROGENIC, ESTABLISHMENT IN VITRO,
 ULTRASTRUCTURE, HUMAN (3360)*
 180 SOLID TUMOR, YEAST POLYSACCHARIDE
 TREATMENT, CARBON CLEARANCE
 ACTIVITY, MOUSE (4748)*
 SARCOMA - CONTINUED
 OSTEOGENIC
 HEAD AND NECK, RADIATION
 THERAPY-INDUCED, CASE REPORTS
 (3736)*
 X-IRRADIATION, HUMAN (2470)*
 OVARIAN, HUMAN (2153)*
 PRIMARY LIVER, SPONTANEOUS RECOVERY,
 CASE REPORT (5380)*
 PRIMARY ROUS, CHROMOSOME ANALYSIS, RAT
 (5462)*
 PRODUCTION, FOOD ADDITIVES,
 PHYSICOCHEMICAL FACTORS (1601)
 PROSTATE GLAND, CLINICAL STUDY (5650)*
 RADIATION INDUCED, HUMAN (2468)*
 RESPIRATION, GLYCOLYSIS, CARTESIAN
 DIVER TECHNIQUE (4073)*
 RETICULUM CELL
 CYTOGENETICS, CASE REPORTS (3317)
 EYELID, VIRUS-LIKE PARTICLES,
 CASE REPORT (6166)*
 IMMUNOLOGICAL INDUCTION, MOUSE
 (5246)
 LYMPHOCYTOSARCOMA, INCIDENCE,
 GERMANY (5420)
 METASTASES, TRANSPLANT HUMAN
 (2113)*
 ORBIT, CASE REPORTS (6174)*
 PLACENTAL METASTASIS, CASE REPORT
 (3368)*
 RADIATION THERAPY, REVIEW (2246)*
 SPLEEN, METASTASES, MICE (1981)
 RHABDOMYOSARCOMA, HUMAN, REVIEW
 (3637)*
 RHODAMINE, CATALASE-DEPRESSING
 ACTIVITY, LIVER, RAT (2949)
 RIBOSOMAL PROTEINS, METABOLISM,
 ELECTROPHORESIS (2182)*
 ROUS
 CELL-MEDIATED IMMUNITY, QUAIL
 (5923)
 ORIGIN OF DOUBLE-MINUTES,
 CHROMOSOME, RAT (4601)*
 VITAMIN A, ENHANCING EFFECT,
 CHICKENS (3112)
 SCLEROSING RETICULUM CELL, HISTIOCYTIC
 LYMPHOMA, CASE REPORTS (3356)*
 SOFT TISSUE, HUMAN (3399)*
 SOLUBLE ANTIGEN FRACTIONATION,
 MACROPHAGE MIGRATION INHIBITION TEST
 GUINEA PIG (5351)
 SPECIFIC ANTIGENS, AUTOLOGOUS SERA,
 CYTOTOXICITY, HUMAN (4669)
 SPERMATIC CORD
 CLINICAL STUDY (5579)*
 HUMAN (4014)
 SPONTANEOUS OSTEOGENIC, MONKEY (4169)*
 TRANSPLANTATION, SPLENECTOMY, MOUSE
 (3299)
 TUMOR ANTIBODY, CLINICAL COURSE, HUMAN
 REVIEW (0307)
 SARCOMA - CONTINUED
 X-IRRADIATION, RAT (2457)
 YOSHIDA
 E-AMINOCAPROIC ACID, SINTROM,
 BLOOD CLOTTING SYSTEM, RAT
 (3438)*
 ANTIGENIC CELL, PERITONEAL

LYMPHOCYTE, ENHANCED CYTOTOXICITY, RAT (2634)
 DEOXYTHYMIDINE KINASES, PURIFICATION AND PROPERTIES (3502)*
 MARKER CHROMOSOMES, RAT (5525)*
 RETICULOENDOTHELIAL SYSTEM, ULTRASTRUCTURE, RAT (6134)*
 SPLENOMEGALY, RETICULOENDOTHELIAL SYSTEM, RATS (0194)*
 TYROSINE AMINOTRANSFERASE ACTIVITY HORMONAL EFFECTS, RAT (4986)*
SARCOMA 180 CELLS
 ANIONIC NATURE, SENSITIVITY, GUANYLHYDRAZONE (1996)
 BRAIN CELL, COMPLEMENT FIXING ANTIBODY MOUSE (3163)
SCALP
 CYLINDROMA, X-IRRADIATION, CASE REPORT (0675)*
 RETICULUM CELL SARCOMA, CELL KINETICS, CASE REPORT (4234)*
SCAR
 CHEMICAL BURN, ESOPHAGUS, TRANSFORMATION, CASE REPORT (1609)*
 CHRONIC ULCERATION, CANCER, HUMAN (3953)*
 MALIGNANT CHANGE, HUMAN, REVIEW (1507)
SCAR TISSUE
 ESOPHAGUS, CARCINOMA, HUMAN (0507)*
SCHISTOSOMA HEMATOBIUM
 INFECTION, BLADDER, EPITHELIAL NEOPLASMS, MONKEY (3944)
SCHWANN CELL
 MALIGNANT NEURINOMA, CLONAL LINE, ETHYLNITROSUREA, RAT (5167)
SCHWANNOMA
 MALIGNANT, CASE REPORT (5613)
 STOMACH, EXOGASTRIC DEVELOPMENT, HUMAN (4160)*
SCROTUM
CANCER
 MINERAL OIL, NETHERLANDS (3024)*
 OIL, PROPHYLACTIC CONSIDERATIONS, CASE REPORT (4475)*
 CARCINOMA, OIL, HUMAN (0645)*
 EPITHELIOMA, CAUSATIVE FACTORS, SCOTLAND (4817)
SEBACEOUS GLAND
 CELLS, PROLIFERATIVE, LABELLING INDEX, REGIONAL VARIATIONS, HUMAN (1880)
SEMINAL GLAND
 TUMORS, CELLOPHANE-INDUCED, RAT (5199)
SEMINAL VESICLES
 TUMORS, MASTOMYS (4883)*
SEMINOMA
 CYTOGENETIC ANALYSIS, HUMAN (3310)
SENSITIVITY
 BALB/3T3 CELLS, MURINE SARCOMA VIRUS, MURINE LEUKEMIA VIRUS, INFECTION, POLYCATIONS (3770)
 DELAYED, HODGKIN'S DISEASE (6033)*
 ERYTHROCYTE, LYSIS, LEUKEMIA (1454)*
SEROMUCOID FRACTION
 WALKER 256 CARCINOMA, OXYPHENBUTAZONE, RAT (1626)*
SEROUS MEMBRANE
 PROLIFERATIVE LESION, STILBESTROL, OVARIECTOMY, DOG (1643)*
SERUM
 ALPHA-FETOPROTEIN
 LIVER CANCER, INCIDENCE, HUMAN (4723)*
 RAT, LIVER, REGENERATION (0762)
 ALPHA-GLOBULIN, TUMOR-BEARING HOST, HUMAN (1402)
 AMINO ACID COMPOSITION, MALE LEUKEMIA PATIENTS, FEMALE LEUKEMIA PATIENTS (6062)*
 ANTIBODY, EPSTEIN-BARR VIRUS, CANCER PATIENT (3876)
 ANTITHYMOCYTE, NORMAL, FRIEND DISEASE VIRUS, MOUSE (3817)
 ASCITES TUMOR-INDUCED CHANGE, HAMSTER (4016)
 CELL MULTIPLICATION, CANCER PATIENTS (5981)*
 COMPLEMENT LEVEL, PROSTATIC CARCINOMA, HUMAN (3177)
 CYTOTOXICITY, RNA SYNTHESIS INHIBITION MALIGNANT MELANOMA, HUMAN (3883)
 ENZYME PATTERN, METASTASIS, LIVER, AH109A-BEARING RATS (6361)*
 ENZYMES, MALIGNANT TUMOR, MAMMARY GLAND, HUMAN (6238)*
 FACTOR, BLOCKING ANTIBODY, TUMOR HOST (1828)
 GLYCOPROTEIN LEVELS, INFLAMMATION, MALIGNANT DISEASES, FEMALE BREAST, CLINICAL STUDY (6156)*
 HODGKIN'S DISEASE, PHA-STIMULATED LYMPHOCYTES, HUMAN (3165)
 IMMUNE, MOLONEY SARCOMA VIRUS, SPECIFIC CYTOTOXICITY, LYMPHOID CELL MOUSE (2605)
 IMMUNOELECTROPHORESIS, LYMPHOPROLIFERATIVE DISEASE, HUMAN (4720)*
 INHIBITION, PHYTOHEMAGGLUTININ-INDUCED LYMPHOCYTE, TRANSFORMATION (0454)
 LIPOPROTEINS, CANCER PATIENTS (4069)*
 MAMMARY CARCINOMA, IMMUNOFLOUORESCENCE, HUMAN (1802)
 NORMAL RAT, EHRlich ASCITES TUMOR CELL (6001)*
 PROTEIN FRACTIONS, LEUKEMIA, HUMAN (3918)*
 PROTEIN RESPONSE, PREGNANCY, LEUKEMIA, MOUSE (4046)
PROTEINS
 EHRlich ASCITES TUMOR, MOUSE (4119)*
 ISOLATION, REGENERATING LIVER AND HEPATOMA, RAT (5393)*
 LEUKEMIA, HUMAN (0770)
 SULFHYDRYL GROUPS, TUMOR-BEARING RATS (0572)*
 SYNTHESIS, DEGRADATION, MORRIS HEPATOMA, RAT (5451)
SEX
 ABERRANT RATIOS, DROSOPHILA, TUMOROUS HEAD STRAINS (1909)*
 LIGHT, WALKER'S CARCINOMA, SURVIVAL RATE, RAT (6218)*
 RATIO OF INCIDENCE, GASTRIC CARCINOMA, HUMAN (0581)*
 SALIVARY GLAND CARCINOMA, 7,12-DIMETHYLBENZ(A)ANTHRACENE, HORMONE, RAT (0351)
 SEXUAL INTERCOURSE
 CERVICAL CARCINOMA (0186)
 PROSTATIC CARCINOMA (0514)
SEX CHROMATIN
 BREAST CANCER, AGE FACTOR, HUMAN (4281)*
 CAROTID BODY TUMOR, CASE REPORT (4280)*
SEX ORGAN
 CATECHOLAMINE CONTENT, MICROSOMAL ENZYME INDUCER, GUINEA PIG (1281)*

- SHAY CHLOROLEUKEMIC TUMOR
CELL ELECTRICAL POTENTIAL DIFFERENCE,
ION DISTRIBUTION (4186)*
- SIALIC ACID
ASSAY, CANCER, HUMAN (2357)
BONE TUMORS, HUMAN (3530)*
- SIBLING
BROTHER, WILM'S TUMOR, CASE REPORT
(1163)*
DESMOID TUMOR, STOMACH, CASE REPORT
(1184)*
- SIDEROSIS
CYSTOPAPILLARY ADENOMA, KIDNEY, CASE
REPORT (6136)*
8-HYDROXYQUINOLINE, IRON, NEOPLASTIC
AND PRENEOPLASTIC LESIONS, LIVER,
RAT (4389)
- SILICA
LYMPHOMA INDUCTION, RAT (3651)
- SINUS
CARCINOMA, INDUCTION, RADIONUCLIDE
(1680)*
ETHMOID, ADENOCARCINOMA, INCIDENCE,
WOOD DUST, FURNITURE WORKERS (1270)
HISTIOCYTOSIS, LYMPHADENOPATHY,
ANALYSIS OF CASES (4932)*
PARANASAL, NASAL CAVITY, CANCER,
CLINICAL STUDY (5642)*
- SINUSITIS
CHRONIC, MALIGNANT TRANSFORMATION,
LDH ACTIVITY, HUMAN (2716)
- SIPPLE'S SYNDROME
MEDULLARY THYROID CARCINOMA,
PHEOCHROMOCYTOMA, FAMILIAL
OCCURRENCE (1443)
- SJOGREN'S SYNDROME
REGION TO MALIGNANT LYMPHOPROLIFERA-
TION, CASE REPORTS (4803)*
- SKELETON
PATHOLOGY, HODGKIN'S DISEASE, HUMAN
(6386)*
- SKIN
ACTINOMYCIN-D, PERSISTENCE,
7,12-DIMETHYLBENZ(A)ANTHRACENE,
TUMOR INHIBITION, MOUSE (5072)
ADJACENT MELANOCYTE, MELANOMA, HUMAN
(0262)*
ALTERATION
GROSS LEUKEMIA
ALLOGRAFT, HYPOTHESIS, MOUSE
(4512)
TUMOR CELLS, MOUSE (5340)
AUTOIMMUNOLOGICAL CHANGES, CARCINOMA
(1856)*
BASAL CELL EPITHELIOMA
COLLAGENOLYTIC ENZYMES
HUMAN (5600)*
ULTRASTRUCTURE, HUMAN (5604)*
BASAL CELL LAYER, MITOSIS, MOUSE
(0266)*
BASEMENT MEMBRANE CHANGES, CARCINO-
GENESIS, ANIMAL, HUMAN, REVIEW
(5705)
- CANCER
BENZO(A)PYRENE, TAR-CONTAINING
(3000)
COAL TAR, SYNTHETIC TAR, MOUSE
(5155)
EFFECT OF MALE HORMONE, METHYL-
CHOLANTHRENE, MOUSE (2947)
ETIOLOGY, HUMAN (3952)*
GEOGRAPHIC DISTRIBUTION, ULTRA-
VIOLET RADIATION, HUMAN (4812)
IMMUNOSUPPRESSION, HUMAN (2642)
INCIDENCE, LEBANON (2775)*
MINERAL OIL, INCIDENCE, ENGLAND
(2797)*
MUCOUS MEMBRANE, PRECANCEROUS
BENIGN LESIONS, HUMAN, REVIEW
(4354)*
OSTEOMYELITIC FISTULAS, MALIGNANT
ULCERS, CLINICAL STUDY (6350)*
PIGMENT DISTRIBUTION, HUMAN
(2060)*
RADON RADIATION (1681)*
RISK FACTORS (3026)
SQUAMOUS CELL, ETIOLOGY, HUMAN
REVIEW (4313)
SUNLIGHT, ULTRAVIOLET, HUMAN,
REVIEW (5702)
TOPICAL HORMONES, INCIDENCE, U.S.
(2764)
UV RADIATION, SUNLIGHT, HUMAN,
REVIEW (5019)
CANCER OCCURRENCE, ATMOSPHERIC FACTORS
HUMAN (4447)
- CARCINOGENESIS
ANTHANRENE, POLYNUCLEAR HYDRO-
CARBON, MOUSE (5142)
ANTHANTHRENE DERIVATIVE, MOUSE
(4405)
CHALONE, 9,10-DIMETHYL-1,2-BENZ-
ANTHRACENE, MOUSE (0053)
INHIBITION, VITAMIN A,
7,12-DIMETHYLBENZ(A)ANTHRACENE,
MOUSE (0638)
TOSYL PHENYLALANINE CHLOROMETHYL
KETONE, MOUSE (5844)*
- CARCINOMA
DIMETHYLBENZANTHRACENE, CASTRATION
RAT (2952)
HUMAN, REVIEW (2286)*
INCIDENCE, ARIZONA (0213)*
ISONIACIDE, TUBERCULOSIS, HUMAN
(0985)*
MALIGNANT MELANOMA, INCIDENCE,
INDIA (0526)*
3-METHYLCHOLANTHRENE, IMMUNO-
SUPPRESSION, MOUSE (1388)
UV RADIATION, DNA REPAIR, HUMAN
(1305)
CELL REPLACEMENT, CHALONE, TUMOR,
REVIEW (5707)
CHEMICAL CARCINOGEN
TOPICAL APPLICATION, MOUSE (0641)
TUMOR PROMOTION (0088)*
CHRONIC CICATRICAL ULCERATION, CANCER
POTENTIAL, HUMAN (3953)*
CLEAR-CELL HYDRADENOMA, CLINICAL STUDY
REVIEW (5730)*
CUTANEOUS CARCINOGENESIS, HYDROQUINONE
CIGARETTE SMOKE CONDENSATE, MOUSE
(2432)*
CUTANEOUS CARCINOMA, YOUNG MEN, CASE
REPORT (4185)*
CUTANEOUS PAPILLOMA, PAPOVA VIRUS,
OPOSSUM (3749)
CUTANEOUS PRECANCER, CANCER, HUMAN,
REVIEW (3641)*
DELAYED CUTANEOUS HYPERSENSITIVITY,
AUTOLOGOUS TUMOR EXTRACT, MALIGNANT
MELANOMA, HUMAN (4657)
7,12-DIMETHYLBENZ(A)ANTHRACENE
BENZO(A)PYRENE, COMBINED EFFECT,
MOUSE (5186)*
ESTERASE, ISOZYME PATTERN, MOUSE
(0960)
TUMOR INITIATION, MOUSE (5773)

UV RADIATION, MOUSE (3719)*
 DNA SYNTHESIS, DIMETHYLBENZANTHRACENE,
 TUMOR PROMOTER, MOUSE (3644)*
 EPIDERMAL CELL, TOXICITY,
 3-METHYLCHOLANTHRENE, BENZO(A)PYRENE
 HUMAN (0964)
 EPIDERMIS CELL CULTURES, CHEMICAL
 CARCINOGENESIS, MOUSE EMBRYO (5859)*
 EPIDERMODYSPLASIA VERRUCIFORMIS
 MALIGNANCY, VIRUS, HUMAN, ULTRA-
 STRUCTURE (1439)
 PAPOVAVIRUSES, ONCOGENESIS (3793)
 VIRUS PARTICLE, ULTRASTRUCTURE,
 IMMUNOLOGY, HUMAN (1764)*
 EPITHELIOMA
 CLIMATIC FACTORS (0331)*
 NEUROHISTOLOGY, EVOLUTIONARY
 ASPECTS (1897)*
 IN - CONTINUED
 FIBROBLAST, TRANSFORMATION, SV40,
 DOWN'S SYNDROME, HUMAN (0435)
 FIBROMA VIRUS, MORPHOGENESIS, RABBIT
 (1038)*
 FIBROSARCOMA, 5-HYDROXY-3,4-BENZO(A)-
 PYRENE, MOUSE (5141)
 GRAFT, LYMPH NODE RESPONSE, MITOSIS,
 MOUSE (4666)
 GRENZ RADIATION, 7,12-DIMETHYLBENZ(A)-
 ANTHRACENE, CARCINOGENESIS, MOUSE
 (5862)
 HEMANGIOENDOTHELIOMA, HISTOLOGY, CASE
 REPORT (6208)*
 HETEROGENIZATION FACTOR,
 7,12-DIMETHYLBENZANTHRACENE-INDUCED
 TUMOR TRANSPLANT, LATENT VIRUS,
 MOUSE (5270)
 HISTOPATHOLOGY, DERMATOFIBROSARCOMA
 PROTUBERANS, CASE REPORT (6214)*
 HODGKIN'S DISEASE, MALIGNANT
 GRANULOMA, MORPHOLOGY, PATHOGENESIS
 (1902)*
 HYPERPLASIA, TUMOR, UREA ANTIGEN,
 MOUSE (4692)
 IMMUNE RESPONSE, HUMAN (1867)*
 INTERFOLLICULAR EPIDERMIS, TUMOR
 PROMOTION, 12-O-TETRADECANOYL-
 PHORBOL-13-ACETATE, MOUSE (4367)
 KERATOACANTHOMA
 EPITHELIOMA, CASE REPORT (1906)*
 VITAMIN A, ACTINOMYCIN D, RABBIT
 (0869)*
 LEIOMYOSARCOMA, CASE REPORT (6363)*
 LESIONS, VITAMIN A, HAMSTER (5786)
 MALIGNANT MELANOCYTE, PIGMENT TRANS-
 FORMATION, HAMSTER (0592)*
 MALIGNANT MELANOMA
 HOST FACTOR, REVIEW (0931)*
 IMMUNOSTIMULATION PROCEDURES,
 THERAPY, PATIENTS (5376)*
 MORPHOGENESIS, HUMAN (4787)
 OCCUPATIONAL EXPOSURE, SUNLIGHT,
 INCIDENCE, ENGLAND, SWEDEN
 (3252)
 TYROSINASE, IMMUNOLOGY, HUMAN
 (0779)*
 MELANOMA
 EPITHELIOMA, INCIDENCE, AUSTRIA
 (1307)
 FAMILIAL, CLINICAL CHARACTERISTICS
 HUMAN (0842)
 METASTASES TO THE STOMACH, CASE
 REPORT (4265)*
 NEVUS, SEX CHROMATIN, DNA, HUMAN
 (0546)
 SUNLIGHT, HUMAN (1310)*
 METASTASIS
 HUMAN (2862)
 MICROCIRCULATION, METHODOLOGY,
 RAT (1168)*
 MULTIPLE CUTANEOUS LEIOMYOMA,
 HEREDITARY, CASE REPORT (1136)*
 MULTIPLE LEIOMYOMA, MULTIPLE GLOMUS
 TUMORS, BLUE RUBBER-BLEB NEVUS
 SYNDROME, GENETICS (4175)*
 MULTIPLE TUMOR, GENETICS, HUMAN
 (4140)*
 NEOPLASIA
 EPIDEMIOLOGY, MEXICO (0207)
 ULTRAVIOLET RADIATION, MAN (0102)
 NUCLEAR CHANGE, RNA SYNTHESIS, PROTEIN
 SYNTHESIS, ULTRAVIOLET, HUMAN (1668)
 OSTEOMA, CHILD, CASE REPORT (6209)*
 PAPILLOMA
 INDUCTION, 7,12-DIMETHYLBENZ(A)-
 ANTHRACENE, MOUSE (0350)
 3-METHYLCHOLANTHRENE, NONIMMUNE
 REGRESSION, MOUSE (1381)
 PATHOLOGY, CARCINOMA, GENETICS, HUMAN
 (0622)*
 PHORBOLESTER, CGCARCINOGENICITY,
 MOUSE (0633)
 PRECANCEROUS CONDITION, DNA (1900)*
 PRIMARY MALIGNANT MELANOMA, METASTASIS
 EYE, CASE REPORTS (6326)*
 RADIATION, SWEAT GLAND CARCINOMA,
 HUMAN (3031)*
 RADIATION CONTAMINATION, HAZARD
 (2466)*
 SEBACEOUS GLANDS, ESTERASE ACTIVITY,
 POLYCYCLIC HYDROCARBONS, TOBACCO
 CONDENSATE, MOUSE (2331)
 SPIRADENOMA, EXOCRINE, ULTRASTRUCTURE,
 CASE REPORT (6131)*
 SPITHELIOMA, ULTRASTRUCTURE,
 EVOLUTIONARY ASPECTS (1898)*
 SQUAMOUS CELL CARCINOMA
 LICHEN PLANUS INFECTION, CASE
 REPORT (0666)*
 MORTALITY, HUMAN (6223)*
 SYNGENETIC TRANSPLANT, HEPATOCARCINO-
 GENESIS, MOUSE (3463)*
 TUMOR
 CIGNOLIN, 9,10-DIMETHYL-1,2-BENZ-
 ANTHRACENE, MOUSE (5777)
 DNA AND HISTONE PROTEIN CONTENT,
 CYTOPHOTOMETRIC MEASUREMENTS,
 RAT, MOUSE (5120)
 INCIDENCE, INDIA (5497)*
 MORPHOLOGY, DIAZO-ACETIC ESTER,
 RAT, MOUSE (5763)
 PATHOLOGY, HUMAN (3461)*
 PROTEIN, MAN (0232)
 VITAMIN A, GLYCOPROTEIN SYNTHESIS,
 HUMAN (4378)
 SKIN - CONTINUED
 TUMOR FORMATION, HAIR-FOLLICLE DAMAGE,
 RADIATION-INDUCED, MOUSE, RAT (5200)
 TUMOR INDUCTION, 7,12-DIMETHYLBENZ(A)-
 ANTHRACENE, DOSE LEVEL, RAT (2923)
 TUMOR IRREVERSIBILITY, CYTOECOLOGICAL
 PROBLEM, HUMAN, REVIEW (5037)*
 TUMOR PROMOTION, PHORBOL, MOUSE
 (0653)*
 TUMOR PROMOTION, PHORBOL ESTER, MOUSE
 (3680)
 TUMORIGENESIS
 ARYL HYDROCARBON HYDROXYLASE,
 INHIBITION, 7,8-BENZOFLAVONE

7,12-DIMETHYLBENZ(A)ANTHRACENE,
 MOUSE (3678)
 CROTON OIL-INDUCED, INHIBITION BY
 STEROID HORMONES, MOUSE (4368)
 3-METHYLCHOLANTHRENE, CANTHARIDIN,
 ASIATICOSIDE, RETICULOSIS, MOUSE
 (4391)
 PHORBOL ESTER, BIOCHEMICAL
 MECHANISM, MOUSE (2927)
 RECONSTITUTED TOBACCO, TAR, MOUSE
 (3684)
 REVIEW (0615)*
 VACCINIA VIRUS, 3-METHYLCHOLAN-
 THRENE, MOUSE (2486)
 TUMORIGENESIS INHIBITION, ANTIOXIDANT,
 7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT
 (3689)
 UREMIA EFFECT, BASAL CELLS, MOUSE
 (3459)*
 WART, ATOPIC SYNDROME, COINCIDENCE,
 HUMAN (1110)*
 SKIN GRAFT
 REJECTION, CYTOSINE ARABINOSIDE, MOUSE
 (4662)
 SKULL
 GIANT CELL TUMORS, PATHOLOGY, HUMAN
 (4290)*
 SODIUM
 REVERSE ION CONCENTRATION GRADIENTS,
 ELECTROGENIC SODIUM PUMP, AMINO ACID
 CONCENTRATION, ASCITES-TUMOR CELLS,
 MOUSE (5544)*
 SODIUM HYPOCHLORITE
 CARCINOGEN POTENTIAL, MOUSE (2334)
 SODIUM NITRITE
 DIMETHYLAMINE, LIVER TOXICITY, MOUSE
 (5778)
 HEPATIC NECROSIS, MOUSE (0975)*
 SODIUM PENTOBARBITONE
 LIVER, ENZYME INDUCTION, RAT (1611)*
 SODIUM PHENOBARBITAL
 BILE FLOW RATE, RAT (1614)*
 SOIL
 CANCER PREDISPOSITION, REVIEW (4318)
 MAGNESIUM CONTENT, LEUKEMIA INCIDENCE,
 POLAND (5427)*
 SPERMATIC CORD
 SARCOMA
 CLINICAL STUDY (5579)*
 HUMAN (4014)
 SPERMATOGONIA
 CHROMOSOME ABERRATION, CHEMICAL
 MUTAGEN, MOUSE (1644)*
 SPHINGOMYELIN
 BIOSYNTHESIS, SV40, TRANSFORMATION,
 MOUSE (4549)
 SPINAL CORD
 EUPLOID SARCOMA, N-METHYLNITROSOUREA,
 KARYOTYPE ABERRATION, RAT (1268)
 LUMBO-SACRAL, GIGANTO-CELLULAR GLIO-
 BLASTOMA, CASE REPORT (5560)*
 SPINDLE CELL
 CARCINOMA, BURN SCAR, UPPER LIMB,
 CASE REPORT (5564)*
 SPINE
 EXTRAMEDULLAR TUMORS, SUPRAFOCAL
 DISORDERS, SUPERFICIAL SENSITIVITY,
 HUMAN (3416)*
 GANGLIA, HERPES SIMPLEX VIRUS
 INFECTION, MOUSE (0729)*
 TUMOR, N-METHYL-N-NITROSOUREA, RAT
 (1592)
 SPIRADENOMA
 EXOCRINE, ULTRASTRUCTURE, CASE REPORT
 (6131)*
 SPIRONOLACTONE
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 BLOOD CHANGES, RAT (1571)
 SPLEEN
 CELL
 CYTOTOXICITY DEPLETION, ALLOGENEIC
 TUMOR CELL, MOUSE (4616)
 PLASMACYTOMA, TRANSPLANTATION
 INHIBITION, MOUSE (5902)
 CELL GRAFT, GRAFT-VERSUS-HOST REACTION
 IMPAIRMENT, TUMOR, RAT (3855)
 CELL IMMUNE RESPONSE, FRIEND VIRUS
 INFECTION, MOUSE (1801)
 CELL PROLIFERATION, ANTIBODY, EHRlich
 TUMOR, MOUSE (3913)*
 CELL STIMULATION, ANTIGENIC RESPONSE,
 CELL FACTOR CHARACTERIZATION, MOUSE
 (4868)
 CELLULAR IMMUNITY, INHIBITION,
 LEUKEMIA, ISOANTIBODY, MOUSE (3159)
 COLONY FORMATION, FIBROSARCOMA, MOUSE
 (0299)*
 COLONY FORMING UNIT, POLYCYTHEMIA
 FRIEND VIRUS, MOUSE (4503)
 CYTOTOXICITY, LYMPH NODE CELL,
 SUPPRESSION, ASCITES TUMOR, MOUSE
 (4752)*
 GIANT FOLLICULAR LYMPHOCYTOMA,
 IMMUNOGLOBULIN FORMATION, NEOPLASMIC
 DISTURBANCES, CASE REPORT (4632)
 GRAFT-VERSUS-HOST REACTION, PLAQUE-
 FORMING CELL RESPONSE, SHEEP RED
 BLOOD CELL, RAT (1790)
 IMMUNE RESPONSE DEPRESSION, 4-NITRO-
 QUINOLINE 1-OXIDE, MOUSE (3679)
 LYMPHOMA, STEMLINE, EVOLUTION, A TYPE
 PARTICLE, MOUSE (3941)
 MALIGNANT HEMANGIOENDOTHELIOMA,
 ULTRASTRUCTURE, CASE REPORT (6071)*
 MURINE MYELOID LEUKEMIA, COLONY, MOUSE
 (4201)*
 MURINE SARCOMA VIRUS, GUAROA VIRUS,
 COINFECTION, MOUSE (3064)
 NUCLEOSIDE DEAMINASE, FRIEND LEUKEMIA
 VIRUS, MOUSE (0447)*
 PLAQUE-FORMING CELL RESPONSE, MAMMARY
 ADENOCARCINOMA, LYMPH NODE, MOUSE
 (0758)
 RAUSCHER LEUKEMIA VIRUS, RNA, MOUSE
 (5887)
 SPLENECTOMY, SARCOMA TRANSPLANTATION,
 MOUSE (3299)
 SPLENOMEGALY
 RAUSCHER LEUKEMIA VIRUS INFECTION,
 VIRUS RECOVERY, FETAL ANTIGEN,
 SUPPRESSION, MOUSE (3204)
 TUMOR, REVIEW (1221)*
 TRANSPLANTABLE COLONY-FORMING UNITS,
 RAUSCHER LEUKEMIA VIRUS, MOUSE
 (5285)*
 TROPICAL SPLENOMEGALY SYNDROME,
 BURKITT'S LYMPHOMA, HUMAN (0400)
 TUMOR-ASSOCIATED TRANSPLANTATION
 ANTIGEN, ROUND CELL CARCINOMA, MOUSE
 (5967)
 SPLENOMEGALY
 TUMOR GROWTH, RAT (2132)*
 SPRUE
 INTESTINAL LYMPHOMA (1449)*
 SQUAMOUS CELL CARCINOMA
 ARTIFICIAL VAGINA, CASE REPORT (5586)*
 CARCINOMA, NON-PARASITIC CYST, LIVER,
 CASE REPORT (6315)*

ELECTRON MICROSCOPE EXAMINATION, HUMAN
EPIDERMIS, ENDOPLASMIC RETICULUM,
NEOPLASTIC KERATINOCYTES (3579)*
PALATE, HISTOLOGICAL STUDY (5581)*

AINING
PRECANCEROUS CONDITION, HEPATOMA,
4-DIMETHYLAMINOAZOBENZENE, RAT
(0992)*
RNA, PROTEIN, LIVER,
4-DIMETHYLAMINOAZOBENZENE, RAT
(0370)*

ATOLON
FRIEND LEUKEMIA VIRUS, INFECTION
SUPPRESSION, HUMORAL ANTIBODY, MOUSE
(5979)

EARIC ACID
CARCINOGENESIS, ACTIVITY BIOASSAY,
MOUSE (2981)

MA-STEAROLACTONE
CARCINOGENESIS, ACTIVITY BIOASSAY,
MOUSE (2981)

EEL
MANUFACTURE, FLUORIDE, LUNG CANCER,
CANADA (5414)

ERIGMATOCYSTIN
AFLATOXIN, EFFECT ON PRIMARY CELL
CULTURES (2959)

EROID
ADRENAL NECROSIS, SUPPRESSION,
7,12-DIMETHYLBENZ(A)ANTHRACENE, RAT
(1566)
ANDROGEN, EXCRETION, MAMMARY CARCINOMA
HUMAN (0789)
BINDING, KINETIC AND EQUILIBRIUM
STUDIES, RAT, DEXAMETHASONE (0287)*
EXCRETION, ESTRADIOL UPTAKE, MAMMARY
TUMOR, HUMAN (1183)*
FECAL, DIET, BOWEL CARCINOMA, AFRICA,
UNITED KINGDOM (1101)
HYDROCORTISONE, CARBOHYDRATE
METABOLISM, EHRLICH'S ASCITES CELLS
(2435)*
TUMOR, INTERSTITIAL, TRANSPLANT,
METABOLISM, MOUSE (1977)

EROID METABOLISM
TUMORS, TESTICULAR, HISTOCHEMISTRY,
RAT (2039)*

EROL
PLANT, MORRIS HEPATOMA, RAT (3301)
SYNTHESIS REGULATION, BETA-HYDROXY-
BETA-METHYLGLUTARYL REDUCTASE,
LIVER, HEPATOMA, MOUSE (1483)*

LBESTROL
ADENOCARCINOMA, VAGINA, HUMAN, REVIEW
(3610)
INDUCED KIDNEY TUMOR, GROWTH
CHARACTERISTICS, HAMSTER (2358)
SEROUS MEMBRANE, PROLIFERATIVE LESION,
OVARIECTOMY, DOG (1643)*
TRANSPLACENTAL CARCINOGENESIS, HUMAN
(0093)*
VAGINAL ADENOCARCINOMA, MATERNAL
THERAPY, CASE REPORTS (3477)*
VAGINAL CANCER, HUMAN, REVIEW (5039)*

MACH
ADENOCARCINOMA
CHEMICAL CARCINOGEN, RADIATION,
REVIEW (1201)
SPONTANEOUS, DOG (0324)*
X-RAY, N,N'-2,7-FLUORENYLENE-
BISACETAMIDE, RAT (2960)
ADENOMA, ARGENTAFFIN CELLS, HUMAN
(4936)*

CANCER

BLOOD GROUP, SEX, AGE, INCIDENCE,
LONDON (1924)
CASE REPORT (3364)*
CHRONIC GASTRITIS
DNA, HUMAN (0496)*
HUMAN (3949)
ENVIRONMENTAL INFLUENCE, INCIDENCE
ITALY (3267)
IMMUNOREACTIVE GROWTH HORMONE,
HUMAN (3927)*
INCIDENCE
HAWAII, JAPAN (5416)
LEBANON (2776)*
SENEGAL (3280)*
METASTASIS, HUMAN (2479)*
PRECANCEROUS STAGES, HUMAN, REVIEW
(5001)
SURGERY, BENIGN, HUMAN (2188)*

CARCINOGENESIS
NITROSAMIDE FORMATION, ALKYLUREAS,
NITROSATION, HUMAN (0358)
NITROSO COMPOUNDS, RAT (2426)*

CARCINOMA
ATROPHIC GASTRITIS, CASE REPORTS
(4781)
GASTRIC MUCOSA, MORPHOLOGY, ACID
SECRETION, MAN (0189)
HISTOLOGY, JAPAN, U.S.A. (0879)*
HUMAN, REVIEW (4322)*
INCIDENCE (1211)*
ATOMIC BOMB SURVIVORS, JAPAN
(1937)*
LIVER METASTASES, ALPHA FETO-
PROTEIN, HUMAN (1842)*
LOCATION OF LESION, SEX RATION,
HUMAN (0581)*
N-METHYL-N'-NITRO-N-NITROSO-
GUANIDINE, HISTOPATHOLOGY, DOG
(1293)*
PATHOLOGY
HUMAN (4065)*
PRECANCEROUS LESIONS, CHILE
(1892)
SERUM ALPHA-FETOGLOBULIN, CASE
REPORT (2635)
SMOKING, HUMAN (0384)*
TIME TREND
INCIDENCE
NORWAY (0805)
UNITED STATES (0806)
TISSUE ISOANTIGENS A,B, AND H,
HUMAN (2632)

CARCINOMA INDUCTION, N-METHYL-N'-
NITRO-N-NITROSOGUANIDINE, RAT (2355)
DESMOID TUMOR, SIBLINGS, CASE REPORT
(1184)*

GASTRIC CANCER
ALIMENTARY FACTORS, EPIDEMIOLOGY,
NEW YORK (5424)
BENZO(A)PYRENE, INCIDENCE,
MANITOBA (3265)
CHRONIC GASTRITIS, HISTOAUTHORADIO-
GRAPHIC EXAMINATIONS, HUMAN
(3426)*
CLINICAL-STATISTICAL ANALYSIS,
OPERABLE PATIENTS, INOPERABLE
PATIENTS (6189)*
COMPARATIVE HISTOLOGY, INCIDENCE,
ISRAEL (3248)
FOOD PREPARATION, CARCINOGENIC
HYDROCARBON FORMATION, HUMAN
(5148)
PRECANCEROUS CONDITION,
EPIDEMIOLOGY (3287)*

- SMOKING, HUMAN (1290)*
 GASTRIC CANCER CELLS, PHOSPHORYLASE
 ACTIVITY, HISTOCHEMICAL STUDIES,
 HUMAN (3430)*
 GASTRIC CANCER INDUCTION, THYROID
 GLAND HORMONES, RAT (5187)*
 GASTRIC CARCINOGENESIS, DIET, RAT
 (5820)*
 GASTRIC CARCINOMA
 HISTOLOGIC TYPES
 HIROSHIMA, NAGASAKI (4816)
 INCIDENCE, KOREA (2778)*
 INCIDENCE COAL MINING REGION
 (3974)
 CLINICOMORPHOLOGY, PROGNOSIS,
 HUMAN (3479)*
 METASTASIS, HYPERNEPHROID CANCER,
 KIDNEY, CASE REPORT (3554)*
 GASTRIC CARCINOSARCOMA
 CASE REPORT (5496)*
 HISTOLOGY, CASE REPORT (2746)*
 GASTRIC CARDIA ADENOCARCINOMA, CLINICAL
 AND PATHOLOGIC FEATURES, HUMAN
 (3380)*
 GASTRIC FIBROMA, CASE REPORT (5660)*
 GASTRIC LEIOMYOBlastoma, ULTRASTRUCTURE,
 HUMAN (3323)*
 GASTRIC MUCOSA
 ATROPHIC GASTRITIS, AUTORADIO-
 GRAPHIC PATTERNS, NUCLEIC ACID,
 PROTEIN SYNTHESIS (3239)
 EPITHELIAL CELL DNA, ULCER,
 CANCER, HUMAN (3954)*
 GASTRIC STUMP, CARCINOMA, ULCER,
 GASTRECTOMY, HUMAN (0258)*
 GASTRIC TUMORS, MUSCULAR ORIGIN, CASE
 REPORT (5562)*
 GASTRITIS, CARCINOMA, JAPAN (0199)
 GASTRO-DUODENUM, CARCINOMA, INCIDENCE,
 UGANDA (0217)*
 GLANDULAR, CANCER, X-RAY DIAGNOSIS,
 RAT (0984)*
 STOMACH - CONTINUED
 INTESTINAL METAPLASIA, ABO BLOOD GROUP
 RHESUS FACTOR, CLINICAL STUDY
 (6337)*
 LEIOMYOMA, CASE REPORT (3566)*
 LUNG, TUMOR CELL, NUCLEIC ACID,
 CYTOPHOTOMETRY (1162)*
 MALIGNANT SCHWANNOMA, EXOGASTRIC
 DEVELOPMENT, HUMAN (4160)*
 MUCOSAL GLYCOPROTEIN, CARCINOMA, HUMAN
 (1071)*
 MYOID TUMOR, CASE REPORT (4162)*
 NEUROGENIC TUMORS (3577)*
 PANCREAS, CANCER, HUMAN, REVIEW
 (2273)*
 PARTIAL GASTRECTOMY, GASTRIC STUMP
 CANCER, HUMAN (3411)*
 PRETUMOROUS DISEASES, HISTAMINE
 METABOLISM, HUMAN (1901)*
 PRIMARY TUMOR, METASTASES,
 ABH ISOANTIGENS, EPITHELIAL, HUMAN
 (1839)
 PRIMITIVE CARCINOMA, PEPTIC ULCER,
 CASE REPORTS (6191)*
 TUMOR
 CARCINOEMBRYONIC ANTIGEN, HUMAN
 (4664)
 MESENCHYMAL, REVIEW (2248)*
 METHYLCHOLANTHRENE-INDUCED,
 FACTORS DETERMINING TUMOR SITES,
 RAT (3661)
 MUSCULAR ORIGIN, CASE REPORT
 (1166)*
 TUMORIGENESIS INHIBITION, ANTIOXIDANT,
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 MOUSE (3689)
 ULCER
 2,7-DIACETYLAMINOFLUORENE,
 TUMORIGENESIS, RAT (0049)
 MALIGNANT TRANSFORMATION, HUMAN
 (0800)*
 STOMATITIS NICOTINA
 HISTOPATHOLOGY, HUMAN (2381)*
 STROMAL CELL
 OVARIAN TUMOR, ENZYME ACTIVITY, HUMAN
 (1153)*
 STRONTIUM
 RADIATION, KINETICS, RABBIT (0999)*
 RETENTION, SOFT TISSUES, MOUSE (1001)*
 STRUCTURE
 ACTIVITY,
 5-OXO-5H-BENZO(E)ISOCROMENO(4,3-B)
 INDOLE, MOUSE (0338)
 SUCROSE
 DNA SYNTHESIS, LIVER CELL NUCLEI,
 MORRIS HEPATOMA (1484)*
 SULFATED ACID MUCOPOLYSACCHARIDE
 SYNTHESIS, DIBUTYRYL CYCLIC ADENOSINE
 MONOPHOSPHATE, TRANSFORMED FIBRO-
 BLASTS (4508)
 SULPHHYDRYL LEVEL
 RECTAL CARCINOMA, HUMAN (0243)
 SUNLIGHT
 OCCUPATIONAL EXPOSURE, MALIGNANT
 MELANOMA INCIDENCE, ENGLAND, SWEDEN
 (3252)
 SKIN CANCER, HUMAN, REVIEW (5702)
 SURFACE ACTIVE AGENT
 TWEEN-80, POLYOMA VIRUS, HAMSTER
 EMBRYO CELLS (1762)
 SURGERY
 TUMOR, BENIGN (1955)
 SURVIVAL
 CANCER OF THE CERVIX, EPIDEMIOLOGY,
 NEW YORK (4837)*
 DELAYED HYPERSENSITIVITY, MAMMARY
 TUMOR EXTRACT, HUMAN (1641)*
 EPENDYMOMA, HISTOLOGY, GERMANY (6180)*
 MAMMARY CARCINOMA, METASTASIS, HUMAN
 (6358)*
 STATISTICAL ANALYSIS, ANIMALS (4999)*
 SUSCEPTIBILITY
 INHERITED, THYMOMA, SERUM ANTINUCLEAR
 FACTOR, MOUSE (0269)*
 KIRSTEN MOUSE SARCOMA VIRUS, CELL,
 HUMAN (0442)*
 LEUKEMIA, HL-A ANTIGEN, HUMAN (0484)*
 MALIGNANT DISEASE, HL-A ANTIGENS,
 HUMAN (1844)*
 TOLERANCE, LEUKEMIA, NEWBORN MOUSE
 (0325)*
 TUMOR, LABORATORY ANIMAL, REVIEW
 (0905)
 SV40
 RETINAL PIGMENT EPITHELIUM, TUMOR,
 HAMSTER (5891)
 SYNOVIAL SARCOMA
 OSTEOSARCOMA, TUMOR, PHENOTYPES (1952)
 ULTRASTRUCTURE (1461)*
 TALCUM
 GRANULOMA, CASE REPORT (5836)*
 TANTALUM
 RADIATION METABOLISM, RAT (0996)*
 TAR
 COAL, SYNTHETIC TAR, SKIN CANCER,
 MOUSE (5185)

AR OINTMENT
 HYDROCARBON CONTENT (2388)*
 ERATOCARCINOGENESIS
 KIDNEY CAPSULE, EMBRYO GRAFT, MOUSE
 (0263)*
 ERATOCARCINOMA
 ENZYME HISTOCHEMISTRY, EMBRYO-DERIVED,
 MOUSE (3462)*
 ERATOGENESIS
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 BENZO(A)PYRENE, 3-METHYLCHOL-
 ANTHRENE, TOAD (0067)
 ERATOMA
 ALPHA1-GLOBULIN, FETUS, HEPATOMA,
 MOUSE (0449)
 CYSTIC, EPIDERMAL CARCINOMA, CASE
 REPORTS (5659)*
 HEPATOMA, ALPHA FETOPROTEIN, CANCER
 PATIENT, CHILDREN, BLOOD TEST (0551)
 MALIGNANT TRANSFORMATION, MEDIASTINUM,
 HUMAN (1890)
 OVARY, ROSENTHAL FIBERS, HUMAN (6204)*
 TESTICLE, TUMOR DEVELOPMENT, MOUSE
 (0188)
 TESTIS, INDUCTION, ZINC, JAPANESE
 QUAIL (1547)
 UTERINE TUBE, CASE REPORT (3543)*
 STES
 CANCER, INCIDENCE, U.S. (2779)*
 CARCINOGENESIS, CADMIUM, RAT (4423)
 GERMAL TUMORS, HUMAN, REVIEW (5033)*
 INTERSTITIAL CELL TUMORS, CADMIUM
 CHLORIDE-INDUCED, RAT (5132)
 MALIGNANT TUMORS, INCIDENCE, MORTALITY
 WHITE POPULATION, UNITED STATES,
 REVIEW (4333)*
 MICROBODIES, LEYDIG CELL TUMORS, RAT
 (5543)*
 ORCHIOBLASTOMA, HISTOPATHOLOGY,
 HISTOGENESIS, HUMAN (6060)*
 SECONDARY TUMOR, HISTOPATHOLOGY, HUMAN
 (6235)*
 SEMINAL GLAND TUMORS, CELLOPHANE-
 INDUCED, RAT (5199)
 SEMINOMAS, CYTOGENETIC ANALYSIS,
 HUMAN (3310)
 ERATOMA, INDUCTION, ZINC, JAPANESE
 QUAIL (1547)
 TESTICULAR CANCER, CHILDREN, MORTALITY
 UNITED STATES (3251)
 TUMOR
 CHILDREN, CASE REPORTS (5431)
 EPIDEMIOLOGY, GERMANY (0519)*
 LYMPHOMA, CASE REPORT (3333)*
 MASTOMYS (4883)*
 STICLE
 CHORIOCARCINOMA, LSD, HUMAN (0986)*
 TERATOMA, TUMOR DEVELOPMENT, MOUSE
 (0188)
 STIS
 CARCINOMA
 KIDNEY TRANSPLANT, CASE REPORT
 (1404)*
 ORCHIDOPEXY, CASE REPORT (3414)*
 LYMPHOMAS, HUMAN (3328)*
 OCCULT SEMINOMA, CASE REPORTS (4085)*
 RETE, ADENOCARCINOMA, CASE REPORTS
 (6320)*
 TUMOR, HISTOPATHOLOGY, INCIDENCE,
 NORWAY (1419)
 STOSTERONE
 EFFECT ON LIVER TUMOR, N-2-FLUORENYL-
 ACETAMIDE-INDUCED, RAT (2338)
 EFFECT ON SKIN CANCER, METHYL-
 CHOLANTHRENE, MOUSE (2947)
 METABOLISM, PROSTATIC ADENOMA,
 CARCINOMA TISSUE (6169)*
 12-O-TETRADECANOYL-PHORBOL-13-ACETATE
 SKIN TUMORIGENESIS, PROMOTION, INTER-
 FOLLICULAR EPIDERMIS, MOUSE (4367)
 TETRAHYDROHOMOFOLATE
 DNA BIOSYNTHESIS, LEUKEMIA, MOUSE
 (1457)*
 THEOPHYLLINE
 DIBUTYRYL CYCLIC ADENOSINE PHOSPHATE,
 MURINE SARCOMA VIRUS, TRANSFORMED
 CELLS, MOUSE (5952)*
 TYROSINE AMINOTRANSFERASE ACTIVITY,
 YOSHIDA SARCOMA, RAT (4986)*
 WHEAT-GERM AGGLUTININ, 3T3 FIBROBLASTS
 POLYOMA VIRUS, CONTACT INHIBITION
 (0439)*
 WHEAT-GERM AGGLUTININ, 3T3 FIBROBLASTS
 POLYOMA VIRUS, PLASMA MEMBRANE
 (0141)*
 THIAMINE
 REQUIREMENTS, TUMOR GROWTH, TRANS-
 KETOLASE ACTIVITY, MOUSE (6272)*
 TISSUE CONTENT, TRANSKETOLASE ACTIVITY
 EXPERIMENTAL TUMOR DEVELOPMENT
 (3597)*
 THIO-TEPA
 IMMUNE RESPONSE, IMMUNOLOGICAL MEMORY,
 MOUSE (5968)
 THIOACETAMIDE
 LIVER, CYTOPLASM, ENZYME SYSTEMS,
 RAT (0341)
 RIBONUCLEOPROTEIN, NUCLEOLUS, LIVER,
 RAT, BIOCHEMISTRY, ULTRASTRUCTURE
 (1249)
 THIOL
 ESTRADIOL BINDING, MALIGNANT BREAST
 TUMORS, HUMAN (6339)*
 THORIUM DIOXIDE
 COLLOIDAL, RETENTION, LIVER, SPLEEN,
 FROG (5838)*
 THOROTRAST
 ALPHA-FETOPROTEIN, LIVER CARCINOMA,
 HUMAN (6048)*
 INDUCED HEPATOMA, CASE REPORT (4500)*
 LEUKEMIA, HEMANGIOENDOTHELIOMA,
 PORTUGAL (4490)
 RADIATION INJURY, REVIEW (0915)*
 RETENTION, HUMAN (0108)*
 THROAT
 CARCINOMA, THERAPEUTIC RADIATION, CASE
 REPORTS (3728)
 THROMBOPLASTIN
 ACTIVITY, LEWIS SARCOMA CELLS, MOUSE
 (3382)*
 THYMECTOMY
 CELL-MEDIATED IMMUNITY, ROUS SARCOMA
 VIRUS, RAT (5324)
 THYMIDINE
 KINETICS, TRANSFORMED LYMPHOCYTE,
 HUMAN (1041)
 POLYPLOIDY INDUCTION, SKIN FIBROBLAST,
 HUMAN (1296)*
 THYMOCYTE
 IN VITRO IMMUNIZATION, CYTOTOXICITY,
 TUMOR PROTECTION, MOUSE (4667)
 THYMOMA
 CHRONIC MUCOCUTANEOUS CANDIDIASIS,
 MYOSITIS, CASE REPORT (6283)*
 ERYTHROCYTE APLASIA, ERYTHROPOIESIS,
 SERUM INHIBITOR LOSS, CASE REPORT
 (1849)*
 IMMUNOGLOBULIN LEVELS, HUMAN (5326)

- MACROPHAGE-L CELL, IMMUNOLOGIC (1850)*
 SPINDLE-CELL, EPITHELIAL NATURE,
 ULTRASTRUCTURE, CASE REPORT (3959)*
- THYMUS
 ATROPHY, FELINE LEUKEMIA VIRUS, CAT
 (1035)*
 BONE MARROW CELL, CYTOTOXICITY,
 ALLOGRAFT IMMUNITY, LYMPHOMA, MOUSE
 (3873)
 C-TYPE VIRUS, NORMAL MOUSE (4569)
 T CELL, B CELL, FUNCTIONAL ONTOGENY,
 MOUSE (3188)
 CELL ACTIVATION, HISTOCOMPATIBILITY
 ANTIGEN, MOUSE (1860)*
 CELL CULTURE, MALIGNANT TRANSFORMATION
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
 RAT (5104)
 CELL PROLIFERATION, STIMULATION, RAT
 (2001)
 DERIVED CELL, HELPER ACTIVITY
 SUPPRESSION, EHRLICH ASCITES TUMOR,
 MOUSE (3863)
 DNA, THYMIDINE INCORPORATION,
 X-IRRADIATION, RAT (1670)*
 EXTRACT, ENZYMIC CHANGES, MOUSE
 (2698)*
 GERMINAL TUMOR, BROTHER, CASE REPORT
 (1482)*
 IMMUNODEFICIENCY, AMES DWARF MOUSE
 (3229)*
 INVOLUTION, POLYOMA VIRUS, ULTRA-
 STRUCTURE, MOUSE (0722)
 LEUKEMIA, 7,12-DIMETHYLBENZ(A)-
 ANTHRACENE, MOUSE (5168)
 LIVER CARCINOMA, INHIBITION, DIETHYL-
 NITROSAMINE, RAT (5145)
 LYMPHOMA
 MURINE LEUKEMIA VIRUS, CHEMICAL
 CARCINOGEN, CELL SURFACE ANTIGEN
 MOUSE, RAT (1062)
 MYELOID LEUKEMIA, ETHYLNITROSOUREA
 INDUCED, RAT (2996)
 MAMMARY TUMOR, DEVELOPMENT, MOUSE
 (4037)
 MOLONEY LEUKEMIA VIRUS, RNA DEPENDENT
 DNA POLYMERASE, RAT (0701)
 PRIMARY MEDIASTINAL ENDOCRINE NEOPLASM
 CLINICAL STUDY (5575)*
 REGENERATION, X-IRRADIATION, LYMPHOMA,
 SPLEEN CELL, BONE MARROW CELL, MOUSE
 (0472)
 ROLE IN LEUKEMOGENESIS, GROSS VIRUS,
 RAT (4561)
 THYMECTOMY
 CANCER RISK (4824)
 INCREASED INCIDENCE OF LYMPHOMAS,
 IMMUNOLOGICAL THEORY OF AGING,
 MOUSE (3206)
 MAMMARY CARCINOMA, MOUSE (0469)
 SUBMANDIBULAR TUMOR,
 9,10-DIMETHYL-1,2-BENZANTHRENE,
 RAT (0056)
 TRANSPLANTATION, LEUKEMIA, ANTI-
 LYMPHOCYTE, HAMSTER, HUMAN
 (5313)
 TUMOR INCIDENCE, MYASTHENIA GRAVIS
 HUMAN (3189)
 TUMOR INDUCTION, MOUSE (3209)
 TUMOR TRANSPLANTATION, HUMAN,
 HAMSTER (0181)*
 THYMIC GRAFTS, LYMPHOMAGENIC VIRUS,
 MORPHOLOGY, MOUSE (3751)
 THYMOMA, INHERITED SUSCEPTIBILITY,
 SERUM ANTINUCLEAR FACTOR, HYBRID,
 MOUSE (0269)*
 TUMORS, MYASTHENIA GRAVIS, CASE
 REPORTS (5626)*
- THYROID
 ADENOCARCINOMA, MICROSCOPIC LUNG
 METASTASIS, AUTOPSY STUDY, HUMAN
 (4987)*
 ADENOMA, METASTASIS TO THE LUNG, CASE
 REPORT (4288)*
 ATOMIC BOMB RADIATION, TUMOR,
 INCIDENCE, HUMAN, REVIEW (3027)
 BLASTOMOGENESIS, 6-METHYLTHIOURACIL,
 RAT (5296)
 CALCITONIN-SECRETING TUMORS, MEDULLOID
 CANCER, AMYLOID STROMA, CASE
 REPORTS, REVIEW (5747)*
- CANCER
 AMYLOIDOSIS OF THE STROMA,
 HISTOCHEMISTRY, C CELLS (6352)*
 EPIDEMIOLOGY, TONSILLECTOMY, ACNE,
 ALLERGY (1422)*
 FAMILIAL STUDIES (4847)
 PATHOLOGY, CLINICAL STUDY (5646)*
 CARCINOGENESIS, 131-IODINE, METHYL-
 THIOURACIL, HAMSTER (3735)*
- CARCINOMA
 BIOCHEMICAL CHANGE, HUMAN (3472)*
 CLINICAL STUDY
 (5662)*, (6146)*
 CHILDREN (5461)*
 DIAGNOSIS, THERAPY, HUMAN (2050)*
 EPIDEMIOLOGY, ETIOLOGY, REVIEW
 (1227)*
 ETIOLOGY, CHILDREN (4045)
 GOITER, RADIATION THERAPY, CASE
 REPORT (0676)*
 HUMAN (2084)*, (2145)*
 INCIDENCE
 JAPAN (0510)
 OHIO (0818)*
 RADIATION THERAPY PREDISPOSITION,
 CASE REPORT (1689)*
 RADIO IODINE THERAPY, CASE REPORT
 (1673)*
 SODIUM IODIDE IRRADIATION, THERAPY,
 CASE REPORT (1688)*
 THERAPEUTIC RADIATION, HODGKIN'S
 DISEASE, HUMAN (0104)*
 C-CELL ADENOMA, CALCITONIN ACTIVITY,
 HUMAN (4874)*
 ESOPHAGEAL CARCINOMA, THYROTOXICOSIS,
 INCIDENCE (0248)
 FOLLICULAR ADENOMA, ULTRASTRUCTURE,
 HUMAN (4910)*
 FUNCTION
 CARCINOGENESIS, RAT (2718)
 IONIZING RADIATION, RAT (0394)
 HURTHLE CELL TUMORS, ULTRASTRUCTURE,
 HUMAN (4931)*
 IODINE, METHYLTHIOURACIL, HAMSTER
 (5170)
 MALIGNANCY, SOLITARY NODULE, CLINICAL
 STUDY (5480)*
 MEDULLARY, PHEOCHROMOCYTOMA,
 SIPPLE'S SYNDROME, FAMILIAL
 OCCURRENCE (1443)
 MEDULLARY CANCER, AMYLOID STROMA,
 CASE REPORT (5594)*
 MEDULLARY CARCINOMA
 ARGYROPHIL SECRETORY GRANULES,
 HISTOLOGIC AND ULTRACYTOCHEMICAL
 STUDIES (5509)*
 HISTAMINASE LEVEL, CALCITONIN
 LEVEL, HUMAN (2836)*

HISTOLOGY, CASE REPORT (4142)*
 ULTRASTRUCTURE, RAT (5686)*
 PAPILLARY ADENOMA, CERVICAL LYMPH
 NODES, HUMAN, REVIEW (2275)*
 PAPILLARY CARCINOMA, ULTRASTRUCTURE,
 HUMAN (0884)*
 SCLEROSING CARCINOMA, ULTRASTRUCTURE,
 CASE REPORTS (4227)*
 SPINDLE-CELL TUMOR, GIANT-CELL TUMOR,
 CLINICAL STUDY (5567)*
 THYROIDITIS, METHYLCHOLANTHRENE,
 AUTOIMMUNITY, RAT (1815)
 TOXIC ADENOMA, THYROIDECTOMY, HUMAN
 (1481)*
 TUMOR
 ASHKINASI CELLS, CLINICO-
 MORPHOLOGICAL STUDY (6140)*
 EMBDEN-MEYERHOF PATHWAY REGULATION
 RAT (6282)*
 IMMUNOLOGY, CYTOGENESIS, RAT
 (2732)*
 IODINE UPTAKE, METHYLTHIOURACIL
 RAT (5087)
 TSH, MOUSE (2942)
 TUMOR CELLS, ENDOPLASMIC RETICULUM
 TUBULES, ULTRASTRUCTURE, DOG (6193)*
 TUMOR INDUCTION, METHYLCHOLANTHRENE,
 C-CELLS, RAT (5090)
 URONIC HYDROCHLORIDE
 INTERFERON INDUCTION, NORMAL, LEUKEMIC
 LYMPHOCYTE CULTURES, HUMAN (6308)*
 TISSUE
 COMPOSITION, NORMAL, NEOPLASTIC,
 REVIEW (4314)
 INTERACTIONS, MORPHOGENESIS, MORPHO-
 STASIS, CARCINOGENESIS (3945)
 SUBCUTANEOUS, REACTION TO CARCINOGENS,
 MAMMALS (2374)*
 TISSUE CULTURE
 HEPATOMA, MOUSE (2006)
 RNA DEPENDENT POLYMERASE, ENZYMES
 (1958)
 ACCO
 BRONCHIAL CANCER, PATHOLOGY, HUMAN,
 REVIEW (5006)
 CHEWING, ORAL NEOPLASIA, COAL MINER,
 ENGLAND, REVIEW (1232)*
 CIGARETTE, MOUTH, PHARYNX, LARYNX,
 CARCINOMA, HUMAN (1272)
 CIGARETTE SMOKE
 FLUORANTHENE CONTENT, FORMATION BY
 PYROLYSIS, TUMOR-INITIATING
 ACTIVITY (4478)*
 LUNG CANCER, TISSUE CULTURES,
 MOUSE (5154)
 TOXICITY, RESPIRATORY TRACT, CAT
 (2939)
 CIGARETTE SMOKE CONDENSATE
 BENZO(A)PYRENE FIXATION, DNA, RAT
 (5130)
 EPIDERMAL CARCINOMA, LUNG, RAT
 (4383)
 HYDROQUINONE, CUTANEOUS CARCINO-
 GENESIS, MOUSE (2432)*
 N-NITROSAMINES (2954)
 SUBFRACTIONS, SOLVENT SEPARATION,
 CARCINOGENESIS ASSAY (4408)
 CIGARETTE SMOKING
 BLADDER CANCER, POPULATION TRENDS,
 UNITED STATES, ENGLAND, DENMARK
 (3266)
 CELL VOLUME, HEMOGLOBIN LEVEL,
 HUMAN (1637)*
 LUNG CANCER, REVIEW (5010)
 LUNG CARCINOMA, HUMAN (1617)*
 MICROSOMAL ENZYMES, CHEMICAL
 CARCINOGEN, HUMAN, REVIEW (0306)
 PULMONARY FUNCTION CHANGES, HUMAN
 (2399)*
 STOMATITIS NICOTINA HISTOPATHOLOGY
 HUMAN (2381)*
 TUMORIGENESIS, HUMAN, REVIEW
 (0625)*
 CIGARETTE TAR, TUMOR PRODUCTION,
 L CELL (1598)
 CONDENSATE
 CIGARETTE SMOKE, N-DIMETHYL-
 NITROSAMINE (2372)*
 POLYCYCLIC HYDROCARBONS, ESTERASE
 ACTIVITY EFFECT, SEBACEOUS GLANDS
 MOUSE (2331)
 VEGETATIVE BUD INDUCTION, CALLUS
 (0383)*
 CYTOKININ PRODUCTION, N-ACETYLAMINO-
 FLUORENE (1612)*
 FRACTIONS, TUMOR PROMOTION, MOUSE SKIN
 (3687)
 IMPROVED CIGARETTE DEVELOPMENT
 BIOASSAY METHODS, REVIEW (2921)*
 DEVELOPMENT, REVIEW (2922)*
 LIVER TUMORS, HAMSTER (3722)*
 LUNG CANCER, OCCUPATIONAL HAZARD, AIR
 POLLUTION, REVIEW (5018)
 MARIJUANA, SMOKING, ALVEOLAR
 MACROPHAGES, HUMAN (0663)*
 MATERNAL SMOKING, FETUS, CARCINO-
 GENESIS (0074)
 MOSAIC VIRUS, BRONCHOGENIC CARCINOMA,
 SMOKERS (4588)*
 ORAL CANCER, HUMAN, REVIEW (0917)*
 ORAL MUCOSA, ULTRASTRUCTURE, HUMAN
 (0096)*
 PROCESSING FACTOR, CANCER HAZARDS,
 EPIDEMIOLOGY (0333)*
 REVERSE SMOKING
 CARCINOMA, ORAL MUCOSA,
 STOMATITIS, CARCINOMA, HUMAN
 (0098)*
 HARD PALATE CARCINOMA, INDIA
 (5193)*
 HARD PALATE DUCT ALTERATIONS,
 INDIA (5191)*
 PALATAL CANCER, INDIA (0200)
 PALATE CARCINOMA, EPITHELIAL
 ATYPIA, HISTOCYTOLOGICAL STUDY,
 INDIA (4407)
 SMOKE, TUMOR ACCELERATOR, TUMOR
 PROMOTER, CARCINOGEN, REVIEW (3604)
 SMOKE CONDENSATE
 N-DIMETHYLNITROSAMINE (2955)
 INDUCED CARCINOGENIC EFFECTS, RAT
 (3020)*
 RNA SYNTHESIS, SKIN, MOUSE (3012)
 TOBACCO - CONTINUED
 SMOKING
 ALVEOLAR MACROPHAGE, RABBIT
 (1291)*
 BLADDER CANCER, REVIEW (5725)*
 BRONCHITIS, LUNG CARCINOMA,
 ASSOCIATION, HUMAN (0381)*
 CANCER, HUMAN, REVIEW (2277)*
 CANCER RISK, MOUSE (1273)
 CARCINOMA, INCIDENCE, LARYNX,
 HUMAN (2962)
 CHEWING, CANCER RISK (0534)*
 GASTRIC CANCER, HUMAN (0384)*,
 (1290)*
 LUNG CANCER

ETIOLOGY, REVIEW (1018)
 INCIDENCE, WOMEN, NETHERLANDS (6096)*
 SURVIVAL, HUMAN (3693)
 LUNG CARCINOMA
 ETIOLOGY, REVIEW (1214)
 WOMEN, STATISTICAL STUDY (5816)*
 PALATAL CARCINOMA, INCIDENCE, INDIA (0820)*
 PRIMARY EPIDERMOID CARCINOMA, BRONCHI, STATISTICAL STUDY (5817)*
 TUMOR PROMOTION, SMOKE CONDENSATE, MOUSE (0651)*
 SMOKING METHODS, CANCER RISK, HUMAN, REVIEW (2901)
 SNUFF, TRACE METAL CONTENT, MAXILLARY ANTRUM, CARCINOMA, HUMAN (0091)*
 SUGAR CONTENT, PH OF SMOKE, LUNG CANCER (3645)
 TAR, TUMORIGENICITY, RECONSTITUTED TOBACCO SHEET, MOUSE SKIN (3684)
 TUMOR, PROMOTER, BENZO(A)PYRENE, 7,12-DIMETHYLBENZANTHRACENE, MOUSE (0075)
 TOLUENE
 BENZENE, AROMATIC HYDROCARBONS, MOLECULAR INTERACTIONS, CARCINOGEN (2428)*
 TONGUE
 BOTRYOID SARCOMA, UTERINE BOTRYOID SARCOMA, CASE REPORT (3264)*
 CANCER, LYMPH NODE INVASION, HUMAN (3344)*
 CARCINOMA, INCIDENCE, ARKANSAS (2766)
 MYOBLASTOMYOMA, HISTOPATHOLOGY, CASE REPORT (6265)*
 TONSILLECTOMY
 THYROID CANCER, EPIDEMIOLOGY (1422)*
 TOOTH
 ODONTOGENIC TISSUE, EPITHELIUM-MESENCHYMAL INTERACTIONS, POLYOMA VIRUS, PROLIFERATION, MOUSE (1034)
 ODONTOGENIC TUMOR, HISTOGENESIS (1086)
 TOPOLOGY
 TUMOR, CELLS, MEMBRANE (2009)
 TOXICITY
 ACUTE, AFLATOXIN B1, MONKEY (1613)*
 ALBUMIN, BILIRUBIN CONJUGATION, HEPATOMA CELL CULTURE, RAT (6334)*
 CIGARETTE SMOKE, RESPIRATORY TRACT, CILIARY MOVEMENT, CAT (2939)
 CYCLAMATES, DIET, RAT (4379)
 DIMETHYLNITROSAMINE, REDUCTION, DISULFIRAM, RAT, MOUSE (1615)*
 DYES, MEAT MARKING COLORS, NEW ZEALAND (2986)
 PHOTODYNAMIC, BENZO(A)PYRENE, ANTI-OXIDANT, PROTECTION, RAT (0352)
 TOXICOLOGY
 MUTAGENICITY TEST EVALUATIONS, MAMMALS (2409)*
 ORGANIC POLYMER, BIOCOMPATIBILITY, REVIEW (3642)*
 TRACE ELEMENT
 NEOPLASTIC GROWTH, INHIBITION, REVIEW (3648)
 TRACHEA
 EPITHELIUM, BIOCHEMICAL AND MORPHOLOGIC EXAMINATIONS, HAMSTER (4394)
 SQUAMOUS METAPLASIA, BENZO(A)PYRENE, VITAMIN A, HAMSTER (3685)
 TRANSDIMETHYLAMINOSTILBENE
 URINARY 7-METHYL GUANINE EXCRETION,

RAT (5076)
 TRANSFER RNA
 HEPATOMA, RAT (1971)
 TRANSFORMATION
 ADENOVIRUS, HORMONAL MODIFICATION, HAMSTER CELLS (5267)
 ADENOVIRUS TYPE 3, HAMSTER EMBRYO (3811)
 ADENOVIRUS TYPE 12, TUMOR, HAMSTER (3078)
 AMNION CELLS, STRAIN LONGEVITY, SV40, HUMAN (1756)
 ASCITES TUMOR, SUBLINES (2169)*
 ASCITIC
 SOLID TUMORS (3563)*
 TUMOR VARIABILITY, HAMSTER (4802)*
 BENZ(A)ANTHRACENE, DIBENZ(A)ANTHRACENE K-REGION DERIVATIVE, HAMSTER (0062)
 BLASTIC
 LYMPHOCYTE
 INHIBITION, ANTI-HL-A ANTIGEN, HUMAN (1879)*
 NEOPLASTIC DISEASES, HUMAN, REVIEW (5044)*
 PHA-STIMULATED CULTURES, LYMPHOSARCOMA, RETICULOSARCOMA, (4843)
 RETICULO ENDOTHELIAL MALIGNANCY, HUMAN (1862)*
 LYMPHOCYTE CULTURES, CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN (4639)
 CARCINOMA, LIVER CELLS, RAT (2823)
 CELL
 BIOCHEMICAL CHANGES, POLYOMA VIRUS SV40, MOUSE (1032)
 CHEMICAL CARCINOGEN, MAMMAL, REVIEW (1210)
 4-NITROQUINOLINE-1-OXIDE, MAMMAL (1597)
 POLYCYCLIC HYDROCARBON, HAMSTER (1535)
 L-CELLS, HERPES SIMPLEX VIRUS, UV RADIATION (5924)
 CELL OVERGROWTH, ROUS SARCOMA VIRUS, CHICK (1412)
 CELLULAR
 DNA ONCOGENIC VIRUSES, REVIEW (5030)*
 SV40, SHEEP CELLS (4607)*
 SV40 INDUCED, LIZARD (3138)
 TEMPERATURE-DEPENDENT, BRYAN ROUS SARCOMA VIRUS INFECTION, CHICK EMBRYO CELLS (4540)
 CELLULAR GROWTH, VIRUS, REVIEW (0603)
 CHEMICAL BURN SCAR, ESOPHAGUS, CASE REPORT (1609)*
 CHROMATIN TRANSCRIPTION, DNA REPRESSION AND DEREPRESSION, WALKER'S CARCINOMA (4090)*
 CHROMOSOMAL ABERRATION, N-METHYL-N'-NITRO-N-NITROSOGUANIDINE, HAMSTER, CELL (3677)
 CHROMOSOME BREAKAGE, CYTOTOXICITY, CHEMICAL CARCINOGEN, ARYL HYDRO-CARBON HYDROXYLASE (4433)
 DNA
 4-HYDROXYAMINOQUINOLINE 1-OXIDE, DIFFERENTIAL INACTIVATION, BACILLUS SUBTILIS (3666)
 POLYMERASE, LYMPHOCYTES (1980)
 RNA, ONCOGENIC VIRUSES, CYTOGENETICS (5934)*
 E. COLI RNA, AGRO BACTERIUM TUMEFACIENS

(1882)
 ENHANCEMENT, BENZO(A)PYRENE, X-RAY,
 HAMSTER (1661)
 FETAL CELL, SV40, HUMAN (1754)
 FIBROBLAST
 DENATURED DNA, ROUS VIRUS-TRANS-
 FORMED CELLS, CHICK EMBRYO
 (2557)
 HERPES SIMPLEX VIRUS TYPE 2,
 HAMSTER EMBRYO (5918)
 SULFATED ACID MUCOPOLYSACCHARIDE
 SYNTHESIS, DIBUTYRYL CYCLIC
 ADENOSINE MONOPHOSPHATE (4508)
 UV RADIATION, HERPES SIMPLEX
 TYPE 2 VIRUS, ULTRASTRUCTURE,
 HAMSTER (5890)
 FLAT TRANSFORMED CELL, SV40, ISOLATION
 MOUSE (1755)
 FORESKIN CELLS, MASON-PFIZER VIRUS,
 MONKEY (5877)
 GLUCOSAMINE TO GLYCOGEN AND LACTATE,
 ASCITES TUMOR CELLS, RAT, MOUSE
 (4012)
 HAMSTER EMBRYO FIBROBLASTS, ROUS
 VIRUS, IN VITRO (0444)*
 HERPES SIMPLEX VIRUS TYPE 2,
 LEUKOSIS VIRUS MARKER, ONCOGENE,
 HAMSTER (3043)
 IN VITRO
 CARCINOGENIC HYDROCARBON, HAMSTER
 (0640)
 CHEMICAL CARCINOGEN, HAMSTER
 EMBRYO CELL (1591)
 INHIBITION
 ADENOVIRUS, ADENO-ASSOCIATED VIRUS
 HAMSTER CELL (2523)
 DNA TEMPLATE INHIBITION,
 10-DIMETHYL-1,2-BENZANTHRACENE,
 BENZO(A)PYRENE, DNA LINKAGE
 (1572)
 SV40, 7,12-DIMETHYLBENZ(A)ANTHRA-
 CENE, 3-METHYLCHOLANTHRENE,
 MOUSE (4504)
 INHIBITORS OF MITOCHONDRIAL FUNCTION,
 CHICK EMBRYO CULTURE (3771)
 KIDNEY CELL, 3-METHYLCHOLANTHRENE,
 MOUSE (1582)
 KIRSTEN MOUSE SARCOMA VIRUS, GUINEA
 PIG EMBRYO CELLS (3756)
 INFORMATION - CONTINUED
 LEUKEMIA-LIKE VIRUS, HUMAN DIPLOID
 CELLS (3760)
 LEUKEMIC, GRAFTED MARROW, MOUSE
 (6028)*
 LEUKOCYTES
 EPSTEIN-BARR VIRUS, MONKEY (3118)
 HUMAN (3843)
 LIVER, HYPERBASOPHILIC FOCI,
 DIMETHYLAMINOAZOBENZENE, RAT (0956)
 LUNG CELLS, URETHANE, INFLUENZA VIRUS,
 HUMAN EMBRYO (4396)
 LYMPH NODE CELLS, PHYTOHEMAGGLUTININ,
 HODGKIN'S DISEASE PATIENTS (6030)*
 LYMPHOCYTE
 ACUTE LYMPHOBLASTIC LEUKEMIA,
 HUMAN (1795)
 DNA SYNTHESIS, DIBUTYRYL ADENOSINE
 CYCLIC 3',5'-MONOPHOSPHATE
 HUMAN (0160)
 KAPOSI'S SARCOMA PATIENTS (6279)*
 LEUKEMIA, ANTILYMPHOCYTE SERA
 EFFECT, ANTIPARABLAST SERA
 EFFECT, CHILDREN (3847)
 PHYTOHEMAGGLUTININ, IMMUNOPRO-
 LIFERATIVE DISORDERS, HUMAN
 (4641)
 PHYTOHEMAGGLUTININ, LYMPHOPRO-
 LIFERATIVE DISEASE PATIENTS
 (6032)*
 PROTEOLYTIC ENZYME INHIBITOR,
 GUINEA PIG (6125)
 THYMIDINE KINETICS, HUMAN (1041)
 MALIGNANT
 FIBROBLASTS, LABELED LECTIN
 FIXATION, ULTRASTRUCTURE, HUMAN
 (3085)
 GASTRIC ULCER, HUMAN, (0800)*
 IMMUNE INDUCTION, CELL-TO-CELL
 INTERACTION, BONE MARROW, HUMAN
 (5394)*
 LDH ACTIVITY, CHRONIC SINUSITIS,
 HUMAN (2716)
 4-NITROQUINOLINE-1-OXIDE, PULMON-
 ARY AND EMBRYONIC CELLS, MOUSE
 (2985)
 POLYP, COLON, RECTUM, HUMAN,
 REVIEW (0629)*
 RNA ONCOGENIC VIRUSES, REVIEW
 (5028)
 SV40 DNA, MEMBRANE ALTERATIONS,
 EMBRYO CELLS, MOUSE, HAMSTER,
 HUMAN (3133)
 MALIGNANT CELL, SURFACE MEMBRANE
 CHANGES, HAMSTER (3938)
 MALIGNANT CELLULAR, KARYOLOGIC
 MODIFICATIONS, INTRASPECIFIC SOMATIC
 HYBRIDIZATION, HAMSTER (5299)
 MALIGNANT CELLULAR, POLYCYCLIC HYDRO-
 CARBONS, EPOXIDES, PROSTATE, MOUSE
 (2304)
 MAMMALIAN CELL
 N-ACETOXY-N-2-FLUORENYLACETAMIDE
 (3646)
 HISTONES, HAMSTER (1537)
 3-METHYLCHOLANTHRENE, SCHMIDT-RUPPIN
 ROUS SARCOMA VIRUS, HUMAN CELL
 (0691)
 METHYLNITROSOUREA, MOUSE EMBRYO (0958)
 MORPHOLOGICAL, FIBROBLASTS, EPSTEIN-
 BARR VIRUS, HUMAN (3107)
 MURINE SARCOMA VIRUS
 GUINEA PIG EMBRYO CELLS (4537)
 RAT (3772)
 REVERTANTS, VIRUS RESCUE, MOUSE
 (3058)
 VIRUS-LIKE PARTICLE RELEASE, MOUSE
 CELL (1732)
 MURINE SARCOMA VIRUS (KIRSTEN), MOUSE,
 HUMAN (1330)
 NEOPLASTIC
 CHEMICALLY INDUCED, CLONED CELL
 LINES, MOUSE (5770)
 HORSE AND BOVINE SERA, EMBRYO
 CELLS, MOUSE (4976)*
 LIVER EPITHELIAL CELLS, NUTRITION-
 AL STRESS, RAT (3936)
 LUNG CELLS, CIGARETTE TAR,
 HAMSTER (2332)
 SERUM EFFECTS, CHROMOSOME
 STABILITY, EMBRYONIC CELLS,
 MOUSE (5430)
 NONPRODUCER BALB/3T3 CELLS, MURINE
 SARCOMA VIRUS, EPITHELIAL FEATURES
 (4600)*
 ONCOGENIC, HAMSTER CELLS, HERPES
 SIMPLEX VIRUS TYPE 2 (0710)
 PHYTOHEMAGGLUTININ, LYMPHOCYTE,
 PROTEIN SYNTHESIS, HUMAN (0840)

- POLYCYCLIC AROMATIC HYDROCARBON,
MICROSOMAL MIXED-FUNCTION OXIDASE,
INDUCTION, MOUSE PROSTATE CELL
(5173)
- POLYCYCLIC HYDROCARBON, EPOXIDE,
HAMSTER CELL (4445)
- POLYCYTHEMIA-INDUCING, FRIEND VIRUS,
MOUSE (2507)
- TRANSFORMATION - CONTINUED
- POLYOMA VIRUS
AMINO ACID UPTAKE, 2-DEOXY-D-
GLUCOSE, HAMSTER (1757)
- 20-METHYLCHOLANTHRENE, TUMOR CELLS
HAMSTER (5819)*
- R TYPE VIRUS PARTICLE, HAMSTER
(5240)
- RAT (2508)
- REVERSION, DNA COPYING, HAMSTER
(5222)
- PROSTATE CELL, ANTIGEN, MOUSE (3881)
- REVERSION, CHROMOSOMAL MECHANISM,
HAMSTER CELL (4038)
- REVERTANT CELL VARIANT, RE-REVERSION,
RNA, HAMSTER (2812)
- ROUS SARCOMA VIRUS
DENSITY DEPENDENCE, CHICK EMBRYO
(1742)
- DNA INTERMEDIATE, CHICK CELLS
(2552)
- DNA SYNTHESIS INHIBITION, ARABINO-
FURANOSYL ADENINE, RAT (3754)
- GENOME INTEGRATION, CHICKEN CELLS
(3813)
- PHOSPHOLIPID, ACYL GROUP CHANGE,
CHICKEN (5248)
- VIRAL GENOME COPIES, PROVIRUS
THEORY (4554)
- VIRUS INDUCTION, HAMSTER (3801)
- ROUS SARCOMA VIRUS MUTANT, TEMPERATURE
CHANGE, CHICK EMBRYO (1749)
- ROUS SARCOMA VIRUS RESCUE, CELL FUSION
MAMMAL (3093)
- SIMIAN ADENOVIRUS 7, RNA, HAMSTER
(5251)
- SMOG EXTRACT, AKR LEUKEMIA VIRUS,
MOUSE (3703)
- SPONTANEOUS
ANTIGENICITY, MOUSE CELL (4629)
- VIRUS ANTIGENS, RAT (3902)
- VIRUS-INDUCED (0003)
- SPONTANEOUS NEOPLASTIC
INHIBITION, FETAL BOVINE SERUM,
EMBRYO CELLS, MOUSE (4977)*
- MOUSE EMBRYO CELLS, HAMSTER LUNG
CELLS (3293)
- MURINE LEUKEMIA VIRUS, SERUM
FRACTIONS, MOUSE (5265)
- SV40
ANTIGEN, MONKEY (5333)
- CONCAVALIN A RECEPTOR, HAMSTER
(4568)
- HAMSTER CELL (4562)
- NUCLEAR RNA SEQUENCES (0430)
- SPHINGOMYELIN BIOSYNTHESIS,
MOUSE (4549)
- SV40 TEMPERATURE-SENSITIVE MUTANT,
MOUSE CELL (4526)
- SV40 VIRUS DNA, CELL MEMBRANE ALTERA-
TIONS, HUMAN, HAMSTER (3094)
- THYMUS CELL, LUNG CELL,
N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
RAT (5104)
- TRANSCRIPTIONAL, WALKER TUMOR
CHROMATIN, NONHISTONE PROTEINS,
LIVER, RAT (4841)
- TRANSPLANTABILITY, KAROTYPE, CELL
SURFACE, EMBRYO CELLS, HAMSTER
(5433)
- VIRUS, RADIATION, GROWTH, SERUM
GROWTH FACTOR, MOUSE (0720)
- VISNA VIRUS, ASTROCYTE, HUMAN (5898)
- TRANSFORMED CELLS
LEUKEMIA, MICE (2035)*
- TRANSHYDROGENASE
CELL ACTIVITY, HEPATOMA, RAT (3997)
- TRANSMISSION
HEREDITY, OSTEOSARCOMA, IRRADIATION,
REVIEW (1518)*
- HERPES-LIKE VIRUS, GUINEA PIG (1722)
- HERPES SIMPLEX VIRUS, AMNION CELLS,
HUMAN (2545)
- TRANSPLACENTAL BLASTOMOGENESIS
DIMETHYLNITROSAMINE, NITROSOMETHYLUREA
MOUSE (1607)*
- URETHANE, NITROSOMETHYLUREA, DIMETHYL-
NITROSAMINE, MOUSE (1603)*
- TRANSPLACENTAL CARCINOGENESIS
CHEMICAL, HUMAN, REVIEW
(1505), (3630)*
- TRANSPLACENTAL EFFECT
NITROSOMETHYLUREA, RAT (2417)*
- TRANSPLANT
CARCINOMA, EHRLICH, MICE (2051)*
- TRANSPLANTABILITY
MAMMARY CARCINOMA CELL, SUBLINE,
IMMUNOSUSCEPTIBILITY, MOUSE (3851)
- TRANSPLANTATION
BOVINE ADENOVIRUS-INDUCED TUMOR,
HAMSTER (5954)*
- CANCER TISSUE, XENOPUS LAEVIS (3934)*
- ENHANCEMENT, TUMOR ELUATE,
IGG2 IMMUNOGLOBULIN, MOUSE (3862)
- HARDING-PASSEY MELANOMA, MOUSE (1157)*
- HOST-TRANSPLANT REACTION, SARCOMA,
MOUSE (1080)*
- HUMAN TUMOR, THYMECTOMY, HAMSTER
(0181)*
- IMMUNITY, RAT ASCITIC TUMOR, MOUSE
(5995)*
- IMMUNITY ENHANCEMENT, MYCOBACTERIUM
BUTYRICUM, MOUSE (3904)
- INHIBITION, PLASMACYTOMA, SPLEEN CELL,
MOUSE (5902)
- KIDNEY, EPSTEIN-BARR VIRUS ANTIBODY,
HUMAN (3884)
- LEUKEMIA, THYMECTOMY, ANTILYMPHOCYTE
SERUM, HAMSTER, HUMAN (5313)
- LYMPHOID CELL, EPSTEIN-BARR VIRUS,
HUMAN, MOUSE (1385)
- MAMMARY ADENOCARCINOMA, NEURAMINIDASE,
MOUSE (0746)
- MAMMARY CARCINOMA, RADIATION RESPONSE,
MOUSE (4493)
- MELANOMA, TUMOR GROWTH, HAMSTER
(4179)*
- MORRIS HEPATOMA, ERYTHROCYTIC
GLYCOLYSIS, RAT (4126)*
- PHOSPHORUS COMPOUNDS, RAT (4128)*
- NERVE TUMOR, ENZYME HISTOCHEMISTRY,
RAT (4102)*
- PITUITARY TUMOR, METASTASIS, OVARY,
BONE, RAT (0998)*
- PLASMA CELL TUMOR, PLOIDY FLUCTUATIONS
MOUSE (2015)
- REACTION, EHRLICH ASCITES TUMOR, MOUSE
(1082)*
- RHABDOMYOSARCOMA, HUMAN, CAT (1002)
- RESISTANCE, SENSITIZING IMPLANT,

FIBROSARCOMA, MOUSE (3169)
 SARCOMA
 MELANOMA, ROUTE OF INTRODUCTION,
 MOUSE (3300)
 METASTASIS, MOUSE (0841)
 SPLENECTOMY, MOUSE (3299)
 TROPHOBLASTIC TUMOR, HAMSTER CHEEK
 POUCH, HUMAN (3278)*
 TUMOR
 BRAIN, ANTILYMPHOCYTIC SERUM, RAT
 (2623)
 CHEMICAL CARCINOGEN, LIVER CELL
 AGGREGATION, RAT (1269)
 IMMUNOSUPPRESSION, HUMAN
 RECIPIENTS, REVIEW (0904)
 TUMOR ALLOGRAFT
 ANTI-LYMPHOCYTE SERUM THYMUS,
 SPLEEN, RAT, RABBIT (1077)*
 GROWTH, RADIATION, IMMUNO-
 COMPETENCE, MOUSE (0463)
 UTERINE CERVIX CANCER, HORMONE
 REACTIVITY, MOUSE (6250)*
 VAGINAL CARCINOMA, ESTROGEN TREATMENT,
 MOUSE (3298)
 MALE
 BREAST PATHOLOGY, HUMAN (6217)*
 NEURINOMA, CASE REPORT (5869)*
 TUMORIGENESIS, JAW, HUMAN (5875)*
 6,6-DIMYCOLATE
 BACILLUS CALMETTE-GUERIN, URETHAN-
 INDUCED LUNG ADENOMA, SUPPRESSION,
 MOUSE (2330)
 RIACANTHINE
 WOUND CICATRIZATION, TUMOR DEVELOPMENT
 (2430)*
 RICAPRYLIN
 CARCINOGENESIS, ACTIVITY BIOASSAY,
 MOUSE (2981)
 8,12-TRIMETHYLBENZ(A)ANTHRACENE
 INDUCED-LEUKEMIA, BONE MARROW CHANGES,
 RAT (3691)
 LEUKEMIA
 LYMPHOID TISSUES, RAT (5799)
 SPLEEN, THYMUS, RAT (5762)
 RITON WR 1339
 METASTASIS, INHIBITION, MOUSE (2361)
 ROPHOBLAST
 CANCER, CHORIOCARCINOMA, HL-A ANTIGEN
 SYSTEM, HUMAN (2413)*
 CELL GROWTH, POLYOMA VIRUS, MOUSE
 (1759)
 CHORIOCARCINOMA, HISTOCOMPATIBILITY,
 REVIEW (1228)*
 ENZYME, CHORIOCARCINOMA, HUMAN (0259)*
 NEOPLASIA, CHORIOCARCINOMA,
 HL-A ANTIGEN, HUMAN (1061)
 TUMOR, IMMUNOLOGY, HAMSTER (1390)
 ROPHOBLASTIC NEOPLASIA
 TISSUE CULTURE, HUMAN (5645)*
 ROPHOBLASTIC TUMOR
 ESTROGEN PRODUCTION, TISSUE CULTURE
 (3307)
 MALIGNANT, HYDATIDIFORM MOLE,
 EPIDEMIOLOGIC ASPECTS, WOMEN, ISRAEL
 (3972)
 PREGNANCY
 HOST CONDITIONS, HUMAN (1812)
 SEX CHROMATIN, HUMAN (2681)*
 TRANSPLANTATION, HAMSTER CHEEK POUCH,
 HUMAN (3278)*
 ROPHOBLASTOMA
 TUMOR DOUBLING TIME, PROLAN TEST,
 HUMAN (0815)*
 RYPAN BLUE
 TUMORS, ULTRASTRUCTURE, LIVER, RAT
 (5163)
 TRYPTOPHAN
 LEUKEMIC CELL, PROTEIN SYNTHESIS
 INHIBITION, E. COLI, MOUSE (1624)*
 METABOLISM
 BLADDER CANCER, AROMATIC AMINE,
 HUMAN (5124)
 BLADDER CARCINOMA, RECURRENCE
 HUMAN, REVIEW (0305)
 BREAST CANCER, CARCINOMA OF CERVIX
 HUMAN (4920)*
 URINARY BLADDER CANCER, CLINICAL
 STUDY (6152)*
 VITAMIN B6, NICOTINAMIDE ADMINIS-
 TRATION, HODGKIN'S DISEASE
 PATIENTS (4921)*
 TYROSINE METABOLITES, EPR SPECTRA
 (4474)*
 URINARY BLADDER TUMORIGENESIS,
 N-NITROSODIBUTYLAMINE, RAT (0947)
 TUBAZID
 CARCINOGENESIS, MOUSE (5821)*
 PHTHIVAZID, CARCINOGENESIS, MOUSE
 (5096)
 TUBERCULIN
 SKIN REACTIVITY, CANCER MORBIDITY,
 BULGARIA (6037)*
 TUBERCULOMA
 BRAIN, INCIDENCE, INDIA (4872)*
 TUBERCULOSIS
 SKIN, BRONCHI, CARCINOMA, ISONIACIDE,
 HUMAN (0985)*
 TUMOR
 ABDOMINAL, CHILDREN (2005)
 ACINIC CELL, LUNG, HUMAN (2165)*
 ALLOGRAFT IMMUNITY, T CELL, MOUSE
 (5310)
 ALLOGRAFT REJECTION, ANTISTREPTOLYSINE
 O LEVEL, SERUM, MOUSE (6034)*
 ALLOGRAFTS, BLOOD LEVEL, PASSIVELY
 TRANSFERRED ALLOANTIBODIES, RAT
 (2701)*
 ANGIOGENESIS, THERAPEUTIC IMPLICATIONS
 (1895)
 ANTIGEN
 SYNTHESIS, DEGRADATION, POLYOMA
 VIRUS, MOUSE (1836)
 TRANSIENT IMMUNE RESPONSE, HUMAN
 (1794)
 TRANSPLANTATION, IMMUNITY (0008)*
 ASCITES
 GROWTH REGULATION, PARABIOTIC
 MOUSE (0527)*
 HYPOGLYCEMIA, RAT (0240)
 SERUM CHANGE, HAMSTER (4016)
 ASTROCYTE SERIES, SUCCINATE-DEHYDRO-
 GENASE DISTRIBUTION, HISTOCHEMICAL
 STUDY (3591)*
 ATOMIC BOMB, BREAST, REPRODUCTIVE
 ORGANS, GALLBLADDER, SALIVARY
 GLAND, LEUKEMIA, THYROID, HUMAN,
 REVIEW (3027)
 AUTOLOGOUS, IMMUNE RESPONSE, HUMAN
 (1796)
 BENIGN, SURGERY (1955)
 BONE, FIBROUS DYSPLASIA, HUMAN (4300)*
 BP8, LYMPH NODE, CELL ADHERENCE, MOUSE
 (1066)*
 BRAIN, X-RAY EXPOSURE, MONKEY (4498)*
 BREAST, ESTROGEN, INCIDENCE, UNITED
 STATES (1922)
 BRENNER, ULTRASTRUCTURE, HUMAN (2109)*
 CALCIUM CONTENTS, MAGNESIUM,

- PHOSPHOROUS, HUMAN, ANIMAL (0538)
 CALCIUM INCORPORATION, PHOSPHORUS
 INCORPORATION, MOUSE (0537)
 CARCINOID, ORGAN DISTRIBUTION, WIENNA
 (4150)*
 CELL
 ADENOVIRUSES, RAT (4593)*
 ASCITES, 67 GALLIUM, MICE (2082)*
 BIOLOGY (0311)*
 DIFFERENTIATION, GROWTH, MOUSE
 (4272)
 FRIEND VIRUS INFECTION, IMMUNO-
 FLUORESCENCE, RAT (1321)
 MEMBRANES, TOPOLOGY (2009)
 MICROWAVE ABSORPTION, HAMSTER
 (1169)*
 PROLIFERATION (1999)
 PROTOPLASMIC INCLUSIONS, HUMAN
 (0547)
 SURFACE ANTIGEN, CELL CYCLE,
 MOUSE (1400)*
 SYNGENEIC, IMMUNOGENICITY, MOUSE
 (1817)
 CELL ANTIGENICITY, RAT (6004)*
 CELL CULTURE, ADENOCARCINOMA, POLYOMA
 VIRUS, MOUSE (0438)*
 CELL CYCLES, MITOSIS, HUMAN, REVIEW
 (2216)
 CELL DIFFUSION, CHORIOALLANTOIC
 MEMBRANE, CHICKEN (0251)
 CELL-FREE EXTRACTS, SINGLE STRANDED
 REOVIRUS RNA, IN VITRO (4583)*
 CELL GROWTH, CONCAVALIN A
 AGGLUTINABILITY (4721)*
 CELL INVASION, LYMPH NODE, IMMUNE
 REACTION, RAT (0775)*
 CELL MEMBRANE, HISTOCOMPATIBILITY,
 REVIEW (1203)
 CELL MORPHOLOGY, INTERFERENCE FROM
 PLANT CELLS, MISDIAGNOSIS (4240)*
 CEREBELLAR HEMANGIOBLASTOMA, TWO
 CONSECUTIVE GENERATIONS, CASE REPORT
 (6255)*
 CHEMODECTOMA, LARYNX, CASE REPORT
 (6212)*
 CHILDHOOD
 BIOPTIC DATA, GERMANY (3283)*
 EPIDEMIOLOGY, HUNGARY (0522)*
 SPECIFIC FEATURES, REVIEW (2255)*
 CHOLINESTERASE, INTRACELLULAR
 LOCALIZATION, RAT (6373)*
 CHONDROBLASTOMA, PATHOLOGY, HUMAN
 (4093)*
 CIRCULATORY DYNAMICS, INTRAHEPATIC,
 RAT (1970)
 CONCOMITANT IMMUNITY, IMMUNOSELECTION
 OF METASTASES, RAT (0757)
 CROWN-GALL, INDUCTION, MUTATION,
 N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
 AGROBACTERIUM TUMEFACIENS (4421)
 CYTOPLASMIC FACTOR, MITOCHONDRIAL DNA
 SYNTHESIS, STIMULATION, RAT (4022)
 DEVELOPMENT, DNASE ACTIVITY, BLOOD
 SERUM, ASCITIC FLUID (6351)*
 7,12 DIMETHYLBENZ(A)ANTHRACENE-INDUCED
 ACTINOMYCIN D, RAT (2395)*
 DNA CONSTANCY, HETEROPLOIDY (1439)
 DOUBLE, INCIDENCE, HOLLAND, REVIEW
 (1240)*
 TUMOR - CONTINUED
 ECCRINE (1961)
 ECTOPIC HORMONE PRODUCTION, PATHOLOGY,
 HUMAN (3400)*
 EHRLICH
 ASCITES CELLS, ANIONIC SITES
 (2086)*
 SERUM PROTEINS, MOUSE (3915)*
 EHRLICH ASCITES
 GLYCEROLIPID BIOSYNTHESIS, MOUSE
 (0300)*
 PURINE RIBONUCLEOTIDE, CONVERSION
 (0291)*
 ULTRASTRUCTURE, ENERGY PRODUCTION,
 MEMBRANE FUNCTION (2064)*
 ELUTION, LYMPHOCYTE CYTOTOXICITY,
 BLOCKING, HUMAN (4671)
 EPITHELIOMA, RESPIRATORY METABOLISM,
 DMBA, MICE, REVIEW (2247)*
 ESTROGEN RECEPTORS, ESTRADIOL (1959)
 EXPERIMENTAL
 ANIONS, CALCIUM PRECIPITATION
 (0846)
 RADIOLOGY, RAT (0517)*
 EXTRANEURAL, N-METHYL-N-NITROSUREA,
 RAT (5118)
 FEMINIZING, OVARY, CHILDHOOD (6202)*
 FIBROUS HISTIOCYTOMA, HISTOLOGY, HUMAN
 (4058)*
 FORMATION, PARAPROTEIN PRODUCTION,
 TRANSPLANTED MOUSE PLASMACYTOMA
 CELLS, HAMSTER (5492)*
 GIANT CELL
 BONE, RECURRENCE, HUMAN (0276)*
 EXTRASKELETAL, PATHOLOGY, HUMAN
 (4219)*
 GLIAL, LYSOSOMES, HUMAN (2121)*
 GLOMAS, ULTRASTRUCTURE, HUMAN (2025)*
 GLOMUS CAROTICUM, HISTOLOGY,
 PATHOGENESIS, HUMAN (0234)
 GRANULAR CELL, URINARY BLADDER,
 MYOGENOUS ORIGIN, HUMAN (1411)
 GRAWITZ, METASTASES TO HAND FINGERS
 CASE REPORT (4252)*
 GROWTH
 ASCITES CARCINOMA, BONE DETERIORA-
 TION, MOUSE (4103)*
 HISTOLOGICAL CHANGE, MOUSE (1197)*
 HISTOLOGY, MOUSE (1196)*
 THIAMINE REQUIREMENTS, TRANS-
 KETOLASE ACTIVITY, MOUSE (6272)*
 GROWTH KINETICS, RADIATION, REVIEW
 (0301)
 GROWTH SUPPRESSION, SPECIFIC TUMOR
 IMMUNITY INDUCTION, MYCOBACTERIUM
 BOVIS INOCULATION, MOUSE (4746)*
 GUERIN T8 ASCITES, EXTENDED PASSAGES
 IN VITRO, CYTOGENETICS (4164)*
 GYNECOLOGIC, SEX CHROMATIN, CLINICAL
 ASPECTS, HUMAN (2863)
 HAMSTER CHEEK POUCH, CYTOLOGY (4141)*
 HEMANGIOMA, SYNOVIOMA, MONKEY (6270)*
 HETEROGENIZATION, 7,12-DIMETHYLBENZ(A)
 ANTHRACENE, VIRUS, HAMSTER (1285)*
 HEXOKINASE AND GLUCOKINASE ACTIVITIES,
 HUMAN, ANIMALS (3292)
 HISTOCHEMISTRY, GIANT CELL, HAMSTER,
 VIRUS (0418)
 HISTOGENESIS, MORPHOGENESIS, REVIEW
 (0926)*
 HISTONE ELECTROPHORESIS, CELL
 REPLICATION RATE, PHOSPHORYLATION
 (4087)*
 HOMOGRAFT, TOLERANCE, MOUSE (0152)
 HORMONE-PRODUCING, HUMAN, REVIEW
 (5701)
 HORMONE SECRETION
 HYPERTENSION, RAT (3500)*
 PATHOLOGICANATOMICAL ASPECTS,

*INDICATES A PLAIN CITATION WITHOUT ACCOMPANYING ABSTRACT

REVIEW (2916)*
 HUMAN, PRIMARY IMPLANTATION, HAMSTER
 CHEEK POUCH (3198)
 IMMUNITY
 HAMSTER, LYMPHOMA, ANTIGENIC
 STIMULATION (0452)
 HUMAN, REVIEW (0908)
 METHYLCHOLANTHRENE, MOUSE (0854)
 MOUSE (0745)
 YEAST, SACCHAROMYCES CEREVISIAE
 (1818)
 IMMUNOLOGY, MURINE SARCOMA VIRUS
 CELL MEDIATED, REVIEW (2245)*
 KIRSTEN, MOUSE (1783)
 PATHOLOGY, REVIEW (2295)*
 REVIEW (2244)*
 IMPLANT METASTASES, THYMECTOMIZED
 HAMSTERS (4733)*
 INCIDENCE
 CHILDREN, INFANTS, AUSTRIA (5428)*
 DOMESTIC ANIMALS, NORTH AMERICA,
 REVIEW (2217)
 INTERNAL EVALUATION, RADIATION
 EMITTER (1686)*
 INDUCTION
 CHEMICAL CARCINOGEN, AXOLOTL
 (2403)*
 HISTOCOMPATIBILITY, IMMUNE
 RESPONSE, REVIEW (1202)
 MOLONEY MURINE SARCOMA VIRUS,
 POLYINOSINIC-POLYCYTIDYLIC
 ACID, MOUSE (0417)
 INHIBITION, ZINC DIET DEFICIENCY,
 MOUSE, RAT (3306)
 OR - CONTINUED
 INTERCRANIAL
 EPIDEMIOLOGICAL STUDY, NORTH
 MORAVIA (3288)*
 FAT INDUCED, MOUSE (2365)*
 FIBRINOLYSIS, HUMAN (4113)*
 INTERSTITIAL
 EXPERIMENTS, MICE (2068)*
 STEROID, TRANSPLANT, METABOLISM,
 MOUSE (1977)
 INTRAOCULAR MEDULLOEPITHELIOMA,
 RHABDOMYOSARCOMATOUS DIFFERENTIATION
 CASE REPORTS (5643)*
 INVASIVE GROWTH, MITOTIC RATES,
 MECHANISMS, MOUSE (0319)*
 ISLET CELL, INSULIN, HUMAN (2814)
 ISOZYME PATTERN, SCHMIDT-RUPPIN ROUS
 SARCOMA VIRUS, RAT (0424)
 JENSEN, SARCOMA, NUCLEIC ACID
 PRECURSOR INCORPORATION, IN VITRO
 (6395)*
 KARYOTYPE, 7,12-DIMETHYLBENZ(A)ANTHRA-
 CENE, ROUS SARCOMA, HAMSTER (4191)*
 KERATOACANTHOMA, MALIGNANT TRANS-
 FORMATION, CASE REPORT (1911)*
 KIDNEY, ANTIGENS, HUMANS (3924)*
 LIVER
 CASE REPORT (4159)*
 INDUCTION, ADENOVIRUS SA7(C8),
 MOUSE (2532)
 KIDNEY, SUBCUTANEOUS TISSUE,
 210 PO, GAMMA-RAYS, DOG (0100)
 MICROSOMES, ENZYMES, MORRIS
 HEPATOMA, MAMMARY CARCINOMA
 (0364)
 RIBOSOMAL SUBUNIT, RAT (1429)
 LUNG
 SCINTISCANNING, HUMAN (4255)*
 ULTRASTRUCTURE, HUMAN (0892)*
 MALIGNANT
 AUTOPSY STUDY, FREQUENCY, AMERICAN
 NEGRO (3276)
 CENTRAL NERVOUS SYSTEM, NUCLEASE,
 HUMAN (0236)
 CHROMOSOME ABERRATIONS, HUMAN
 (3417)*
 CHROMOSOME ABERRATIONS, VIRAL
 ETIOLOGY, HUMAN, REVIEW (5042)
 EPSTEIN-BARR VIRUS, INFECTIOUS
 MONONUCLEOSIS, HUMAN (0141)*
 IMMUNITY, REVIEW (2294)*
 IMMUNOLOGIC FEATURES, REVIEW
 (2204)
 INCIDENCE, ITALY (1943)*
 MICROORGANISMS, REVIEW (5031)*
 OXYGEN TENSION, HUMAN (6323)*
 SPONTANEOUS REGRESSION
 CASE REPORTS (5379)*
 HUMAN, REVIEW (4345)*
 MAMMARY
 B.C.G., EFFECT, RAT (1990)
 GROWTH, HOST RESISTANCE, MOUSE
 (1396)
 HORMONE, REVIEW (2243)*
 VASCULAR SUPPLY, MOUSE (2003)
 MAMMARY CARCINOMA, REGRESSION,
 DIMETHYLBENZANTHRACENE, NURSING
 PERIOD, RAT (3655)
 MAMMARY GLAND, CELL INTERACTION,
 ELECTRIC CHARGE, LIVER, RAT (6389)*
 MAMMOSOMATOTROPIC, REGRESSION, MAMMARY
 RESECTION, RAT (2829)
 MAMMOTROPIC, GROWTH HORMONE VARIANTS,
 RAT (1982)
 MEDIASTINUM, PATHOLOGICAL ANATOMY,
 HUMAN (4284)*
 MEDULLOEPITHELIOMA, REVIEW (2287)*
 METASTASIS
 DOUBLING TIME, HUMAN (0493)
 MODEL, SYRIAN HAMSTER (0054)
 OXYGEN, MICE (2185)*
 MOLONEY SARCOMA, RESORPTION, IMMUNITY,
 MOUSE (5348)
 MORRIS HEPATOMA
 AMINO ACID TRANSPORT, TYROSINE
 AMINOTRANSFERASE, RAT (4271)*
 CYCLIC AMP, RAT (4178)*
 MUCINOUS CYSTADENOMA, OVARY,
 INTESTINAL ANTIGENICITY, HUMAN
 (1846)*
 MULTIPLE MALIGNANT, FREQUENCY
 CLINICAL STUDY (5676)*
 MURINE, BIOSYNTHESIS (2052)*
 MYOID, STOMACH, CASE REPORT (4162)*
 NECROSIS, CIRCULATION, PULMONARY
 (1988)
 NODULES, LUNG, RABBIT (2147)*
 OAT CELL CARCINOMA, PANCREATIC, TUMOR
 PEPTIDE, CORTICOTROPIN-RELEASING-
 FACTOR-LIKE ACTIVITY, ACTH SYNDROME,
 HUMAN (0847)
 OVARIAN, ELECTROPHORESIS, PROTEINS,
 HUMAN (2107)*
 PANCREAS
 INSULIN, HEPATIC LIPOGENESIS
 HUMAN (2101)*
 PERNICIOUS ANEMIA, ACROMEGALY,
 HUMAN (2149)*
 PATHOLOGY, MURINE SARCOMA VIRUS,
 RODENT (4550)
 TUMOR - CONTINUED
 PERICARDIUM, RADIOLOGY, RAT (0494)*
 PHENOTYPES, OSTEOSARCOMA, SYNOVIAL
 SARCOMA (1952)

POLYOMA, IMMUNITY STIMULATION,
 BACILLUS CALMETTE-GUERIN, MOUSE
 (1824)
 POLYOMA VIRUS-INDUCED, IMMUNOLOGICAL
 STUDY, HAMSTER (2699)*
 PRECANCEROUS CHANGES, ETIOLOGY,
 PATHOGENESIS, IMMUNE MECHANISMS,
 HUMAN REVIEW (2267)*
 PREPUTIAL GLAND, MICROSOMAL ENZYMES,
 CHOLESTEROL ACYLATION, MOUSE (4237)*
 PRIMARY
 MALIGNANT, SIMULTANEOUS, HUMAN
 (2074)*
 METASTATIC, STOMACH ABH ISO-
 ANTIGENS, EPITHELIAL, HUMAN
 (1839)
 MULTIPLE, GYNECOLOGY, HUMAN
 (3470)*
 SMALL INTESTINE, HISTOLOGY, HUMAN
 (6026)*
 PRIMARY INTRACRANIAL, ELDERLY,
 AUTOPSY STUDIES, REVIEW (3269)
 PRODUCTION
 HUMAN, HAMSTER, ADENOMA (0832)
 PHORBOL MYRISTATE ACETATE,
 CELLULAR INTERACTIONS, MOUSE
 (2418)*
 PROGRESSION, CHEMICAL VACCINE,
 SUBSTITUTED GLUCOSAMYL POLY
 (L-ASPARTATE) (1798)
 PROMOTION, CIGARETTE SMOKE
 CONDENSATE, MOUSE (0651)*
 PROTECTION, THYMOCYTE, IN VITRO
 IMMUNIZATION, CYTOTOXICITY, MOUSE
 (4667)
 PROTEIN-DNA RATIO, RAT, MOUSE,
 ELECTRON MICROSCOPE (0296)*
 PULMONARY, CYTOPLASMIC INCLUSIONS,
 HUMAN (2200)*
 RAT TISSUE
 EFFECT OF HYPERGLYCEMIA ON OXYGEN
 AND GLUCOSE UPTAKE, DS-CARCINO-
 SARCOMA (3581)*
 OXYGEN PRESSURE MEASUREMENTS,
 DS-CARCINOSARCOMA (3582)*
 RECURRENCE, TUMOR CELL IMPLANTATION,
 SURGICAL WOUNDS, HUMAN (6357)*
 REGRESSION, FELINE SARCOMA VIRUS, CAT
 (1013)
 RESEARCH, LABORATORY ANIMAL, REVIEW
 (0905)
 RESISTANCE, TOXOPLASMA GONDII,
 BESNOITIA JELLISONI, INFECTION,
 MOUSE (1799)
 REVERSION, DIMETHYLNITROSAMINE,
 HAMSTER (5808)
 RNA-DEPENDENT DNA POLYMERASE, HUMAN
 (1984)
 SALIVARY GLAND
 HUMAN (2138)*
 RECURRENCE, INCIDENCE, HUMAN
 (5438)
 SARCOMA 180, GROWTH, HEAT TREATMENT,
 STARVATION, MOUSE (0252)
 SHAY CHLOROBLASTIC, CELLULAR ION
 DISTRIBUTION, POTENTIAL DIFFERENCE
 (4186)*
 SILICONE-INDUCED, ACID MUCOPOLY-
 SACCHARIDE CONTENT, RAT (2443)*
 SIZE, POLYOMA VIRUS, ANTIGEN,
 THYMECTOMY, RAT (5956)*
 SPECIFIC ANTIGEN, MALIGNANCY, ETIOLOGY
 (0326)*
 SPINDLE-CELL
 GIANT-CELL, THYROID GLAND,
 CLINICAL STUDY (5567)*
 ULTRASTRUCTURE, HUMAN (6207)*
 SPONTANEOUS
 INCIDENCE
 MOUSE (5593)*
 VIROLOGY, HAMSTER (4579)*
 STEM LINE THEORY, HETEROPLIIDY, DNA,
 HUMAN, HAMSTER (1440)
 SUCCESSIVE GENERATIONS, SV40, HAMSTER
 (5242)
 TESTICULAR
 FSH, CHORIONIC GONADOTROPIN, HUMAN
 (2148)*
 HISTOCHEMISTRY, STEROID METABOLISM
 RAT (2039)*
 HISTOLOGY, HUMAN (2069)*
 THECA-GRANULOSA CELL, PROLIFERATIVE
 ENDOMETRIAL RESPONSE, HUMAN (1896)
 TISSUE, IMMUNOLOGY, MOUSE (3931)*
 TOOTH BEARING REGIONS, MORPHOLOGY,
 FISH, MAMMALS (4291)*
 TUMOR - CONTINUED
 TRANSPLANT GROWTH, COUPLED TUMOR
 PROTEIN ANTIGEN (LEWIS), MOUSE
 (1793)
 TRANSPLANTABLE, POLYOMA VIRUS-INDUCED,
 MORPHOLOGY, BIOLOGICAL PROPERTIES
 (4578)*
 TRANSPLANTABLE LYMPHOID, ANEMIA,
 CHICKEN (5519)*
 TRANSPLANTED, HISTOCHEMISTRY, CELL
 DEATH, MOUSE (2845)
 TRNA METHYLASE INHIBITOR (0225)
 ULTRASTRUCTURE, GIANT CELL, VIRUS,
 HAMSTER (0421)
 UVT, BACILLUS CALMETTE-GUERIN,
 IMMUNIZATION, MOUSE (1067)*
 VARIABILITY, H102 TISSUE CULTURE,
 MORPHOLOGY, GENETICS (3475)*
 VENERAL, CELL ADHERENCE, DOG (1878)*
 VIRAL ETIOLOGY, IMMUNITY, REVIEW
 (2206)
 WALKER, DORMANCY, LIVER MASSAGE, RAT
 (0787)
 WALKER 256, METASTASES, CYTOSTATIC
 THERAPY (2076)*
 XENOGRAFTS, CELL-MEDIATED RESPONSES,
 MOUSE (2603)
 YOSHIDA, L-GLUTAMINE, D-FRUCTOSE
 6-PHOSPHATE AMIDOTRANSFERASE, LIVER,
 RAT (0544)
 TUMOR CELL
 INOCULATION, LYMPHOCYTE DEPLETION,
 MOUSE (3859)
 MEMBRANE, SIALIC ACID-LECITHIN
 BINDING (0853)
 SPREAD, BIOPSY HAZARD (1148)*
 TUMOR GROWTH
 BIOPSY, HUMAN (2080)*
 SPLENOMEGALY, RAT (2132)*
 TUMOR PROMOTION
 ALCOHOLIC BEVERAGE (5180)
 ANTHRALIN, MOUSE (1541)
 EPSILON-N-TRIMETHYLLYSINE, ASCITES
 TUMOR, MOUSE (0670)*
 SKIN, PHORBOL ESTER, MOUSE (3680)
 TOBACCO, FRACTION, MOUSE SKIN (3687)
 TWEEN-60, CROTON OIL, DIMETHYLBENZ-
 ANTHRACENE, EPITHELIUM, DNA
 SYNTHESIS, MOUSE (3644)
 TUMOR TISSUES
 EMBRYONIC NERVE CELLS, MUTUAL GROWTH
 INFLUENCE, TISSUE CULTIVATION

TECHNIQUE (3588)*
 ORAL CALCINOSIS
 INCIDENCE, UGANDA (5546)*
 ORIGENESIS
 BIOLOGICAL SUBSTANCES, HAMSTER (2811)
 C-TYPE PARTICLE, MOUSE, REVIEW (2238)*
 CELL MEMBRANE, CONCAVALIN A, HUMAN
 (2093)*
 CELLULAR CHANGES, PITUITARY TUMORS,
 ESTROGEN INDUCED, RAT (2416)*
 1,2-DIMETHYLHYDRAZINE DIHYDROCHLORIDE,
 HYDRAZIN SULFATE, ISONICOTINIC ACID,
 HAMSTER (2349)
 FOREIGN BODY, ULTRASTRUCTURE,
 PRENEOPLASTIC TISSUE REACTIONS,
 MOUSE (5404)
 IMMUNOLOGICAL INTERFERENCE, ROUS
 SARCOMA VIRUS, RAT (2625)
 IMMUNOLOGICAL PROBLEM, REVIEW (5068)*
 INHIBITION, EHRLICH ASCITES TUMOR,
 L CELL (1119)
 PERSISTENT ESTRUS, ESTROGEN DEFICIENCY
 RAT (2943)
 PRECANCEROUS CONDITION, DEPRESSION OF
 IMMUNE RESPONSE, REVIEW (2907)
 RNA TUMOR VIRUS, EMBRYOGENESIS,
 REVIEW (0308)
 RNA VIRUS-INDUCED, HUMAN, REVIEW
 (2239)*
 TUMOR GROWTH, IMMUNOSUPPRESSION,
 REVIEW (5761)*
 VIRUS, B-TYPE PARTICLE, MICE, HUMAN,
 REVIEW (2237)*
 ORIGINICITY
 AGGLUTINABILITY, CONCAVALIN A,
 HAMSTER CELLS, CELL HYBRIDS (3694)
 CYTOTOXICITY, ENZYME, ARYL HYDROCARBON
 MECHANISM (0348)
 OVARY, MICE (2158)*
 WILM'S SYNDROME
 WILM'S TUMOR, IMPERFORATE ANUS,
 45,XO CHROMOSOME, CASE REPORT
 (1139)*
 EN-60
 TUMOR PROMOTION, EPITHELIUM, DNA
 SYNTHESIS, MOUSE (3644)
 IDENTICAL, LYMPHOCYTE CYTOTOXICITY,
 LEUKEMIA, HUMAN (4674)
 NASOPHARYNGEAL CARCINOMA, CASE REPORT
 (0535)
 SINGLE-OVUM, LYMPHOGRANULOMATOSIS,
 CASE REPORT (0857)*
 OSINE AMINOTRANSFERASE
 SYNTHESIS, RIBOSOME, HEPATOMA
 (0294)*
 OSINE METABOLITES
 TRYPTOPHAN, EPR SPECTRA (4474)*
 ER
 GASTRIC, MALIGNANT TRANSFORMATION,
 HUMAN (0800)*
 MALIGNANT, OSTEOMYELITIC FISTULAS,
 SKIN CANCER, CLINICAL STUDY (6350)*
 PARTIAL GASTRECTOMY, CANCER OF GASTRIC
 STUMP, HUMAN (3411)*
 RASTRUCTURE
 ACUTE THYMIC INVOLUTION, POLYOMA
 VIRUS INFECTION, MOUSE (0722)
 ADAMANTINOMA, TIBIA, CASE REPORT
 (5649)*
 ANTIBODY, HUMAN, EPSTEIN-BARR VIRUS,
 LEUKEMIA (0403)
 BREAST TUMOR, CALCIFICATIONS, HUMAN
 (6262)*

BURKITT'S LYMPHOMA, CYTOLOGY, CASE
 REPORT (4207)*
 CANCER, BREAST, STROMA, HUMAN (2033)*
 CARCINOMA
 LIMBUS, HUMAN (0569)*
 SALIVARY DUCT, HUMAN (4129)*
 VAGINA, PATHOLOGY, HUMAN (4225)*
 CHONDROBLASTOMA, HISTOCHEMISTRY, CASE
 REPORT (4216)*
 CYTOCHEMISTRY, IMMATURE CELL
 LEUKEMIAS, CLASSIFICATION (4153)*
 ENDOMETRIAL CARCINOMA, HUMAN (0886)*
 ENDOMETRIUM, ENDOMETRIAL ADENO-
 CARCINOMA, HUMAN (4233)*
 ENDOMETRIUM GLANDULAR CELLS, CARCINOMA
 HUMAN (4245)*
 EPITHELIAL ODONTOGENIC TUMOR, HISTO-
 CHEMISTRY, CASE REPORT (4100)*
 EWING'S SARCOMA, BONE, CASE REPORTS
 (4299)*
 FOLLICULAR ADENOMA, IODINE DEFICIENCY,
 GOLGI APPARATUS, HUMAN (6269)*
 GIANT CELL, VIRUS, HAMSTER, TUMOR
 (0421)
 GLIAL TISSUE, NEOPLASIA, GROWTH
 IN VITRO (6216)*
 GONADOBLASTOMA, HISTOCHEMISTRY, HUMAN
 (4077)*
 HERPES SIMPLEX VIRUS, VARICELLA-ZOSTER
 VIRUS (4591)*
 HIGH-VOLTAGE ELECTRON MICROSCOPY,
 WET WHOLE CANCER CELLS (6330)*
 LEIOMYOSARCOMA, UTERINE LEIOMYOMA,
 CELLULAR LEIOMYOMA (1462)*
 LUNG ADENOCARCINOMA, TRANSMISSION AND
 SCANNING ELECTRON MICROSCOPY, HUMAN
 (4218)*
 MALIGNANT MELANOMA, CHOROID, CASE
 REPORT (4154)*
 MAMMARY GLAND TUMOR, HUMAN (4146)*
 MELANOMA, HAMSTER (0600)*
 MYOMATOUS PULMONARY TUMORS,
 MICROSCOPY, HUMAN (0892)*
 NUCLEOLAR SEGREGATION, CARCINOGENICITY
 4-NITROQUINOLINE-1-OXIDES, CHANG
 LIVER CELL (0644)
 ORGANS, MAREK'S DISEASE, CHICKEN
 (0144)*
 PARATHYROID, HYPERPARATHYROIDISM,
 ADENOMA, MAN (0539)
 PERIPHERAL NERVE, MAREK'S DISEASE,
 FOWL (4592)*
 PIGMENTED TUMOR, LIP, HUMAN (6177)*
 PITUITARY ADENOMA, PROLACTIN
 PRODUCING CELLS, HUMAN (0573)*
 PLASMA, MULTIPLE MYELOMA, PLASMA CELL
 LEUKEMIA (0597)*
 ULTRASTRUCTURE - CONTINUED
 RETINOBLASTOMA, PATHOGENESIS, HUMAN
 (0506)*
 SALIVARY GLAND TUMORS, ONCOCYTOMA,
 MITOCHONDRIAL HYPERPLASIA, MAN
 (1480)*
 SCLEROSING CARCINOMA, THYROID, CASE
 REPORTS (4227)*
 SPINDLE-CELL TUMOR, HUMAN (6207)*
 SV40, TRANSFORMED CELL, CONTACT
 INHIBITION, MOUSE (0721)
 TUBULAR CARCINOMA, BREAST, HUMAN
 (4054)*
 TUMOR CELL DIFFERENTIATION, GROWTH,
 MOUSE (4272)*
 TUMORS
 CELL SURFACE, CONTACT MECHANISM

- (0549)
 LYMPH NODE, IMMUNE REACTION,
 RAT (0775)*
 SPONTANEOUSLY TRANSFORMED TISSUE
 CULTURE CELLS, MOUSE (6335)*
- ULTRAVIOLET
 SUNLIGHT, SKIN CANCER, HUMAN, REVIEW
 (5702)
- URANIUM
 ENVIRONMENTAL HAZARD, LANDFILL, CANCER
 MORTALITY, COLORADO (5412)
 RADIATION, OCCUPATIONAL HAZARD MINE
 WORKERS (5866)*
- UREMIA
 MAST-CELL PROLIFERATION, SPLEEN, HUMAN
 (4801)*
- URETER
 CARCINOMA, HISTOLOGY, CASE REPORT
 (4104)*
 NEOPLASIA OF URETERAL STUMP, PARTIAL
 NEPHROURETERECTOMY, CASE REPORT
 (5661)*
 SIGMOIDOSCOPY, COLONIC TUMOR, CASE
 REPORT (1450)*
 TUMOR, PELVIS, ETIOLOGY, HUMAN (1198)*
- URETHANE
 BLASTOMOGENESIS, DNA NUCLEOTIDE
 COMPOSITION, LUNG TISSUE, MOUSE
 (5813)*
 BRONCHIOLAR EPITHELIUM, MOUSE (1092)*
 CARCINOGENESIS
 MOUSE (4412)
 STRAIN DIFFERENCE, RAT (2965)
 CARCINOGENICITY, HEPATOCYTES,
 ULTRASTRUCTURE, MOUSE (2327)
 DIETHYL PYROCARBONATE, BEVERAGE,
 ENVIRONMENTAL HAZARD (4428)
 DNA BINDING, LUNG, KIDNEY AND LIVER
 TISSUES, MOUSE, RAT (2988)
 EFFECT, NUCLEIC ACIDS, LIVER, MOUSE
 (2329)
 EPIDERMIS, DNA CONCENTRATION, MOUSE
 (2969)
 IMMUNOSUPPRESSION, RAT (3921)*
 INDUCED LUNG ADENOMA, CELLULAR
 IMMUNITY, MOUSE (2326)
 LEUKEMOGENESIS, IMMUNODEPRESSION,
 MOUSE (1610)*
- LIVER
 ENZYME INDUCTION, RAT (1611)*
 PARTIAL HEPATECTOMY, NUCLEIC
 ACID, BINDING, MOUSE (2933)
 RNA, MOUSE (0371)*
 LYMPHOMAGENESIS, SKIN-GRAFT
 REJECTION, MOUSE (0755)
 MACROMOLECULAR INTERACTIONS, LUNG AND
 LIVER TISSUES, MOUSE (5114)
 MAMMARY GLAND EXCRETION, PULMONARY
 ADENOMA, MOUSE (0362)
 MAMMARY NODULE INDUCTION, SERIAL TUMOR
 TRANSPLANTATION, MOUSE (3003)
 NARCOSIS, PANCREAS, HUMAN (2383)*
 NEOPLASMS, ULTRASTRUCTURE, MOUSE
 (5833)*
 NUCLEIC ACID, METABOLISM, MOUSE
 (0667)*
 OVULATION, RAT (5196)*
 PROTEIN BIOSYNTHESIS, RADIOACTIVITY
 ASSAYS, RAT (4457)*
 RELATED CARBAMATES, TUMOR FORMATION,
 MOUSE (4399)
 SUSCEPTIBILITY, AGE FACTOR, MOUSE
 EMBRYO (0367)*
 TRANSFORMATION, LUNG CELLS, HUMAN
- EMBRYO (4396)
 UPTAKE, CATABOLISM, MOUSE, PEROMYSCUS
 LEUCOPUS (5115)
 X-IRRADIATION, ADDITIVE LEUKEMO-
 GENICITY, MOUSE (2328)
 X-RAY, TUMOR-RESISTANT MOUSE (5792)
- URETHRA
 EXCRETO-URINARY CANCERS, HUMAN, REVIEW
 (3613)
- URINARY BLADDER
 CANCER, TRYPTOPHAN METABOLISM,
 CLINICAL STUDY (6152)*
 EPITHELIAL TUMORS, HISTOCHEMISTRY,
 CLINICAL STUDY (6151)*
 GRANULAR CELL TUMOR, MYOGENOUS ORIGIN,
 HUMAN (1411)
- TUMOR
 2-NAPHTHYLAMINE, DOSE-RESPONSE
 RELATIONSHIPS, DOG (4469)*
 PRENEOPLASTIC STAGES, RAT (6072)*
 TUMOR INDUCTION,
 BUTYL(3-CARBOXYPROPYL)NITROSOAMINE,
 RAT (4470)*
 TUMORIGENESIS, 2-ACETYLAMINOFLUORENE,
 INDOLE, HAMSTER (4376)
- URINARY SYSTEM
 UNILATERAL URETER LIGATION, TUMOR
 DEVELOPMENT, N-BUTYL-N-(4-HYDROXY-
 BUTYL)-NITROSOAMINE, RAT (4372)
- URINARY TRACT
 CARCINOMA
 ANALGESIC ABUSE, HUMAN (3718)*
 BILHARZIASIS, HUMAN (4057)*
- URINE
 CYTOLOGY, PRIMARY CARCINOMA OF RENAL
 PELVIS AND URETER, HUMAN (5553)*
- UROGENITAL TRACT
 CARCINOMA, SV40-NEUTRALIZING ANTI-
 BODIES, SERUM, HUMAN (3054)
 ESTROGEN, CARCINOGENIC ACTION, HUMAN
 (2345)
- TUMOR
 SERUM PROTEIN, CLINICAL STUDY,
 HUMAN (3544)*
 URINARY CYTOLOGY, HUMAN (6258)*
- UTERINE ADENOCARCINOMA
 DEHYDROGENASE ACTIVITY (3595)*
- UTERINE CANCER
 ANDROGENOUS METABOLITE EXCRETION
 (3569)*
 NICKEL, MAGNESIUM, HUMAN (2389)*
 TETRAHYDRO-S DETERMINATION, CHROMATO-
 GRAPHY (3568)*
 URINARY ESTROGENS, ADRENAL CORTEX AND
 THYROID FUNCTION, LIVER FUNCTION
 TESTS, WOMEN (3663)
 UTERUS-SPECIFIC PROTEIN LIBERATION,
 MOUSE (2391)*
- UTERINE CERVIX
 ADENOCARCINOMA, CASE REPORTS (4793)
 ADENOID CYSTIC CARCINOMA, CASE
 REPORTS (5663)*
- CANCER
 BREAST CANCER, REVIEW (5732)*
 ETIOLOGY, REVIEW (3629)*
 INCIDENCE, DENMARK (4826)*
 PREVALENCE, DISTRIBUTION, INDIA
 (4828)*
 CANCER IN SITU, EPIDEMIOLOGY, CUBA
 (3979)*
- CARCINOMA
 INCIDENCE
 GERMANY (6093)*
 GERMANY, REVIEW (5065)*

HUNGARY (6091)*
 JAPAN (6102)*
 POLAND (6097)*
 METASTASIS, HUMAN (4127)*
 MICROINVASIVE SQUAMOUS CELL,
 HUMAN (1887)
 MORPHOLOGY, ORGAN CULTURES (6369)*
 NUCLEOPROTEIN, CHORIOALLANTOIS
 MEMBRANE, EMBRYONIC CHICKEN EGG
 (6065)*
 PROTEIN STRUCTURE, IMMUNOLOGY,
 HUMAN (5295)
 STROMAL INVASION, PATHOLOGY
 (4249)*
 EPITHELIAL LESIONS, CONNECTIVE TISSUE,
 HISTOPATHOLOGICAL STUDY, HISTO-
 CHEMICAL STUDY, HUMAN (6061)*
 MELANOMA, IMMUNOLOGY, CASE REPORT,
 REVIEW (3914)*
 PRECANCEROUS CHANGES, HUMAN, REVIEW
 (5058)*
 PRECANCEROUS LESIONS, CYTOLOGIC AND
 HISTOLOGIC RELATIONSHIPS, HUMAN
 (3551)*
 SQUAMOUS CELL CARCINOMA, BLOOD VESSELS
 HISTOLOGICAL STUDY (6067)*
 STAGES OF CANCERIZATION, ONCOGENIC
 INFECTIOUS NUCLEOPROTEIN, HUMAN
 (1894)
 UTERINE TUBE
 TERATOMA, CASE REPORT (3543)*
 UTERUS
 ADENOCARCINOMA
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 RAT (5086)
 INTRAUTERINE CONTRACEPTIVE DEVICE,
 CASE REPORT (4495)*
 BILATERAL BRENNER TUMOR, HISTOPATH-
 OLOGY, CASE REPORT (4131)*
 BINDING SITE, ESTROGEN, MOUSE (0337)
 CANCER
 INCIDENCE, JAPAN (6085)
 MALIGNOLIPIN, BLOOD, AMINO ACID,
 HUMAN (1143)*
 PATHOGENETIC VARIETIES, CLINICAL
 STUDY (6055)*
 CARCINOMA
 BLOOD AND URINE MICROELEMENTS,
 HUMAN (4109)*
 HUMAN, REVIEW (5735)*
 CERVICAL CANCER, HISTOCHEMISTRY, HUMAN
 (6237)*
 CERVIX
 CARCINOMA, GRANULOCYTE, ZINC
 CONTENT, HUMAN (0570)*
 GLANDULAR EPITHELIUM, HYPERPLASIA,
 ORAL CONTRACEPTIVES, HUMAN
 (0365)*
 UTERINE CORPUS, MORTALITY (0206)
 CERVIX CARCINOMA
 GLYCOGEN HISTOCHEMISTRY, HUMAN
 (4078)*
 PREGNANCY, HUMAN (6382)*
 CHORIOCARCINOMA, HYDATIDIFORM MOLE,
 CASE REPORT (6221)*
 ENDOMETRIAL STROMAL SARCOMA, CASE
 REPORT (1190)*
 ENDOMETRIUM CARCINOMA, EPIDERMOID
 CARCINOMA OF CERVIX, CASE REPORTS
 (3244)*
 FIBROCYSTIC MASTOPATHY, INCIDENCE,
 ITALY (0810)
 HEMANGIOPERICYTOMA, ULTRASTRUCTURE,
 HUMAN (3393)*
 LEIOMYOBLASTOMA, CASE REPORT (5595)*
 LEIOMYOMA, CELLULAR LEIOMYOMA,
 LEIOMYOSARCOMA, ULTRASTRUCTURE
 (1462)*
 LEIOMYOMATA, ASCITES AND HYDROTHORAX-
 ASSOCIATED, CASE REPORT (5621)*
 LEIOMYOSARCOMA, HISTOLOGY, PATHOLOGY,
 HUMAN (4220)*
 MALIGNANT MIXED MESODERMAL TUMOR,
 ULTRASTRUCTURE, HUMAN (0598)*
 MALIGNANT MUELLERIAN TUMORS, HUMAN
 (3467)*
 MESODERMAL MIXED TUMOR, CYTOLOGY,
 HISTOLOGY, ULTRASTRUCTURE, HUMAN
 (5463)*
 3-METHYLCHOLANTHRENE
 ESTROGEN, CASTRATION, MOUSE (4435)
 ESTROGEN BINDING (5771)
 MYOMA, HORMONAL FACTORS, HUMAN (5648)*
 OVARIAN FUNCTION, PRECANCEROUS
 CONDITIONS, HUMAN (3951)*
 TONGUE, BOTRYOID SARCOMA, CASE REPORT
 (6264)*
 TUMORS
 HEXOKINASE ISOZYMES, HUMAN (4095)*
 HUMAN, REVIEW (5036)*
 PROTEINS, AMINO ACIDS, HUMAN
 (0559)*
 VACCINATION
 YELLOW FEVER, CANCER RISK, AVIAN
 LEUKOSIS VIRUS, HUMAN (3740)
 VACCINE
 BACILLUS CALMETTE-GUERIN, HEPATO-
 CELLULAR CARCINOMA, IMMUNITY,
 GUINEA PIG (4655)
 CHEMICAL, TUMOR PROGRESSION,
 SUBSTITUTED GLUCOSAMYL POLY
 (L-ASPARTATE) (1798)
 SMALLPOX, TUMOR, CASE REPORT (4715)*
 THIMEROSAL, CARCINOGENICITY, TOXICITY,
 RAT (1271)
 TUMOR CELL, DISRUPTION, IMMUNOGENICITY
 ADENOVIRUS, HAMSTER (0415)
 VAGINA
 ADENOCARCINOMA
 CERVICAL ENDOMETRIOSIS, CASE
 REPORT (0794)*
 MATERNAL SYNTHETIC ESTROGEN
 THERAPY, CASE REPORTS (3477)*
 VAGINAL ADENOSIS, CASE REPORT
 (1093)*
 ADENOMA WITH MESONEPHRIC RESIDUES,
 HISTOPATHOLOGY, CASE REPORT (6267)*
 BASAL CELL CARCINOMA, TRANSPLANTATION,
 ESTROGEN TREATMENT, MOUSE (3298)
 CANCER
 DEVELOPMENT, ESTROGEN, WOMEN
 (4464)*
 STILBESTROL, HUMAN, REVIEW (5039)*
 CARCINOMA
 CHILDREN, REVIEW (4340)*
 SYNTHETIC ESTROGEN, HUMAN (0083)*
 CARCINOMA IN SITU, HYSTERECTOMY, HUMAN
 (5482)*
 CELL POPULATION, HORMONAL CONDITION,
 HUMAN (6203)*
 CLEAR CELL CARCINOMA, ULTRASTRUCTURE,
 PATHOLOGY, HUMAN (4225)*
 ORAL CONTRACEPTIVE, CYTOLOGY,
 HISTOLOGY, HUMAN (0971)*
 PRIMARY CARCINOMA, INCIDENCE, SCOTLAND
 (2782)*
 VAGINAL-CERVIX-INNervation, CARCINOMA,
 RELATIONSHIP, HUMAN (3347)*

VARICELLA-ZOSTER
 INFECTION, CANCER PATIENTS (4659)
 VASCULAR SUPPLY
 MAMMARY TUMOR, MOUSE (2003)
 VIRAL HEPATITIS
 LIVER NEOPLASMS, METASTASIS, REVIEW
 (1528)*
 VIRAL INHIBITOR
 INTERFERON, CHICK EMBRYO (2415)*
 VIRILIZING LUTEOMA
 PREGNANCY, STEROID HORMONE CONTENT,
 HUMAN (1140)*
 VIROLOGY
 AGGLUTINATION, COMPLEMENT FIXATION
 (1948)
 BREAST CANCER VIRUS, MORPHOLOGIC
 DEVELOPMENT, TRANSMISSION MECHANISM,
 REVIEW (3632)*
 VIRUS
 A-TYPE PARTICLE, SPLENIC LYMPHOMA,
 STEMLINE EVOLUTION, MOUSE (3941)
 ABELSON, LEUKEMIA, MOUSE, RAT (4794)
 ACTIVATION
 5-IODODEOXYURIDINE, DIMETHYL
 SULFOXIDE, HUMAN (2493)
 ACUTE INFECTION, IMMUNE RESPONSE,
 ASSESSMENT, IMMUNOSUPPRESSION
 (1854)*
 ADENO
 ADENO-ASSOCIATED, TRANSFORMATION
 INHIBITION, HAMSTER CELL (2523)
 CAPSID PROTEIN, IMMUNOLOGY, HUMAN,
 MONKEY (1070)*
 CHROMOSOMAL ABERRATION, HUMAN
 (0446)*
 CHROMOSOME ABERRATION, FANCONI'S
 ANEMIA (0143)*
 CHROMOSOME BREAKING, CELL
 SUSCEPTIBILITY, HUMAN (0142)*
 COMPLEMENT-FIXATION ANTIBODIES,
 TUMORS, HUMAN (2526)
 DEOXYRIBONUCLEASE, VIRAL PENTON
 AGGREGATE, SODIUM DEOXYCHOLATE
 (0739)*
 DNA, POLYRIBONUCLEOTIDE BINDING,
 STRAND SEPARATION (0702)
 DNA FATE, KB CELL (1715)
 DNA-PROTEIN COMPLEX, HAMSTER CELL
 (4529)
 EHRlich ASCITES TUMOR, GRAFT
 RESISTANCE, MOUSE (1037)*
 ENDONUCLEASE, VIRAL PENTON, DNA,
 KB CELL (0704)
 INFECTIVITY, HUMAN (0734)*
 KIDNEY CELL RESPONSE, CALF, HUMAN
 (1336)
 MESSENGER RNA, TRANSPORT, CELL
 NUCLEUS (1333)
 MRNA, MAMMALIAN (2586)*
 NUCLEAR INCLUSION, KB CELL (1036)*
 PROTEIN SYNTHESIS, KB CELL (1332)
 REPLICATION, THERMOSENSITIVE EVENT
 (1363)*
 REPLICATION INHIBITION, EMBRYO
 KIDNEY CELLS, HUMAN (2525)
 RNA SYNTHESIS, INFECTED CELL
 (0732)*
 RNA TRANSCRIPTS, BASE SEQUENCE
 (1714)
 SEROTYPE, MONKEY (0731)*
 SV40 HYBRID, RNA CHARACTERIZATION
 (0707)
 SYNTHESIS, ARGININE REQUIREMENT
 MECHANISM (1713)

TEMPERATURE-SENSITIVE MUTANTS,
 CHICK EMBRYO (2527)
 TITRATION COMPARISON (2577)*
 TUMOR, CYTOTOXIC ANTIBODY, MOUSE,
 RAT (0479)
 TUMOR ANTIGEN, TUMORIGENICITY,
 TRANSFORMED CELL, HAMSTER (4519)
 TUMOR CELLS
 ANTIGEN, HAMSTER (4710)*
 RAT (4593)*
 VACCINE, IMMUNOGENICITY, HAMSTER
 (0415)
 TYPES 1,3
 DOUBLE IMMUNIZATION, RABBIT
 (6002)*
 TYPE 2
 DNA SYNTHESIS, INTERMEDIATE
 (1334)
 HELA, CAMPTOTHECIN, CELLULAR
 DEGRADATION, RAT (2419)*
 INFECTED CELL, RNA, NUCLEOTIDE
 SEQUENCE (1358)*
 INHIBITION
 CAMPTOTHECIN, HELA CELLS
 (5936)*
 INTERFERON, HUMAN, MONKEY
 (1054)
 RNA CHANGES, CULTURED HUMAN
 CELLS (2531)
 RNA SYNTHESIS, KB CELL (0683)
 SV40, ABORTIVE INFECTION,
 PROTEIN SYNTHESIS AND
 TRANSPORT, MONKEY (0709)
 TYPE 3
 SOLUBLE ANTIGENS, RABBIT
 (5986)*
 TYPES 3,6,12
 CELL CULTURE INTERACTIONS,
 CHICK EMBRYO FIBROBLASTS
 (5928)*
 TYPE 10
 INFECTED CELL, NUCLEIC ACID
 SYNTHESIS, HELA (1019)
 TYPE 12
 ARGININE DEPRIVED CELLS,
 IMMUNOFLUORESCENCE (2587)*
 N,N'-DIMETHYLNITROSOUREA,
 CRANIAL TUMOR, MOUSE (5252)
 INFECTION, UV-RADIATION,
 FIBROBLASTS, RAT (5874)*
 TUMOR ANTIBODY DETECTION,
 INDIRECT PAIRED RADIOIODINE-
 LABELED ANTIBODY TECHNIQUE,
 HAMSTER (0708)
 TUMOR DEVELOPMENT, NASAL
 INFECTION, MOUSE (5942)*
 TUMOR FORMATION, CLAM EXTRACTS
 METHOTREXATE, HAMSTER
 (5932)*
 TUMOR INHIBITION, MATERNAL
 IMMUNIZATION, ADENOVIRUS 12,
 PROTEINS, HAMSTER (1805)
 UV RADIATION, CELLULAR DNA
 SYNTHESIS, SUPPRESSION, HUMAN,
 MONKEY (1335)
 VIRAL RNA, NUCLEUS, CYTOPLASM,
 INFECTED HUMAN CELLS (0706)
 VIRUS - CONTINUED
 ADENO-ASSOCIATED AAV2H, DNA,
 NUCLEOTIDE STRAND SEPARATION (3072)
 ADENO MUTANTS, RECOMBINATION, HAMSTER
 CELL (3820)
 ADENOVIRUS
 CANCER, ETIOLOGY, HUMAN, REVIEW

(3602)
 INFECTION, SURFACE MEMBRANE CHANGE
 HUMAN (3748)
 SURFACE ANTIGEN, VIRION (4563)
 SV40, TRANSFORMED CELLS,
 MITOCHONDRIAL DNA (3117)
 TRANSFORMATION, HORMONAL
 MODIFICATION, HAMSTER CELLS
 (5267)
 TYPE 2
 HEXON, PHYSICAL AND CHEMICAL
 PROPERTIES (3057)
 INHIBITION OF FORMATION,
 CAMPTOTHECIN (3739)
 TYPE 2 AND 3
 STRUCTURAL CORE PROTEINS,
 PROPERTIES (3095)
 TYPE 2 AND 4
 INTERFERENCE WITH ADENOVIRUS
 TYPE 12, KIDNEY CELLS,
 GUINEA PIG (3826)*
 TYPE 3
 TRANSFORMATION, HAMSTER EMBRYO
 (3811)
 TYPE 5 AND 12
 CELLULAR LACTATE DEHYDROGENASE
 DIFFERENTIAL RELEASE DURING
 REPLICATION (3150)*
 TYPE 7
 HELA CELL LYSOSOME (3828)*
 TYPE 12
 T-ANTIGEN, COMPLEMENT FIXING
 ANTIBODY, IMMUNOLOGY (3167)
 INFECTION, BHK 21 CELLS (3798)
 RNA AND DNA, HYBRIDIZATION,
 HUMAN (3108)
 TRANSFORMATION, HAMSTER (3078)
 ULTRASTRUCTURE, SOUTH AMERICAN
 MONKEYS (3832)*
 ENOVIRUS-ASSOCIATED TYPE 3,
 STRUCTURAL PROTEINS (4725)
 ENOVIRUS INFECTION, CELL SURFACE
 CHANGES, EMBRYONIC KIDNEY CELLS,
 HUMAN (4547)
 VENTITIOUS
 DETECTION, KIDNEY CELLS, MONKEY
 (2573)*
 R LEUKEMIA
 INFECTED CELL, 3-METHYLCHOLANTHRENE,
 TRANSFORMATION, MOUSE (2315)
 SMOG EXTRACT, TRANSFORMATION, MOUSE
 (3703)
 IMALS
 CELLS, REVIEW (2261)*
 TIBODY, NASOPHARYNGEAL CARCINOMA,
 HUMAN, TAIWAN (1383)
 TI-RAUSCHER MURINE LEUKEMIA
 AFFINITY CHROMATOGRAPHY, SOLID
 PHASE IMMUNOADSORBENT (2498)
 SCITES TUMOR, TRANSFORMATION, EMBRYO
 CELLS, MOUSE (0124)
 IAN
 LEUKOSIS COMPLEMENT, CHICKEN (2520)
 MAMMALIAN, RNA ONCOGENIC, IMMUNO-
 FLUORESCENCE (2561)*
 MURINE
 COMPARATIVE MORPHOLOGY (2521)
 REVERSE TRANSCRIPTASE INHIBITION,
 ANTISERUM (3867)
 IAN LEUKEMIA-SARCOMA
 PROTEIN CHROMATOGRAPHIC
 SEPARATION, ANTIGENIC ANALYSIS
 (1708)
 IAN LEUKOSIS

ANTIBODY PRODUCTION, CHICKEN
 (0455)
 ANTIGEN TYPE SPECIFICITY, CHICKEN
 CELL (5357)
 DEFECTIVENESS (3075)
 FOCUS FORMATION (0742)*
 GROUP-SPECIFIC ANTIBODY, LEUKEMIA,
 HUMAN (0175)*
 GROUP-SPECIFIC ANTIGEN AND
 ANTIBODY, DETECTION (3039)
 MAREK'S DISEASE HERPESVIRUS,
 INTERACTIONS, TISSUE CULTURE
 (3762)
 RNA, RIBOSOME, CHICK CELL (0404)
 SERUM ANTIBODY, HUMAN (3178)
 YELLOW FEVER VACCINATION, CANCER
 RISK, HUMAN (3740)
 AVIAN LEUKOSIS GROUP
 SEQUENCE OF DEVELOPMENT, NEPHRO-
 BLASTIC NEPHROBLASTOMA, ULTRA-
 STRUCTURE, CHICKEN (3100)
 AVIAN LEUKOSIS SARCOMA
 TRANSFORMED CELLS, ULTRASTRUCTURE,
 AVIAN, MAMMALIAN, REVIEW (5749)*
 VIRUS - CONTINUED
 AVIAN MYELOBLASTOSIS
 ANTIGENIC VARIATION, FIBROBLASTS,
 CHICK EMBRYO (6018)*
 CORE, ABSENCE OF RNA METHYLASE
 (3106)
 CORE CHARACTERISTICS (2518)
 CORE COMPONENT (2567)*
 DETECTION, FIBROBLAST CULTURES,
 CHICK (3081)
 DNA, PURIFICATION (1352)*
 DNA POLYMERASE (0147)*
 RNA-DNA MOLECULE PRODUCT
 (1012)
 DNA POLYMERASE ACTIVITY (5876)
 DNA SYNTHESIS STIMULATION, CHICKEN
 FIBROBLASTS (3777)
 HEMAGGLUTINATION REACTION,
 NEURAMINIDASE (0134)*
 IN VITRO PROTEIN SYNTHESIS, GEL
 ELECTROPHORESIS, RADIOIMMUNE
 ASSAY, FERRITIN, E.COLI (3068)
 LEUKEMIA, REVIEW (2236)*
 REVERSE TRANSCRIPTASE (5921)
 RNA
 3'-HYDROXYL NUCLEOSIDE (2563)*
 IMMUNOLOGIC STUDIES (2606)
 3'-TERMINAL NUCLEOSIDES (3788)
 RNA METHYLASE (1709)
 RNA-DEPENDENT DNA POLYMERASE,
 STIMULATING FACTOR (4551)
 RNA-DNA LINKAGE, DNA POLYMERASE
 (5219)
 ROUS SARCOMA, DNA POLYMERASE,
 DNA POLYMERASE, EXOGENOUS PRIMER
 (5901)
 TRANSFER RNA, BASE COMPOSITION,
 HOST RNA (1705)
 VIRAL ENVELOPE, ANTIGEN (4570)
 VIRUS-SPECIFIC RNA, TISSUE DISTRI-
 BUTION, CHICKEN (5215)
 AVIAN ONCORNAVIRUS
 DNA POLYMERASE
 MONOSPECIFIC ANTISERUM (5214)
 SEROLOGIC ANALYSIS (5234)
 AVIAN RNA TUMOR
 INFECTION, GENETIC RESISTANCE
 (1324)
 AVIAN SARCOMA
 CELL TRANSFORMATION, RAT (0681)*

- CROSS PROTECTION, CHICKEN (4531)
 GENETIC STABILITY, TRANSFORMED
 NONPRODUCER CELLS (3096)
 LETHAL MUTANTS, TEMPERATURE
 LESIONS, CHICK EMBRYO (2522)
 PRODUCTION, TUMOR CELL, RADIATION,
 RAT (0737)*
- AVIAN SARCOMA-LEUKOSIS
 CELL RESISTANCE, GENETIC (1748)
 GROUP-SPECIFIC ANTIGEN, ROUS
 SARCOMA VIRUS-INDUCED TUMOR,
 HAMSTER, CHICK (1792)
 INDUCTION, CHEMICAL CARCINOGEN,
 RADIATION, NORMAL CHICK CELL
 (1707)
- AVIAN TUMOR, ROUS SARCOMA, MIXED
 INFECTION, REASSORTMENT OF MARKERS
 (3052)
- B-TYPE PARTICLE
 TUMORIGENESIS, MICE, HUMAN, REVIEW
 (2237)*
- BITTNER
 BREAST CANCER, MALE CARRIERS,
 HUMAN (5941)*
 SUSCEPTIBILITY, INHERITANCE, MOUSE
 (1340)
- BITTNER MILK FACTOR, MAMMARY CARCINOMA
 (0017)*
- BOVINE ADENOVIRUS
 TUMOR TRANSPLANTATION, HAMSTER
 (5954)*
- BOVINE ADENOVIRUS TYPE 3
 DNA SYNTHESIS INDUCTION, CONTACT
 INHIBITED CELL LINE, MOUSE (2530)
 MORPHOLOGY, HAMSTER (2591)*
 TUMOR GROWTH, HAMSTER (5286)*
 TUMOR INDUCTION
 BIOLOGICAL PROPERTIES, MORPHOLOGY,
 HAMSTER (5945)*
 HAMSTER (5939)*
- BOVINE TYPE C, MURINE AND FELINE
 LEUKEMIA VIRUSES, ANTIGENIC
 COMPARISON (4651)
- BOVINE PAPILLOMA
 BRAIN TUMOR, HAMSTER (5237)
 CYST PRODUCTION, CALF (1312)
- BRAZILIAN MYXOMA, EPIDEMIC POTENTIAL,
 RABBIT (1356)*
- BREAST, HUMAN (2589)*
- BREAST CANCER
 MORPHOLOGIC DEVELOPMENT, TRANS-
 MISSION MECHANISMS, REVIEW
 (3632)*
- BREAST CARCINOMA, HUMAN, REVIEW
 (5040)*
- BRYAN ROUS SARCOMA, TEMPERATURE,
 DEPENDENT CELL TRANSFORMATION, CHICK
 EMBRYO CELLS (4540)
- BURKITT'S LYMPHOMA
 INFECTIOUS MONONUCLEOSIS, EPSTEIN-
 BARR TRANSFORMED LYMPHOBLASTS,
 RNA CHROMATOGRAPHY (4590)*
 RHINOPHARYNGEAL CANCER, CELLS
 (2594)*
- VIRUS - CONTINUED
- C-TYPE
 ANTIBODY PRODUCTION, RAT (4614)
 ANTIGENIC REACTIONS, GROUP-
 SPECIFIC, INTERSPECIES SPECIFIC,
 IMMUNOGLOBULINS (3875)
 BUDDING, ULTRASTRUCTURE (3783)
 CYTOPATHOLOGY, RAT EMBRYO, CELLS
 (3800)
 FIBROSARCOMA, MONKEY (1493)*
- GROUP-SPECIFIC ANTIGEN
 3-METHYLCHOLANTHRENE TUMOR
 INDUCTION, MOUSE (3848)
 SPONTANEOUS NEOPLASM, MOUSE
 (4665)
- GROWTH, CYTOPATHIC EFFECT, CELL
 CULTURE, RAT (3069)
- HEPATOMA, RAT (5810)
- LYMPHOID CELL LINE, MOUSE (5308)
- LYMPHOMA, MOUSE (3789)
- LYMPHOSARCOMA
 GIBBON (5264)
 TRANSFER, COW, SHEEP (5236)
- MAMMARY CARCINOMA, CULTURE, RAT
 (0119)
- PANCREAS, THYMUS, NORMAL MOUSE
 (4569)
- PARTICLES, ONCORNA, MORPHOGENESIS,
 ULTRASTRUCTURE (5280)*
- PLEURAL EFFUSION CULTURE, LYMPHOMA
 HUMAN (0401)
- REPLICATION, GROUP-SPECIFIC
 ANTIGEN, LIFE SPAN, MOUSE (5331)
- REVERSE POLYMERASE, RNA,
 HYBRIDIZATION (0121)
- REVERSE TRANSCRIPTASE, IMMUNO-
 LOGICAL MARKER, MONKEY (5970)
- RHABDOMYOSARCOMA, CHROMOSOMES,
 HUMAN (3076)
- RHABDOMYOSARCOMA CELLS, HUMAN
 (2495)
- RNA, ACTIVATION, HORMONE, UTERUS,
 MOUSE (5250)
- SEROLOGICAL DETECTION, LEUKEMIA,
 BOVINE CULTURES (4735)*
- SPONTANEOUS TRANSFORMATION, BRAIN
 CELL, HUMAN (3750)
- C-TYPE INDUCTION
 BROMODEOXYURIDINE, CLONAL CELL
 LINES, MOUSE (4523)
- C-TYPE LATENT
 ACTIVATION, HUMAN (2483)
- C-TYPE PARTICLES
 CELL-FREE-INDUCED SARCOMAS,
 HAMSTER (5885)
 ERYTHROLEUKEMIA, SPLEEN, MOUSE
 (0733)*
- FIBROSARCOMA, TRANSPLANTATION,
 CAT (0405)
- LEUKEMIA
 CELL CULTURE MEDIUM, COW (1008)
 MOUSE (0727)*
- LUNG TUMORS, HYDRAZINE SULFATE
 INDUCED, ULTRASTRUCTURE, MOUSE
 (4371)
- LYMPHOMA, SALIVARY GLAND, CAT
 (0695)
- N-NITROSOBUTYLUREA, LEUKEMIA, RAT
 (4505)
- RAUSCHER LEUKEMIA, BURKITT
 LYMPHOMA CELL, HUMAN (1697)
- REVERSE TRANSCRIPTASE, BURKITT'S
 LYMPHOMA, HUMAN (0688)
- TRANSPLANTABLE MESOTHELIOMA,
 HAMSTER (5931)*
- TUMORIGENESIS, REVIEW (2238)*
- C-TYPE RNA
 ANTIGEN EXPRESSION, TUMOR,
 3-METHYLCHOLANTHRENE, MOUSE
 (2500)
- GS ANTIGENICITY EXPRESSION HORMONE
 CONTROL, MOUSE (1007)
- ISOLATION, 3-METHYLCHOLANTHRENE,
 TUMOR, HAMSTER (1581)

C-TYPE RNA TUMOR
 HOST-GENE CONTROL, GROUP-SPECIFIC
 ANTIGEN, RECIPROCAL BACKCROSS
 PROGENIES, MOUSE (2647)
 TUMORIGENESIS, HOST-GENE CONTROL,
 MOUSE, HUMAN (1207)
 VIRAL GENOME, WILD MOUSE (0684)
 CALIFORNIA MYXOMA, TUMOR INFECTIVITY,
 RABBIT, MOSQUITO (1425)*
 CANCER
 ETIOLOGY
 HUMAN (0002)
 REVIEW (1508)
 HUMAN, REVIEW (4347)*, (5071)*
 REVIEW (2292)*
 CANCER RESEARCH PROGRAM, PROGRAM
 PLAN (1773)*
 CANINE HERPES, REPLICATION, DNA
 SYNTHESIS, PROTEIN SYNTHESIS,
 TEMPERATURE SUPPRESSION (1720)
 CARCINOGENESIS
 EXPERIMENTAL, REVIEW (2241)*
 HUMAN REVIEW (0614)
 REVIEW (4339)*
 CARR-ZILBER ROUS SARCOMA
 EMBRYO, CHORIOALLANTOIC MEMBRANE,
 FIBROSARCOMA, CHICK (1027)
 RHABDOMYOSARCOMA, RAT, MOUSE,
 MONKEY (0126)
 CELL TRANSFORMATION, SPONTANEOUS
 (0003)
 CELO, TUMOR INDUCTION, MORPHOLOGY,
 HAMSTER (3130)
 CHARACTERIZATION, ROUS MOUSE CELL LINE
 (4589)*
 CHEMICAL CARCINOGEN, RADIATION, CELL
 CULTURE (0022)*
 VIRUS - CONTINUED
 CHICK EMBRYO LETHAL ORPHAN
 BIOPHYSICAL PROPERTIES (0414)
 DNA, CHARACTERIZATION (1005)
 INFECTION IN VITRO, MONKEY (0111)
 LIVER, HEPATOMA INDUCTION, HAMSTER
 (0703)
 PROPERTIES, ANTIGEN (1353)*
 SMALL PLAQUE VARIANT, INDUCED
 TUMORS, LIGHT AND ELECTRON
 MICROSCOPIC STUDIES (4506)
 TUMOR ANTIGEN, ANTIBODY, HAMSTER
 (0476)
 TUMOR FORMATION, HAMSTER (1314)
 CHROMOSOMES, REVERSION, TRANSFORMED
 CELLS (2002)
 CLONED AVIAN SARCOMA, NONTRANSFORMING
 VIRUS, SEGREGATION (1743)
 CONNECTIVE TISSUE DISEASES, HUMAN,
 ANIMAL (1778)*
 CONTAMINATION, LEUKEMIA VIRUSES,
 TRANSPLANTABLE TUMORS, MOUSE (5283)*
 CYTOMEGALOVIRUS, ASYMPTOMATIC INFECTION
 LEUKEMIA, CHILD (1317)
 CYTOPLASMIC POLYHEDROSIS
 POLYPEPTIDE COMPOSITION, ULTRA-
 STRUCTURE (5213)
 RNA, 3' TERMINUS (5217)
 DEVELOPMENT, PRIMARY ADENOPATHY, HUMAN
 (2596)*
 7,12-DIMETHYLBENZ(A)ANTHRACENE, TUMOR
 HETEROGENIZATION, HAMSTER (1285)*
 DNA
 CANCER CELL, MOLECULAR HYBRIDIZA-
 TION, REVIEW (4311)
 CELL MEMBRANE, BIOCHEMICAL CHANGE,
 TRANSFORMATION, MOUSE (1315)

EPSTEIN-BARR, ABORTIVE INFECTION,
 LYMPHOID CELL LINES, HUMAN
 (5882)
 POLYOMA, REPLICATION, MOUSE
 EMBRYO (3827)*
 REPRODUCTION, REVIEW (2259)*
 DNA POLYMERASE
 HOST DNA, REVIEW (0626)*
 NUCLEIC ACID, MAMMARY CARCINOMA,
 MONKEY (1696)
 DNA POLYMERASE ACTIVITY, C-TYPE, MOUSE
 (2496)
 DNA REPLICATION REPRESSOR, PAPOVA,
 TRANSFORMED CELLS, REVIEW (2235)*
 DNA SYNTHESIS, ADENOVIRUS-INFECTED
 KB CELLS (3819)
 EPIDERMODYSPLASIA VERRUCIFORMIS,
 MALIGNANCY, HUMAN, ULTRASTRUCTURE
 (1439)
 EPSTEIN-BARR
 ACTIVATION
 5-BROMODEOXYURIDINE, HUMAN
 (2512)
 ANTIBODIES
 CHIMPANZEES (2628)
 CHRONIC LYMPHOCYTIC LEUKEMIA,
 CHRONIC MEYLOCYTIC LEUKEMIA,
 HUMAN (0764)
 CONNECTIVE TISSUE DISEASE, HUMAN
 (5969)
 IMMUNOFLOUORESCENCE, LOWER
 PRIMATES (4654)
 KIDNEY TRANSPLANT, HUMAN (3884)
 LYMPHOBLASTOID CELLS, LEUKOCYTE
 TRANSFORMATION, HUMAN (0756)
 NASOPHARYNGEAL CANCER (0161)
 SERUM, INDONESIA (1833)
 TREATMENT WITH PLATINUM COMPOUND
 (3101)
 VIRAL ILLNESS, LEUKEMIA, HUMAN
 (0403)
 ANTIBODY LEVELS, INCIDENCE,
 CHILDREN, UGANDA (3744)
 ANTIBODY PATTERN, CHRONIC LYMPHO-
 CYTIC LEUKEMIA, LYMPHOCYTIC
 LYMPHOMA, HUMAN (2516)
 ANTIGEN
 IMMUNOFLOUORESCENCE, BURKITT'S
 LYMPHOMA (1045)
 INFECTIOUS MONONUCLEOSIS, ACUTE
 LYMPHOCYTIC LEUKEMIA, HUMAN
 (5402)
 LYMPHOID CELL, HUMAN (4635)
 ANTIGEN PRODUCTION, LEUKEMIC CELLS
 (0110)
 BURKITT'S LYMPHOMA
 AMERICAN PATIENT (4630)
 CASE REPORT, SOUTH INDIA (0736)*
 DNA SYNTHESIS, ARGININE DEPRIVA-
 TION (0402)
 ETIOLOGY, REVIEW (0903)
 HOST CELL GROWTH (1010)
 LEUKEMIA, CELL LINE ESTABLISH-
 MENT (4032)
 MEMBRANE IMMUNOFLOUORESCENCE
 (1046)
 REVIEW (5041)*
 BURKITT'S LYMPHOMA CELLS, VERO
 CELLS COCULTIVATION (0693)
 CAPSID ANTIGEN, SOLUBLE ANTIGEN,
 ANTIBODY, INFECTIONS MONONUCLEO-
 SIS, HUMAN (3042)
 DNA, TUMOR CELLS, HUMAN (5225)
 GENOME DETECTION, NONPRODUCTIVE

CELL (1703)
 HERPESVIRUS SAIMIRI, LYMPHOMA,
 REVIEW (4320)
 IGM, INFECTIOUS MONONUCLEOSIS,
 BURKITT'S LYMPHOMA, NASOPHARYN-
 GEAL CARCINOMA (5977)
 IGM ANTIBODIES, INFECTIOUS MONO-
 NUCLEOSIS PATIENTS (6025)*
 INFECTION
 DNA SYNTHESIS, FRAGMENTATION,
 RAJI CELLS (3792)
 LYMPHOBLASTOID CELL, HUMAN
 (4575)
 REVIEW (0913)*
 INFECTIOUS MONONUCLEOSIS
 MALIGNANT LYMPHOMAS, HUMAN,
 REVIEW (5738)*
 MALIGNANT TUMORS, HUMAN (0141)*
 INFLAMMATORY BOWEL DISEASE, HUMAN
 (2511)
 INVADER, PRECURSOR, REVIEW (2257)*
 LEUKOCYTE TRANSFORMATION,
 CYTOPATHIC CHANGES, MONKEY
 (3118)
 LYMPHOBLASTOID CELL LINES
 CULTURE METHODS, HUMAN (2593)*
 HUMAN (5908)
 LYMPHOID CELL CULTURE, HUMAN CELL
 (5913)
 LYMPHOID CELL TRANSPLANTATION,
 HUMAN, MOUSE (1385)
 MEMBRANE ANTIGEN, EARLY ANTIGEN,
 BURKITT'S LYMPHOMA CELLS (0448)
 NEW ANTIGENS, BIOLOGICAL STUDIES,
 HUMAN (2672)*
 PRODUCTION
 BURKITT'S LYMPHOMA, LYMPHOCYTE,
 MONKEY (1011)
 NON-VIRION ANTIGEN SYNTHESIS,
 BURKITT'S LYMPHOMA (3062)
 RAUSCHER MURINE LEUKEMIA, DUAL
 INFECTION, LYMPHOBLAST, HUMAN
 (3773)
 REPRESSION, BURKITT'S LYMPHOMA
 CELLS (2517)
 RESCUE, 5-IODODEOXYURIDINE,
 SOMATIC CELL HYBRID, BURKITT
 LYMPHOBLASTOID CELLS (4536)
 SERA, ANTIGEN, ADENOID VEGETATION,
 HUMAN (1065)*
 SERUM ANTIBODY
 CANCER PATIENT (3876)
 LYMPHOCYTIC LYMPHOMA, HUMAN
 (3814)
 SYNTHESIS, BURKITT LYMPHOMA, CELL
 DENSITY (1322)
 VIRAL ANTIGEN, MACROMOLECULAR
 SYNTHESIS, RAJI CELL (0466)
 VIRAL CAPSID ANTIGEN, EARLY VIRAL
 ANTIGEN, ANTIBODY, INFECTIOUS
 MONONUCLEOSIS, HUMAN (0456)
 VIRUS - CONTINUED
 EQUINE ABORTION (HERPES), INFECTION,
 RNA SYNTHESIS, MOUSE (3087)
 EQUINE HERPES 3, HERPES SIMPLEX,
 COMPARATIVE STUDY, CHROMOSOMES,
 KIDNEY CELLS, RABBIT (3079)
 EQUINE HERPESVIRUS, DNA (2542)
 ETIOLOGY
 BREAST CANCER, HUMAN (2590)*
 TUMOR, IMMUNITY, REVIEW (2206)
 FBJ, TUMOR INDUCTION, HISTOPATHOLOGY,
 RELATION TO OSTEOSARCOMA, HUMAN,
 MOUSE (3071)

FELINE C-TYPE
 ANTIGENIC DETERMINANTS, PROTEIN
 (0465)
 REPLICATION, PLASMA MEMBRANE,
 ERYTHROCYTES (4608)*
 FELINE LEUKEMIA
 ANTIGEN DETECTION, RNA-VIRUS,
 ELECTROPHORESIS (2336)
 BUDDING, ULTRASTRUCTURE (3783)
 DETECTION, CANINE FIBROSARCOMA
 (1767)*
 DIMETHYL SULFOXIDE, CELL
 MULTIPLICATION, HEMOGLOBIN
 SYNTHESIS, MOUSE (0412)
 DNA POLYMERASE, ENZYME ACTIVITY
 (0149)*
 HEMATOPOIETIC TUMOR, LYMPHOSARCOMA
 CAT (3805)
 INFECTION
 FOCI, HUMAN (0419)
 RESISTANCE, GENETICS, MOUSE
 (0408)
 LONG-TERM REPLICATION IN CELL
 CULTURES, CANINE (3036)
 LYMPHATIC LEUKEMIA, ISOLATION,
 PATHOGENICITY, MOUSE (0406)
 MURINE LEUKEMIA, PROTEIN ASSAY
 (5358)
 MURINE SARCOMA, INTERACTION, DNA
 SYNTHESIS, CAT CELL (1327)
 PSEUDOTYPE, MURINE SARCOMA,
 FOCUS-FORMATION, KIDNEY CELL
 LINE, CAT (3758)
 RNA, NUCLEOTIDE COMPOSITION,
 CAT, HUMAN (5247)
 ROWSON-PARR, ANTIGENIC REACTION,
 SPLEEN, MOUSE (0410)
 SPLEEN, NUCLEOSIDE DEAMINASE,
 MOUSE (0447)*
 THYMUS, ATROPHY, CAT (1035)*
 FELINE SARCOMA
 DNA POLYMERASE, CARCINOGENESIS
 MECHANISM (0697)
 FELINE LEUKEMIA, HUMORAL ANTIBODY,
 NEONATAL CAT (2612)
 FERRITIN-LABELED ANTIBODY, CAT
 (0696)
 FOCUS FORMATION, HELPER ACTIVITY,
 MARMOSET CELL, CAT CELL (4532)
 GARDNER-ARNSTEIN STRAIN, ISOLATION
 (1328)
 ONCOGENICITY, ANTIGEN, MARMOSET
 (4572)
 TUMOR INDUCTION, MONKEY (4524)
 TUMOR REGRESSION, CAT (1013)
 FIBROMA, MORPHOGENESIS, SKIN, RABBIT
 (1038)*
 FOCUS FORMING, GENOME RESCUE,
 NON-PRODUCTIVE CELL,
 5'-BROMODEOXYURIDINE, RAT (1731)
 FRIEND
 DEVELOPMENT, POLYTHENE IMINE,
 MOUSE (1770)*
 DIMETHYL SULFOXIDE, ULTRA-
 STRUCTURAL CHANGE (1366)*
 H-2 DETERMINING SUSCEPTIBILITY,
 MOUSE (2506)
 ERYTHROCYTE, POLYCYTHEMIA, MOUSE
 (4533)
 INFECTED CELL, TUMOR, IMMUNO-
 FLUORESCENCE, RAT (1321)
 INFECTION, SPLEEN CELL IMMUNE
 RESPONSE, MOUSE (1801)
 LEUKEMIA, SPLEEN FOCUS-FORMING

ACTIVITY, HUMAN LEUKEMIC TISSUE
 EXTRACTS, MOUSE (3122)
 LIVER CATALASE-DEPRESSING FACTOR,
 SPLEEN, MOUSE (3077)
 POLYCYTHEMIA-INDUCING, TRANSFORMA-
 TION, MOUSE (2507)
 RUNTING SYNDROME, RAT (2570)*
 TUMOR CELL, MEMBRANE-SPECIFIC
 ERYTHROCYTE ANTIGEN (1831)
 FRIEND AND RILEY, CONTACT SENSITIVITY,
 IMMUNODEPRESSION, MOUSE (5375)*
 FRIEND DISEASE
 ANTITHYMOCYTE SERUM, NORMAL SERUM,
 MOUSE (3817)
 FRIEND LEUKEMIA
 COATING, SPECIFIC ANTISERUM
 TREATMENT, MOUSE (5944)*
 ERYTHROID DIFFERENTIATION, GLOBIN
 MRNA INDUCTION, TRANSFORMED
 CELLS, MOUSE (5950)*
 FRACTION, INFECTIVITY ENHANCEMENT,
 MOUSE CELL (4521)
 IMMUNOSUPPRESSION
 ANTIBODY FORMATION, MOUSE (1375)
 LEUKOCYTE MIGRATION, MOUSE
 (4574)
 INFECTION SUPPRESSION, STATOLON
 HUMORAL ANTIBODY, MOUSE (5979)
 INHERITED SUSCEPTIBILITY, MOUSE
 (4576)
 LEUKOCYTE MIGRATION, MOUSE (1009)
 REGRESSION, H-2 ANTIGEN, MOUSE
 (4645)
 REMISSION, AGE, MOUSE (0743)*
 RESISTANCE, IMMUNOSUPPRESSION,
 MOUSE (5352)
 RIBONUCLEOTIDE REDUCTASE, SPLEEN,
 MOUSE (0849)
 ULTRASTRUCTURE, MOSQUITO (1369)*
 FRIEND LEUKEMIA INFECTION, CIRCULATION
 OF LYMPHOID CELLS, MOUSE (4507)
 FROG, RNA DEGRADATION (2490)
 GAMMA RADIATION, MAMMARY TUMOR (2595)*
 GARDNER-FELINE FIBROSARCOMA, MELANOMA
 INDUCTION, GNOTOBIOTIC, CAT (3066)
 GAZDAR MURINE SARCOMA, ANTIGENICITY,
 HAMSTER (5886)
 GENITOURINARY TRACT, TUMOR, HUMAN
 (0028)*
 GENOME
 ONCOGENIC, NUCLEIC ACID HYBRIDIZA-
 TION, RODENT (2491)
 POLYOMA, SYNTHESIS, CLEAVAGE (2560)
 TRANSCRIPTION, RNA POLYMERASE,
 HELA CELLS (2524)
 GENOME EXPRESSION, REVIEW (0909)
 VIRUS - CONTINUED
 GRAFFI
 ALKALINE AND ACID PHOSPHATASES,
 HISTOCHEMISTRY, MOUSE (0116)
 ANTIBODY INDUCTION, MOUSE (2485)
 CELL-FREE FILTRATES, PERIPHERAL
 BLOOD ALTERATIONS, MOUSE (0137)*
 MORPHOLOGICAL ALTERATIONS,
 THYMUS, SPLEEN, MOUSE (0115)
 GRAFFI LEUKEMIA, IMMUNODEPRESSIVE
 EFFECT, MOUSE (5322)
 GROSS
 7,12-DIMETHYLBENZ(A)ANTHRACENE,
 LEUKEMOGENESIS, RAT (0140)*
 LEUKEMIA
 CELL-SURFACE ANTIGEN, SUPPRESS-
 ION, MOUSE (4694)
 DNA SYNTHESIS, IMMUNOLOGY, MOUSE
 (3919)*
 LEUKEMOGENESIS, H-2 ANTIGEN,
 MOUSE (1316)
 LYMPHOMA
 CELLULAR IMMUNITY, RAT (4621)
 SURFACE ANTIGEN, ANTIBODY BIND-
 ING, RAT (3903)
 MURINE LEUKEMIA, ANTIGENS, HISTO-
 COMPATIBILITY ANTIGEN, MYELOMA
 CELL LINE, MOUSE (4615)
 RAUSCHER, LEUKEMIA CELLS, CELL
 SURFACE ANTIGENS, MOUSE, RAT
 (3880)
 SKIN GRAFT, LEUKEMIA, MOUSE (0118)
 THYMUS, LEUKEMOGENESIS, RAT (4561)
 GROSS LEUKEMIA
 IMMUNOSUPPRESSION, POLYINOSINIC-
 POLYCYTIDYLIC ACID, MOUSE
 (1853)*
 INTERFERING VIRUS, MOUSE (1003)
 PROTOZOAN INFECTION, MORTALITY,
 MOUSE (0698)
 SKIN GRAFT REJECTION, TUMOR CELL,
 MOUSE (0769)
 GROSS MURINE LEUKEMIA VIRUS, AUTO-
 IMMUNE DISEASE, MOUSE (0906)
 GROWTH
 CONTACT INHIBITION, 3',5'-CYCLIC
 MONOPHOSPHATE, THEOPHYLLINE
 (0439)*
 H PARTICLE, TUMOR, HAMSTER (4564)
 HAMSTER SARCOMA, MORPHOLOGY, THETA
 PARTICLES (5256)
 HAMSTER-SPECIFIC SARCOMA
 HARVEY MURINE SARCOMA, GROUP-
 SPECIFIC ANTIGEN (0767)
 HELPER ISOLATION (1313)
 HARVEY MURINE SARCOMA
 TRANSFORMATION SUSCEPTIBILITY,
 GROWTH PHASE, MOUSE (0685)
 TUMOR, CULTURED CELLS, MOUSE
 (0122)
 TUMOR GIANT CELL
 ENZYME, HAMSTER (0418)
 ULTRASTRUCTURE, HAMSTER (0421)
 TUMOR-ASSOCIATED ANTIGEN, HAMSTER
 (4676)
 HERPES
 ANTIBODY
 SERUM
 HUMAN (4691)
 SARCOIDOSIS PATIENTS (1848)*
 ANTIGEN DETECTION, INDIRECT
 IMMUNOFLUORESCENCE, LUCKE RENAL
 ADENOCARCINOMA, FROG (3035)
 CELL-SPECIFIC POLYSOME, INHIBITION
 (1717)
 DNA, PHYSICO-CHEMISTRY (1716)
 FLUORESCENT ANTIBODY, IDENTIFICA-
 TION, PRIMATE (3757)
 IMMUNOLOGICAL SPECIFICITY, CELL
 MEMBRANE, MODIFICATION, REVIEW
 (1206)
 IMPAIRMENT, ALPHA-AMANTIN, CHICK
 EMBRYO (2539)
 INFECTION
 MONKEY, REVIEW (4312)
 RIBONUCLEOTIDE REDUCTASE, DNA
 SYNTHESIS, KB CELLS (3059)
 ISOLATION, LEUKEMIA, GUINEA PIG
 (1338)
 LATENCY, CYTOSINE ARABINOSIDE
 TREATMENT, HUMAN (3033)
 NASOPHARYNGEAL CARCINOMA, CELL

- ULTRASTRUCTURE, HUMAN (1431)
ONCOGENICITY, REVIEW (0613)
PRESENCE IN RENAL ADENOCARCINOMA,
FROG (3061)
REPLICATION, RENAL ADENOCARCINOMA,
FROG (5238)
SIMPLEX
CELL DEPENDENT DIFFERENCE,
SUPRAOPTIMAL TEMPERATURE,
RABBIT, HAMSTER (3141)
VIRUS-SPECIFIC PROTEINS,
PURIFICATION (3050)
SIMPLEX TYPE 1, ORAL INFECTION,
GUINEA PIG (3114)
SIMPLEX TYPE 1 AND 2
DEOXYTHYMIDINE KINASE ACTIVITY,
THERMAL STABILITY DIFFERENCES
(3083)
IMMUNOFLUORESCENT ASSAY, RABBIT
RABBIT (3171)
SIMPLEX TYPE 2
CELL TRANSFORMATION, LEUKOSIS
VIRUS MARKER, ONCOGENE,
HAMSTER (3043)
REVERSIBLE VULVAR ATYPIA, CASE
REPORT (3329)*
SPECIES SPECIFICITY, OWL, MONKEY
(3781)
TYPE, CYTOMEGALOVIRUS, ULTRA-
STRUCTURE, MONKEY (3099)
VIRAL ANTIBODY, CERVICAL
CARCINOMA IN SITU, HUMAN (0462)
ZOSTER, VARICELLA, PRESENCE IN
NERVE AND GANGLION, IMMUNO-
FLUORESCENCE, ULTRASTRUCTURE,
HUMAN (3123)
HERPES GENITALIS
CERVICAL CARCINOMA, REVIEW (1223)*
HERPES SIMPLEX, INFECTION,
CYTOLOGICAL CHANGES, HUMAN CELL
(1024)
HERPES HOMINIS
ADENOVIRUS, CERVICAL CARCINOMA,
ANTIBODY, INCIDENCE, HUMAN
(3864)
CANCER (0315)*
CERVIX, INFECTED CELL, ULTRA-
STRUCTURE, HUMAN (3815)
HERPES HOMINIS TYPE 2, CORNEA, RABBIT
(1355)*
HERPES-LIKE
ISOLATION, LYMPHOSARCOMA, COW
(3737)
SIMIAN, OCCUPATIONAL HAZARD,
REVIEW (3605)
TRANSMISSION, GUINEA PIG (1722)
HERPES SAIRIRI
ANTIGEN, INFECTED LYMPHOCYTE,
MARMOSSET (3806)
ANTIBODY, POLYINOSINIC-
POLYCYTIDYLIC ACID, GOAT,
FLUORESCENT ANTIBODIES (0491)*
MALIGNANT LYMPHOMA, LYMPHOCYTIC
LEUKEMIA, MONKEY (1337)
MORPHOLOGY, GROWTH, MONKEY, HUMAN
(0741)*
ONCOGENICITY, MARMOSSET (1339)
PROPAGATION IN VITRO, HUMAN,
ANTIGEN (0443)*
VIRUS - CONTINUED
HERPES SIMPLEX
ANTIBODY, NASOPHARYNGEAL CANCER
PATIENTS (5973)
ARGINYL TRANSFER RNA, HAMSTER
(2541)
AUTORADIOGRAPHY, CELL CULTURES
(2598)*
CAPSID ANTIGEN, ENVELOPE ANTIGEN,
SOLUBLE ANTIGEN, CROSS-REACTIV-
ITY (4647)
CERVICAL CARCINOMA
EPIDEMIOLOGY (0216)*
HUMAN (2566)*
CHROMOSOME, HEMATOPOIETIC CELL,
HUMAN (3812)
DIFFERENTIAL SUSCEPTIBILITY,
HAMSTER CELLS (2543)
DIFFERENTIATION OF TYPES 1 AND 2,
TEMPERATURE MARKERS (2600)*
DISSOCIATED NERVOUS TISSUE, HUMAN
(2547)
ENVELOPED PARTICLE UNENVELOPED
PARTICLE, SEPARATION (1779)*
FL CELLS, ELECTRON MICROSCOPY
(2579)*
GENOME SIZE, RENATURATION KINETICS
(1365)*
GROWTH, LYMPHOID CELLS, HUMAN
(3746)
HEP-2 CELLS (2571)*
IMMUNOLOGICAL ANALYSIS (5980)*
INFECTED CELL
DNA SYNTHESIS, 7,12-DIMETHYL-
BENZ(A)ANTHRACENE, RABBIT
(4520)
TYPE-SPECIFIC SURFACE ANTIGEN,
HUMAN (1719)
INFECTION
HEMATOLOGIC MALIGNANCIES, HUMAN
(3786)
SPINAL GANGLIA, MOUSE (0729)*
INTERFERON INDUCTION (3753)
REPRODUCTION, GAMMA-IRRADIATED
CELL CULTURES, HUMAN, IN VITRO
(0136)*
SEROLOGICAL STUDIES, GUINEA PIGS
(2564)*
SHOPE PAPILLOMA, RABBIT, IN VITRO
(0397)
STRUCTURE, DEVELOPMENT, ELECTRON
MICROSCOPY (2544)
TEMPERATURE-SENSITIVE MUTANT,
GLYCOPROTEIN SYNTHESIS DEFECT
(1360)*
THYMIDINE KINASE, INFECTED CELL,
HAMSTER (0713)
TRANSMISSION, AMNION CELLS, HUMAN
(2545)
TRANSPORT MEDIA (2580)*
TYPE 1 AND TYPE 2, GENETIC
RELATEDNESS, DNA-DNA HYBRIDIZA-
TION (4548)
TYPE 1 AND TYPE 2 DIFFERENTIATION,
IN VITRO (4581)*
TYPE 2
CELL TRANSFORMATION, FIBRO-
BLASTS, HAMSTER EMBRYO
(5918)
CERVICAL CARCINOMA, ANTIBODY,
HUMAN (0712)
COMPLEMENT FIXING ANTIGEN,
PREPARATION (1359)*
TEMPERATURE-SENSITIVE MUTANT
(1724)
TRANSFORMATION, UV, HAMSTER
CELL (0710)
UV RADIATION, TRANSFORMED
FIBROBLASTS, ULTRASTRUCTURE,

HAMSTER (5890)
 TYPE DIFFERENTIATION, INDIRECT
 IMMUNOFLUORESCENCE, HAMSTER
 (0711)
 UV RADIATION, TRANSFORMATION,
 L-CELLS (5924)
 VARICELLA HERPES ZOSTER, ANTIGENIC
 RELATIONSHIPS (1775)*
 VARICELLA-ZOSTER, ULTRASTRUCTURE
 (4591)*
 VIABILITY (2572)*
 VIRAL PROTEINS, PLASMA MEMBRANE
 (3821)
 HERPES SPECIES, RELATEDNESS, DNA RNA
 HYBRIDIZATION (1721)
 HERPES SYLVILAGUS
 LYMPHOMA INDUCTION, RABBIT (2536)
 HERPES-TYPE
 ADENOID, LYMPHOBLASTOID CELL LINE,
 HUMAN (1023)
 ANTIBODIES, NASOPHARYNGEAL
 CARCINOMA, HUMAN (2540)
 CHARACTERIZATION
 MAREK'S DISEASE, CHICKEN
 (1020), (1022)
 EPSTEIN-BARR, SERUM ANTIBODY,
 HUMAN, MONKEY (1059)
 INFECTION, CHROMOSOME CHANGES,
 HUMAN CELL (1025)
 LYMPHOCYTES, MAREK'S DISEASE
 (2597)*
 NASOPHARYNGEAL CARCINOMA,
 TRANSFORMATION, HUMAN (1021)
 RENAL ADENOCARCINOMA, FROG (5218)
 HERPES TYPE 1 AND 2
 ANTIBODIES, HODGKIN'S DISEASE,
 NASOPHARYNGEAL CARCINOMA, HUMAN
 (2538)
 OCULAR PATHOGENICITY, RABBIT
 (2537)
 THYMIDINE KINASE-INDUCING ABILITY,
 RABBIT (2534)
 HERPES TYPE 2
 CERVICAL CARCINOMA, SEROEPIDEMIO-
 LOGIC STUDY (1718)
 ISOLATION, CERVICAL TUMOR, HUMAN
 (1723)
 VIRUS - CONTINUED
 HERPESVIRUS
 ANTIBODIES, CERVICAL CANCER
 PATIENT, SERUM (2535)
 ANTIGENIC RELATIONSHIPS,
 INFECTIOUS BOVINE RHINO-
 TRACHEITIS, MAREK'S DISEASE,
 BURKITT'S LYMPHOMA (4611)
 INTERFERON PRODUCTION, IMMUNO-
 LOGICAL REACTIVITY, LEUKOCYTES,
 MACROPHAGES, RABBIT (5997)*
 MALIGNANT LYMPHOMA, RABBIT, REVIEW
 (5713)
 MAREK'S DISEASE, CHICKEN, REVIEW
 (5714)
 NEUTRALIZATION, COMPLEMENT, KIDNEY
 CELLS, RABBIT (2694)*
 RECOVERY, CHARACTERIZATION,
 INFECTED, SPIDER, MONKEY (3823)*
 RENAL ADENOCARCINOMA, FROG, REVIEW
 (5737)*
 REPLICATION, TURKEY (5284)*
 SEROLOGICAL RELATIONSHIPS, MAREK'S
 DISEASE VIRUS, PSEUDORABIES
 VIRUS, IMMUNOFLUORESCENCE
 (3761)
 SPIDER, MONKEY (3822)*
 TYPE 2
 CERVIX INFECTION, HUMAN (2533)
 ULTRASTRUCTURE, SOUTH AMERICAN
 MONKEYS (3832)*
 HERPESVIRUS HOMINIS
 TYPE 2, HUMAN CERVICAL CANCER,
 REVIEW (5715)
 HERPESVIRUS HOMINIS INFECTION,
 POLY I:C-INDUCED INTERFERON EFFECT,
 MOUSE (3149)*
 HERPESVIRUS SAIMIRI
 ATELES, MALIGNANT LYMPHONAS,
 MONKEY (5925)
 HYBRID CELL LINES, MARMOSET-
 MOUSE (4538)
 INTRACELLULAR AND MEMBRANE ANTIGEN
 IMMUNOFLUORESCENCE, MONKEY
 (5345)
 HERPESVIRUS SYLVILAGUS, MORPHOLOGICAL
 STUDY, KIDNEY CELL CULTURE, RABBIT
 (3151)*
 HUMAN ADENOVIRUS INFECTION, ENHANCE-
 MENT BY SV40, MECHANISM, MONKEY
 CELLS (4543)
 HUMAN ADENOVIRUS TYPE-12
 SIMIAN VIRUS 40, REACTION TO UV
 LIGHT (2529)
 UNDIFFERENTIATED INTRAPERITONEAL
 TUMORS, HAMSTER (5287)*
 HUMAN CANCER
 EPIDEMIOLOGY, AFRICA (0316)*
 HUMAN TUMORS
 CAUSE (2588)*
 MOUSE, TUMOR-SPECIFIC ANTIGENS,
 BLOCKING ANTIBODY (0460)
 IMMUNITY, MACROPHAGE, REVIEW (1230)*
 IMMUNOSUPPRESSION, INTERFERON, REVIEW
 (2208)
 INDUCED THYMIC LYMPHOMA, ALKALINE
 PHOSPHATASE ACTIVITY, MOUSE (3775)
 INFECTED CELL, MITOSIS, REVIEW (1219)*
 INFECTION
 DNA REPLICATION, REVIEW (5717)
 IMMUNE DEFICIENCY, HUMAN (1700)
 IMMUNOLOGICAL INJURY, INHIBITION,
 ENHANCEMENT, RABBIT (1810)
 IMMUNOSUPPRESSION, REVIEW (1379)
 SEROLOGIC EVIDENCE, SOUTH AMERICAN
 MONKEYS (3825)*
 INFLUENZA
 IMMUNOGENICITY
 EHRlich ASCITES TUMOR, MOUSE
 (0150)
 TUMOR CELL HOMOGENATES, MOUSE
 (2655)*
 LUNG CARCINOMA INDUCTION,
 DIETHYLNITROSAMINE, MOUSE (5079)
 LUNG TUMOR INCIDENCE, MOUSE (4413)
 KILHAM RAT, DNA SYNTHESIS INHIBITION,
 MITOSIS INHIBITION, RAT EMBRYO CELL
 (1702)
 KIRSTEN MOUSE SARCOMA
 CELL SUSCEPTIBILITY, HUMAN (0442)*
 KIRSTEN MURINE LEUKEMIA, TEMPERATURE
 SENSITIVE MUTANT, MOUSE (4535)
 KIRSTEN MURINE SARCOMA, TRANSFORMATION
 GUINEA PIG EMBRYO CELLS (3756)
 LATENT
 METHYLCHOLANTHRENE CARCINOGENESIS,
 MOUSE (0353)
 LEUKEMIA
 ACTIVATION, GRAFT-VERSUS-HOST
 REACTION, MIXED LYMPHOCYTE
 REACTION, MOUSE (2515)

- H-2 ANTIGENS, MOUSE (3870)
 ETIOLOGY, REVIEW (1220)*
 IMMUNOGENICITY, MOUSE (1047)
 INFECTION, TRANSPLANT RESISTANCE,
 MOUSE (5309)
 ISOLATION OF COMPONENTS, MOUSE
 (2487)
 MAMMARY GLAND CANCER (0330)*
 RNA, ELECTROPHORETIC ANALYSIS,
 MOUSE (4580)*
 LEUKEMIA INDUCTION, IMMUNOSUPPRESSION,
 IMMUNOCOMPETENCE, MOUSE (1785)
 LEUKEMIA-LIKE
 CYTOLOGY, HUMAN (5289)*
 HEMOCYTOBLASTOSIS, SKIN TUMOR,
 HAMSTER (5208)
 LARYNGEAL CANCER, HUMAN (5883)
 LYMPHOMA INDUCTION, GRAFT-VERSUS-HOST
 REACTION, MOUSE (1780)
 LYMPHOMAGENIC, THYMIC GRAFTS,
 MORPHOLOGY, MOUSE (3751)
 LYMPHOCYTIC SARCOMA, C-TYPE PARTICLES,
 MOUSE (4594)*
 VIRUS - CONTINUED
 MACROMOLECULE, INTERFERON INDUCING
 ACTIVITY (3444)*
 MAMMARY
 CARCINOMA
 ONCOGENIC RNA, ULTRASTRUCTURAL
 COMPARISON, MONKEY (3116)
 TUMOR
 REPLICATION, GROWTH REGULATION,
 MOUSE (3067)
 VIRUS PRODUCTION, KINETICS,
 MOUSE (3049)
 MAMMARY CARCINOGENESIS, REVIEW (5015)
 MAMMARY TUMOR
 ANTIGEN, STRAIN SPECIFICITY, MOUSE
 (1341)
 BREAST CANCER
 IMMUNOLOGICAL REACTION, HUMAN
 (5305)
 MOUSE (5211)
 CIRCULATING ANTIBODY, IMMUNO-
 SUPPRESSION, MOUSE (3857)
 GLUCOSE OXIDATION, MOUSE (4573)
 GROWTH, CARCINOGENICITY ETHYLENE
 OXIDE, MOUSE (1728)
 HUMAN, REVIEW (1501)
 HYPERPLASTIC NODULE, HORMONE,
 PITUITARY GRAFT, MOUSE (0416)
 IMMUNOLOGICAL CROSS REACTIONS,
 MOUSE (5884)
 MAMMARY NODULE OUTGROWTH,
 PITUITARY ISOGRAFT, MOUSE (0120)
 MURINE LEUKEMIA, MAMMARY TUMOR,
 ANTIGENS, MOUSE (3784)
 REPLICATION, HORMONE, MOUSE (0714)
 SPONTANEOUS ANTIBODY, MOUSE (1043)
 SUSCEPTIBILITY, HISTOCOMPATIBILITY
 GENE, MOUSE (1727)
 MAMMARY TUMOR ACTIVITY, PHENYLALANINE
 DEFICIENCY INFLUENCE, MOUSE (4606)*
 MAMMARY TUMOR-ASSOCIATED ANTIGENICITY,
 LEUKEMIA CELLS, MOUSE (3193)
 MAREK'S DISEASE
 ANTIGEN, FEATHER FOLLICLE, CHICKEN
 (0451)
 ASSAY, CHICKEN (1006)
 COURSE OF INFECTION, TISSUES,
 CHICKEN (5273)
 ONCOGENICITY, DNA SYNTHESIS, BIRD
 (4586)*
 PATHOGENICITY, MARMOSSET MONKEYS
 (5282)*
 REPLICATION, CHICKEN (0146)*
 MAREK'S DISEASE HERPESVIRUS
 AVIAN LEUKOSIS VIRUS, INTERACTIONS
 TISSUE CULTURE (3762)
 PARTICLES, PRECIPITATING ANTIBODY-
 FREE TISSUES, CHICKEN (3152)*
 TURKEY HERPESVIRUS, INTERFERENCE
 OF TYPE 1 AND 2 PLAQUE-PRODUCING
 AGENTS, KIDNEY CELL CULTURE,
 CHICKEN (3148)*
 VIRUS-ASSOCIATED ANTIGEN, CHICK
 CELLS (2546)
 MASON-PFIZER
 FORESKIN CELL TRANSFORMATION,
 MONKEY (5877)
 MAMMARY CARCINOMA, ANTIGEN, MONKEY
 (0138)*
 MAMMARY TUMOR, MONKEY (4522)
 MORPHOLOGY, BIOPHYSICAL PROPERTIES
 MONKEY (3137)
 SEROLOGY, STRUCTURE, MAMMARY
 TUMOR, MONKEY (1695)
 MAZURENKO, FRIEND, RAUSCHER, LEUKEMIA,
 GROUP-SPECIFIC ANTIGEN, TYPE-SPECI-
 FIC ANTIGEN, MOUSE (4631)
 MOLONEY, LYMPHOID TUMOR, GROWTH,
 ULTRASTRUCTURE, MOUSE (3097)
 MOLONEY LEUKEMIA
 ANTIGEN, MITOSIS, MOUSE (0409)
 CARCINOGENESIS, NORMAL CELL,
 TUMOR-SPECIFIC ANTIGEN, MOUSE
 (1877)*
 MURINE SARCOMA, INFECTED KIDNEY,
 PATHOLOGIC CHANGE, MOUSE (1776)*
 PRODUCTION, IMMUNOGLOBULIN PRODUC-
 TION, INFECTION, RAT (1771)*
 REPLICATION, HUMAN CELL, MOUSE
 HYBRID (5245)
 RNA DEPENDENT, DNA POLYMERASE,
 THYMUS, RAT (0701)
 TRANSFORMED LYMPHOCYTE, IMMUNE
 LYSIS, CELL CYCLE-DEPENDENT,
 VIRAL ANTIGEN, RAT (1832)
 UV RADIATION, INACTIVATION OF
 REPLICATION, ABILITY TO RESCUE
 MSV (3111)
 VIRUS RELEASE, CELL SURFACE
 ANTIGEN, MOUSE (1823)
 MOLONEY MURINE SARCOMA
 CELL TRANSFORMATION, ACTINOMYCIN D
 IN VITRO (0339)
 INHIBITOR, CELLS, MOUSE (3102)
 NUCLEIC ACID, CHARACTERIZATION,
 MOUSE (0420)
 POLYINOSINIC-POLYCYTIDYLIC ACID,
 TUMOR INDUCTION, MOUSE (0417)
 TUMOR INDUCTION, MOUSE (0112)
 MOLONEY SARCOMA
 ANEMIA-INDUCING VIRUS DERIVATIVE,
 RAT (4513)
 IMMUNE LYMPHOCYTE, CONCENTRATION,
 CYTOTOXICITY, RAT, ANTISERUM
 (3869)
 LYMPHOCYTE RESPONSE, MOUSE (5888)
 RESISTANCE, MOUSE (5209)
 SERUM GROWTH FACTOR, MOUSE (0744)
 SPECIFIC CYTOTOXICITY, LYMPHOID
 CELL SERUM, IMMUNE MOUSE (2605)
 STRESS, IMMUNOLOGY, MOUSE (3920)*
 TUMOR PROTECTION, POLYRIBOINOSINIC
 ACID, POLYRIBOCYTIDYLIC ACID,
 INTERFERON, MOUSE (2497)
 TUMOR RESORPTION, IMMUNITY, MOUSE

(5348)
 MONKEY ADENOVIRUS, REDOX ENZYMES,
 HISTOCHEMISTRY, HAMSTER (5897)
 MOUSE MAMMARY TUMOR
 MOUSE LEUKEMIA, ANTIGENIC RELATION
 MOUSE (5212)
 RNA-DIRECTED DNA POLYMERASE, MOUSE
 (3803)
 STRUCTURAL COMPONENTS (1726)
 SUBVIRAL COMPONENT (1026)
 MULTIPLICATION, INHIBITION,
 DISTAMYCIN A (1350)
 VIRUS - CONTINUED
 MURINE LEUKEMIA
 ACTIVATION, 5-IODODEOXYURIDINE,
 5-BROMODEOXYURIDINE, MOUSE
 (1031)
 ALLELE, CELL, MOUSE (0117)
 ANTIGEN, MICE (2013)
 ASSAY TECHNIQUES (2569)*
 BUDDING, ULTRASTRUCTURE (3783)
 CELL PENETRATION, MECHANISMS
 (5927)*
 CELLULAR, ANTIGEN, LEUKEMIA CELL,
 MYELOMA CELL, MOUSE (4555)
 CHEMICAL CARCINOGEN, THYMIC
 LYMPHOMA, CELL SURFACE ANTIGENS,
 MOUSE, RAT (1062)
 ELECTRON MICROSCOPY (2578)*
 FRIEND, HELPER, MOUSE, DETECTION
 (0440)*
 GENE MAPPING, MOUSE (5258)
 GIX ANTIGEN EXPRESSION, GENE,
 MOUSE (5336)
 GROUP-SPECIFIC ANTIGEN, HUMAN CELL
 (0699)
 IMMUNOSUPPRESSION, INFECTION
 (0478)
 INFECTION, ULTRASTRUCTURE (3142)
 INFECTIVITY, GENETIC DETERMINATION
 MOUSE (0407)
 INFECTIVITY TITER, NATURAL
 INFECTION, MOUSE (1711)*
 LEUKEMIC CELL, SURFACE ANTIGEN,
 MOUSE (1814)
 MURINE SARCOMA
 INFECTION REQUIREMENT, MOUSE
 EMBRYO CELL (1329)
 POLYINOSINIC POLYCYTIDYLIC
 ACID, TUMORIGENESIS, MOUSE
 (0123)
 RNA-DEPENDENT DNA POLYMERASE,
 ACTIVITY, MOUSE (3132)
 RAUSCHER LEUKEMIA, RIFAMYCIN,
 FOCUS-FORMATION, REVERSE TRANS-
 CRIPTASE (3742)
 RETICULUM CELL SARCOMA, HAMSTER
 (5896)
 RNA-DEPENDENT DNA POLYMERASE
 INHIBITION, ANTIBODY (0450)
 PRIMER (5900)
 SPONTANEOUS INFECTION, ANTIBODY
 RESPONSE, MOUSE (3852)
 SPONTANEOUS NEOPLASTIC TRANSFORMA-
 TION, SERUM FRACTIONS, MOUSE
 (5265)
 STRUCTURE, RNA (1017)
 TEMPERATURE-SENSITIVE MUTANTS
 (5935)*
 TRANSFORMATION, FISCHER RAT EMBRYO
 CELLS, CANNABINOIDS (3080)
 VACCINE 3-METHYLCHOLANTHRENE,
 CARCINOGENESIS INHIBITION, MOUSE
 (2964)

VIRAL DNA, MOUSE CELL (0413)
 VIRAL GENOME, CHROMOSOMAL
 INTEGRATION, CELL SURFACE
 ALLO-ANTIGEN (1841)
 MURINE LEUKOSIS, TISSUE CULTURE, HELA
 CELL, L CELL (3807)
 MURINE MAMMARY TUMOR
 REVERSE TRANSCRIPTASE ACTIVITY,
 GEL ELECTROPHORESIS, MOUSE
 (5953)*
 RNA-DEPENDENT DNA POLYMERASE, RNA,
 MAMMARY CARCINOMA, HUMAN (5926)
 MURINE RAUSCHER LEUKEMIA, CHARACTER-
 IZATION, EMBRYONIC KIDNEY CELLS,
 HUMAN (3104)
 MURINE SARCOMA
 ANTIGEN SYNTHESIS, MOUSE, RAT,
 HAMSTER, CHICKEN, HUMAN (3065)
 CELL TRANSFORMATION, VIRUS-LIKE
 PARTICLE RELEASE, MOUSE CELL
 (1732)
 DETECTIVE GENOME, HAMSTER CELLS
 (2550)
 FOCUS-FORMING INDUCTION, 5-BROMO-
 DEOXYURIDINE (3665)
 GENETIC STABILITY, TRANSFORMED
 NONPRODUCER CELLS (3096)
 GENOME, TUMOR CELL, CYTOLOGY,
 HAMSTER (3785)
 GENOME DETECTION, NON-INFECTIOUS
 MAMMALIAN VIRUS (1734)
 GENOME RESCUE, NON-PRODUCER
 HAMSTER, TUMOR CELL (2548)
 GENOME RESCUE KINETICS,
 NONPRODUCER CELL, MOUSE (1735)
 GUAROA, COINFECTION, SPLEEN CELLS,
 MOUSE (3064)
 HARVEY, TRANSFORMATION, RAT
 (3772)
 HETEROTRANSPLANT, CAT (2582)*
 INDUCED TUMOR, CULTURE, ANTIGEN
 PROPERTIES (2549)
 LEUKEMIA, RNA-DNA HYBRIDIZATION,
 GENETIC DIFFERENCES (3135)
 LOSS OF CELL SENSITIVITY TO INTER-
 FERON, MOUSE (3091)
 NEOPLASM, MOUSE (0730)*
 NEOPLASTIC RESPONSE, RAT, MOUSE
 (5904)
 NEWCASTLE DISEASE, INTERFERON
 PRODUCTION, MOUSE (2488)
 NONPRODUCER AND S+L- TRANSFORMED
 CELLS, COMPARISON (3126)
 NONPRODUCER TRANSFORMED CELL,
 TRANSPLANTATION ANTIGEN, MOUSE
 (3808)
 OSTEOSARCOMA INDUCTION
 RAT (2575)*
 VIRUS-PERSISTENT CELL LINE, RAT
 (5204)
 RESCUE
 LEUKEMIA VIRUS REQUIREMENT,
 MOUSE CELL (1733)
 PSEUDOTYPE SARCOMA VIRUS
 DERIVATION (5919)
 REVERSE TRANSCRIPTASE INHIBITION,
 RIFAMYCIN (3782)
 ROUS SARCOMA, POLYOMA, TRANSFORMA-
 TION, CELL MEMBRANE, GLYCOSYL
 TRANSFERASE (4552)
 SARCOMA AND LEUKEMIA, INDUCTION,
 ENHANCEMENT BY INTERFERON
 INDUCERS, MOUSE, RAT (4553)
 70S RNA, 3' TERMINUS IDENTIFICA-

TION (5281)*
 TEMPERATURE-SENSITIVE MUTANT,
 ISOLATION (5232)
 TRANSFORMATION
 GUINEA PIG EMBRYO CELLS (4537)
 NONPRODUCER BALB/3T3 CELLS,
 EPITHELIAL FEATURES (4600)*
 REVERTANTS, VIRUS, RESCUE, MOUSE
 (3058)
 TRANSFORMED CELL
 CLONAL ISOLATION, RAT (1729)
 DIBUTYRYL CYCLIC ADENOSINE
 PHOSPHATE, THEOPHYLLINE,
 MOUSE (5952)*
 TUMOR INDUCTION
 NUCLEOTIDE, MOUSE (5223)
 PATHOLOGY, RODENT (4550)
 POLYRIBOINOSINIC-POLYRIBOCYTIDY-
 LIC ACID, MOUSE (3764)
 TUMORIGENESIS, LEUKEMIA, MOUSE,
 HAMSTER, RAT (3098)
 VIRUS-SPECIFIC RNA, TRANSFORMED
 CELLS, RAT, MOUSE, HAMSTER
 (3745)
 VIRUS - CONTINUED
 MURINE SARCOMA KIRSTEN
 CELL TRANSFORMATION, MOUSE, HUMAN
 (1330)
 TUMOR IMMUNOLOGY, MOUSE (1783)
 MURINE SARCOMA-LEUKEMIA
 DNA, ISOLATION (1015)
 POLYPEPTIDE SYNTHESIS, IMMUNO-
 LOGICAL STUDIES, RAT CELLS
 (5347)
 NEOPLASIA (0327)*
 HUMAN, REVIEW (5052)*
 NEWCASTLE DISEASE
 HERPES, GROWTH, INTERFERON PRODUC-
 TION, MONKEY-MOUSE HYBRID CELL
 (1777)*
 RNA ACTIVITY, CHICK EMBRYO (2494)
 9H, GROWTH PATTERN LIVER, HEPATITIS,
 ANTIBODY, RAT (4544)
 OCULAR HERPES SIMPLEX, INFECTION
 INHIBITION, BURKITT'S LYMPHOMA CELLS
 HUMAN (1725)*
 ONCOGENIC
 CANCER, HUMAN, REVIEW (3643)*
 DNA
 CELL TRANSFORMATION, REVIEW
 (5030)*
 RNA TRANSFORMATION, CYTOGENETICS
 (5934)*
 MALIGNANT LYMPHOMAS, IMMUNO-
 REGULATION, HUMAN, REVIEW
 (5745)*
 REVIEW (5004)
 ONCOGENIC RIBOVIRUSES, PRESENCE OF DNA
 CHICKEN, MOUSE (3794)
 ONCOGENIC RNA
 DETECTION, CHARACTERIZATION,
 LASER BEAT FREQUENCY, SPECTRO-
 SCOPY (3154)*
 MAMMARY CARCINOMA, MONKEY (1694)
 REPLICATION, TEMPLATE POLYMERASE
 PREFERENCE, CALF THYMUS (2503)
 ONCOGENIC THEORIES, REVIEW (3615)
 ONCORNIA
 CHICKEN, REVIEW (5035)*
 NUCLEOCAPSID STRUCTURE (1325)
 TRANSFER-LIKE RNA (0690)
 ONCORNAVIRUS
 ANTIGEN SYNTHESIS, CHROMATO-
 GRAPHY, CHICKEN, MOUSE, HAMSTER,

CAT (3144)
 TUMOR, CELL-MEDIATED IMMUNITY,
 MOUSE (5920)
 OSTEOSARCOMA, EVIDENCE, HUMAN (2484)
 PAPILLOMA, WART, HUMAN (4509)
 PAPOVA
 CHOROID PAPILLOMA, HUMAN (0398)
 EPIDERMODYSPLASIA VERRUCIFORMIS,
 ONCOGENESIS (3793)
 NONVIRION ANTIGEN, REVIEW (1205)
 TUMOR, FETAL ANTIGEN, MOUSE (3835)
 PAPOVAVIRUS, ULTRASTRUCTURE, SOUTH
 AMERICAN MONKEYS (3832)*
 PARA(3CT)-ADENOVIRUS 7 MUTANT, TUMOR
 INDUCTION, ANTIGENICITY, HAMSTER
 (1712)
 PARAMYXOVIRUS, ULTRASTRUCTURE, SOUTH
 AMERICAN MONKEYS (3832)*
 PARTICLES
 EPIDERMODYSPLASIA VERRUCIFORMIS,
 ULTRASTRUCTURE, IMMUNOLOGY,
 HUMAN (1764)*
 EWING SARCOMA, TISSUE CULTURE
 (2405)*
 LYMPHOMA, MALARIAL PARASITE, MOUSE
 (0114)
 MALIGNANT MELANOMA, HUMAN (5224)
 PENETRATION, MAMMARY CARCINOMA,
 PRODUCTIVE CELL, MOUSE (1701)
 STRUCTURE, ANTIGENIC PROPERTIES,
 MOUSE TUMORS (2492)
 VASCULITIS, BRAIN TUMOR, CASE
 REPORT (2568)*
 PLAQUE CHARACTERIZATION, SOUTH
 AMERICAN NONHUMAN PRIMATES (3824)*
 POLIOVIRUS, VESICULAR STOMATITIS VIRUS
 DOUBLE INFECTION, INTERFERENCE,
 HELA CELL (3041)
 POLYCYTHEMIA FRIEND, COLONY FORMING
 UNIT, SPLEEN, MOUSE (4503)
 POLYHEDRAL CYTOPLASMIC DEOXYRIBOVIRUS
 REACTIVATION MECHANISMS, RNA
 POLYMERASE, FROG (2599)*
 VIRUS - CONTINUED
 POLYOMA
 ADENOCARCINOMA, TUMOR CELL CULTURE
 MOUSE (0438)*
 AGGLUTINATION, TRANSFORMED CELL,
 MOUSE (0132)
 ANTIBODY RESPONSE, HAMSTER (5260)
 ANTIGEN, THYMECTOMY, TUMOR SIZE,
 RAT (5956)*
 ANTIGEN FORMATION, INHIBITOR,
 MOUSE (4567)
 T ANTIGEN SYNTHESIS, GLYCOLYTIC
 ENZYMES, HAMSTER, MOUSE (5225)
 CAPSID STRUCTURE, ULTRASTRUCTURAL
 STUDY (5910)
 CELL AGGREGATION, NEURAMINIDASE,
 HAMSTER (5905)
 CELL INFECTION, ARGININE BIOSYN-
 THESIS, MOUSE (3046)
 DISRUPTED, SHELL-LIKE PARTICLE,
 REASSEMBLY (1768)*
 DISRUPTION, PROTEIN STRUCTURE
 (5275)
 DNA
 HOST DNA, INFECTED CELL, HIGH
 TEMPERATURE, MOUSE (1760)
 ISOLATION, MOUSE (0395)
 DNA REPLICATION MODEL (1758)
 DNA SECONDARY STRUCTURE (3139)
 DNA SUPERCOILING, MOUSE EMBRYO
 (2482)

*INDICATES A PLAIN CITATION WITHOUT ACCOMPANYING ABSTRACT

DNA SYNTHESIS, INFECTED CELL,
 MOUSE (0726)
 DNA TRANSFER, HUMAN CELL, MOUSE
 CELL (1761)
 ENDONUCLEASE ACTIVITY (1772)*
 H-2 HISTOCOMPATIBILITY ANTIGEN,
 TUMOR SPECIFIC CELL SURFACE
 ANTIGEN, MOUSE (0724)
 INFECTION, VIRUS PRODUCTION TIME
 COURSE, MOUSE (5261)
 INHIBITOR PRODUCTION, MOUSE,
 HAMSTER (5911)
 KIDNEY SARCOMA INDUCTION, PRO-
 LIFERATION KINETICS, RAT (5955)*
 MUTANTS, REVIEW (5026)
 ODONTOGENIC TISSUE, EPITHELIUM-
 MESENCHYMAL INTERACTIONS,
 PROLIFERATION, MOUSE (1034)
 ONCOGENIC ACTIVITY, RAT (5266)
 PHI X 174, DNA STRUCTURE (1444)
 PLASMA MEMBRANE, FORSSMAN ANTIGEN,
 MONOSACCHARIDE COMPOSITION,
 HAMSTER (1044)
 POLYNUCLEOTIDE LIGASE, MOUSE CELL
 (3818)
 PROPERTIES OF TRANSFORMED CELLS,
 REVERSION, RE-REVERSION (3045)
 PROTEIN COMPONENT (1033)
 RAUSCHER, PYRAN COPOLYMER,
 TUMORIGENESIS INHIBITION,
 IMMUNOSUPPRESSION, MOUSE (3686)
 REPLICATIVE INTERMEDIATE, DNA
 STRUCTURE (1763)
 REVERSION, DNA COPYING, HAMSTER
 (5222)
 RNA, INFECTION, MOUSE CELLS (5903)
 ROUS SARCOMA, NUCLEIC ACID
 METABOLISM, EMBRYO CELL CULTURES
 MOUSE, CHICKEN (5274)
 SERUM BLOCKING ACTIVITY, RAT
 (0723)
 SURFACE ANTIGEN, POLYPSEUDOPODIA,
 THYMIC INVOLUTION, ULTRASTRUCTURE,
 MOUSE (0722)
 TRANSFORMATION
 BHK 21 CELLS (5964)
 CONTACT INHIBITION UDP-GAL,
 LACTOSYL CERAMIDE ALPHA-
 GALACTOSYLTRANSFERASE,
 HAMSTER (0437)
 RAT EMBRYO (2508)
 TRANSFORMED CELL, AMINO ACID
 UPTAKE, 2-DEOXY-D-GLUCOSE,
 HAMSTER (1757)
 TRANSFORMED HYBRID CELL,
 MORPHOLOGICAL REVERTANT, HAMSTER
 (0725)
 TRANSPLANTABLE TUMORS, MORPHOLOGY,
 BIOLOGICAL PROPERTIES (4578)*
 TROPHOBLASTIC CELL, GROWTH, MOUSE
 (1759)
 TUMOR, IMMUNITY STIMULATION,
 BACILLUS CALMETTE-GUERIN, MOUSE
 (1824)
 TUMOR ANTIGEN, SYNTHESIS,
 DEGRADATION, MOUSE (1836)
 TUMOR CELL, TUMOR-SPECIFIC ANTIGEN
 MOUSE (3871)
 TUMOR GROWTH FACILITATION, BLOCK-
 ING SERUM, TUMOR ELUATE, RAT
 (4649)
 TUMOR IMMUNITY, BLOCKING EFFECT,
 COUNTERACTION, RAT (4612)
 TWEEN-80, HAMSTER EMBRYO CELL
 (1762)
 VIRAL DNA, MOLECULE, REPLICATION,
 MOUSE (0436)
 VIRUS - CONTINUED
 POLYOMA-TRANSFORMED, FIBROBLASTS,
 GLYCOSPHINGOLIPIDS, MOUSE (4587)*
 POLYOMA TRANSFORMED CELLS
 CONCANAVALIN SURFACE RECEPTORS,
 ULTRASTRUCTURE (2585)*
 POLYOMA TUMOR
 IMMUNOLOGICAL STUDY, HAMSTER (2699)*
 POX, SPONTANEOUS DISSEMINATED FIBROMA,
 SQUIRREL (4584)*
 PROVIRUS, REVIEW (4305)
 R TYPE PARTICLE, POLYOMA, TRANSFORMED
 CELL, HAMSTER (5240)
 RADIATION LEUKEMIA
 ALKALINE PHOSPHATASE ACTIVITY,
 MOUSE (3775)
 ANTISERUM, ANTIBODIES, MOUSE
 (0768)
 IMMUNOSUPPRESSION, LEUKEMIA
 DEVELOPMENT, MOUSE (0751)
 VACCINE, 3-METHYLCHOLANTHRENE,
 CARCINOGENESIS INHIBITION, MOUSE
 (2964)
 RADIO-LEUKOSIS, LEUKEMOGENESIS, MOUSE
 (5276)
 RAUSCHER
 FREUND ADJUVANT, LEUKEMOGENESIS,
 MOUSE (0445)*
 GROUP-SPECIFIC ANTIGEN, MOUSE
 (0153)
 INFECTION, RNA, SPLEEN CELLS,
 MOUSE (3090)
 PROTAMINE, MORTALITY, MOUSE (0113)
 SMOG RESIDUE, BENZO(A)PYRENE,
 TRANSFORMATION, RAT, HAMSTER
 (0059)
 ULTRASTRUCTURE, SPLEEN, MOUSE
 (5203)
 RAUSCHER LEUKEMIA
 ANTIBODY AND INTERFERON PRODUCTION
 MOUSE (2639)
 ANTINUCLEAR ANTIBODY FORMATION,
 SUPPRESSION, MOUSE (4559)
 AVIAN MYELOBLASTOSIS, RNA-DEPEND-
 ENT DNA POLYMERASE, TEMPLATE
 REQUIREMENT (3047)
 DIFFERENTIATION, INFECTED CELL,
 HEMOCYANIN, MOUSE (4680)
 DNA POLYMERASE, REVERSIBLE
 INACTIVATION (5257)
 DNA POLYMERASE INHIBITION, SINGLE-
 STRANDED POLYRIBONUCLEOTIDES
 (2510)
 HAMSTER LEUKEMIA, ANTIGENIC DETER-
 MINANTS, IMMUNOFLUORESCENCE,
 MOUSE (2551)
 HARVEY SARCOMA, STRUCTURAL
 PROTEINS (1710)
 IMMUNOGLOBULIN MEMORY, IMMUNO-
 SUPPRESSION, MOUSE (0700)
 INFECTION, ERYTHROPOIETIC
 RESPONSES, MOUSE (3119)
 LACTIC DEHYDROGENASE, LYMPHATIC
 TISSUE RESPONSE, MOUSE (4530)
 MULTIPLICATION, SUSCEPTIBILITY,
 MOUSE (2509)
 NONSPECIFIC IMMUNITY, GUINEA PIG
 (1875)*
 NUCLEIC ACIDS, MOUSE (5210)
 PARTICLE, SEDIMENTATION, ULTRA-
 CENTRIFUGATION (0738)*

- PLASMA, ULTRACENTRIFUGATION STUDY,
MOUSE (1769)*
RECOVERY, SPLENOMEGALY, FETAL
CELL ANTIGEN, SUPPRESSION,
MOUSE (3204)
- RNA
RIBOSOME BINDING (3738)
SPLEEN, MOUSE (5887)
RNA-DIRECTED DNA POLYMERASE
INHIBITION, CYTOSINE ARABINOSIDE
TRIPHOSPHATE (4585)*
MOUSE (2565)*
TRANSPLANTABLE COLONY-FORMING
UNITS, SPLEEN, MOUSE (5285)*
TUMOR RESISTANCE INDUCTION, ADULT
MOUSE, NEWBORN MOUSE (4687)
TUMOR TRANSPLANTATION, MOUSE
(3070)
ULTRASTRUCTURE (1361)*
VACCINE, 3-METHYLCHOLANTHRENE,
CARCINOGENESIS INHIBITION,
MOUSE (2964)
- RAUSCHER MURINE LEUKEMIA
CHEMICAL CARCINOGENESIS, TRANS-
FORMATION, RAT (3713)
CHROMOSOME, V-CELL, MOUSE (3779)
DNA POLYMERASE, INHIBITOR (0411)
EPSTEIN-BARR, DUAL INFECTION,
LYMPHOBLAST, HUMAN (3773)
FOCUS-FORMATION, REVERSE TRANS-
CRIPTASE, RIFAMYCIN (3742)
LIPID PHASE STRUCTURE (5933)*
PROTEIN KINASE, PHOSPHATE ACCEPTOR
(1016)
REVERSE TRANSCRIPTASE, RIFAMYCIN
(3790)
RNA, MOLECULAR WEIGHT, MOUSE
(1354)*
- RD-114
PROTEIN PURIFICATION, IMMUNOLOGICAL
CHARACTERIZATION (2592)*
RECEPTOR, BLOOD GROUP, GENETICS,
MONONUCLEOSIS, HUMAN (0133)*
- VIRUS - CONTINUED
RELEASE, SURFACE ANTIGEN, FIBROBLAST,
MOLONEY LYMPHOMA CELL, HYBRID, MOUSE
(1784)
- REO
AMYLOIDOSIS, IMMUNOCOMPETENCE,
MOUSE (1368)*
RNA POLYMERASE, ULTRASTRUCTURE
(1364)*
- REOVIRUS
POLYPEPTIDE COMPOSITION, ULTRA-
STRUCTURE (5213)
RNA, 3' TERMINUS (5217)
RNA SYNTHESIS (1318)
RESTRICTED ADENOVIRUS INFECTION, RNA
SYNTHESIS, MONKEY CELLS (4527)
RETICULOENDOTHELIOSIS, AVIAN TUMOR,
SEPARATION (3127)
RETICULUM CELL SARCOMA
IMMUNOLOGICAL INDUCTION, MOUSE
(5228), (5246)
RHABDOMYOSARCOMA, TRANSPLANTATION,
HUMAN, CAT (1002)
RICH, LEUKEMIA, ADENOSINE DEAMINASE,
MOUSE (1331)
- RNA
BIOCHEMISTRY, REVIEW (2201)
DNA, SIALYL TRANSFERASE ACTIVITY,
TRANSFORMED CELLS (5878)
HOST CELL MEMBRANE, PHOSPHOLIPID,
CHICK (1342)
- HOST GENOME, ONCOGENESIS, REVIEW
(4309)
NUCLEASE ACTIVITY (2502)
ONCOGENESIS
GLUCOSE TRANSPORT (1114)
HUMAN REVIEW (2239)*
PLEURAL EFFUSION, MAMMARY TUMOR,
HUMAN (1692)
RNA C-TYPE, DNA POLYMERASE INHIBITION,
RAT ANTISERA (1698)
RNA ONCOGENIC
MALIGNANT TRANSFORMATION, REVIEW
(5028)
REVIEW (5748)*
RNA SPECIFIC
TRANSLATION, MAMMARY CARCINOMA,
MOUSE (2489)
RNA TUMOR
ANTIGEN, HOST RANGE, GENETICS,
REVIEW (0308)
DNA POLYMERASE, PRIMER REQUIREMENT
TEMPLATE SPECIFICITY (1706)
DNA POLYMERASE INHIBITION,
RIFAMYCIN DERIVATIVES (1730)
GENOME, POLYADENYLIC ACID SEQUENCE
(2501)
GLYCOSIDASE, PROTEOLYTIC ENZYME,
ELEVATION, TRANSFORMED CELL,
MOUSE (1741)
POLY A CONTENT (3802)
REVERSE TRANSCRIPTASE DISTINCTION
(1704)
RIBONUCLEASE H CONTENT (5922)
ULTRASTRUCTURE, MORPHOLOGY, REVIEW
(4334)*
RNA TUMOR TYPE
DNA POLYMERASE, INHIBITION, BIS-DEAE
FLUORENONE (2504)
DNA SYNTHESIS, MOUSE (2505)
- ROUS
FIBROBLAST TRANSFORMATION, HAMSTER
EMBRYO, IN VITRO (0444)*
ROUS-ASSOCIATED, DNA POLYMERASE,
INFECTED CELL, CHICKEN (5220)
- VIRUS - CONTINUED
ROUS SARCOMA
ABSORPTION BY RESISTANT CELLS,
ELECTRON MICROSCOPE STUDY (4528)
ACTIVATION, CELL CYCLE, CHICKEN
(4511)
ALPHA DNA POLYMERASE DEFICIENCY
(5233)
ANTIGEN SPECIFICITY (2576)*
AVIAN MYELOBLASTOSIS, GROUP-
SPECIFIC ANTIGENS, IMMUNO-
ELECTROPHORESIS (3051)
BRAIN TUMOR, RAT (5277)
BRYAN STRAIN, PROTEINS (3743)
CARR-ZILBER STRAIN, MOUSE (3833)*
CELL LYSIS, CHICKEN (0139)*
CELL TRANSFORMATION
AGGLUTINATION CONCAVALIN A,
WHEAT GERM AGGLUTININ (5914)
DENSITY DEPENDENCE, CHICK
EMBRYO (1742)
MAMMAL (1736)
CHROMOSOME ANALYSIS, RAT (2554)
DNA
HYBRIDIZATION, CHICKEN (0423)
RNA, CHICKEN, RAT (2556)
SOURCE AND SIGNIFICANCE (3086)
VIRUS RELEASE, CHICKEN CELL
(5916)
DNA POLYMERASE (1343)

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PURIFICATION, CHARACTERIZATION
(3110)

RIBONUCLEASE (0425)
DNA:RNA HYBRIDIZATION, CELL
INFECTION, RAT, CHICK (3040)
EARLY INFECTION, ANTIGENS (3044)
ENZYME, NUCLEOTIDE (1345)
GENOME EXPRESSION, MOUSE (5244)
GROUP SPECIFIC ANTIGEN, PERMISSIVE
CELL, CHICKEN (0441)*
GROWTH INHIBITION, INTERFERON
PRODUCTION, HYALURONIC ACID,
CHICKEN CELL (1983)
IMMUNITY, ONCOGENICITY, THYMECTOMY
QUAIL (0135)*
IMMUNOLOGY, MOUSE (1840)
INDUCED TUMORS, HAMSTER (3831)*
INFECTED CELL, DNA, RNA, CHICKEN
(1326)
INFECTION, INHIBITION, RIFAMPIN,
CHICK CELL (0422)
MITOCHONDRIA, CHICKEN (0127)
MONKEY, CYTOGENETICS (0692)
MURINE C-TYPE, PARTICLE PRO-
DUCTION, MOUSE (5253)
MUTANTS, REVIEW (5003)
MUTATION, ADENOSINE 3',5'-MONO-
PHOSPHATE, TRANSFORMATION
CONTROL (1737)
NEONATAL THYMECTOMY, RAT (2601)*
PARTICLE, TRANSFORMED CELL, RAT
(0689)
PERSISTENCE, RESISTANT CELLS,
MOUSE (5948)*
PHOSPHOLIPID COMPOSITION, FIBRO-
BLASTS, CHICK EMBRYO (5917)
PRAGUE STRAIN, DNA POLYMERASE
(0426)
PRODUCTION SYNCHRONIZATION, CHICK
EMBRYO CELL (1746)
RAUSCHER MOUSE LEUKEMIA, RNA,
ADENYLIC ACID-RICH SEQUENCE
(1740)
REPLICATION, MITOCHONDRIA, TUMOR,
CHICKEN (0125)
REPLICATION INHIBITION, ALPHA-
AMANTIN, CHICK CELL (1344)
RESCUE
CELL FUSION, MAMMAL (3093)
TRANSFORMED CELL, RAT (4518)
REVERSE TRANSCRIPTASE, DISTAMYCIN
A, CONGOICIDINE (1744)
REVERSE TRANSCRIPTASE INDUCTION,
ARGININE DEPRIVATION (5262)
RIBONUCLEOPROTEIN (5907)
RIFAMYCIN, TRANSFORMED FIBROBLASTS
CHICKEN (5946)*
RNA DEPENDENT DNA POLYMERASE,
DNA REASSOCIATION KINETICS
(0686)
MITOCHONDRIA, TUMOR, CHICKEN
(3810)
RNA MUTATION, DNA ANALOGUE, CHICK
EMBRYO (2499)
RNA-SENSITIVE DNA POLYMERASE,
INFECTED CELL, RAT (1745)
RNA SEQUENCE, CELLULAR DNA,
CHICKEN (5226)
RNA SUBUNIT, DNA POLYMERASE
TEMPLATE (5207)
RNA TEMPLATE, DNA TEMPLATE,
DNA POLYMERASE (1739)

VIRUS - CONTINUED

ROUS SARCOMA - CONTINUED

SARCOMA, CHROMOSOME, SEQUENTIAL
CHANGE, RAT (5221)
SARCOMA INCIDENCE, VITAMIN A,
CHICK CELLS (1774)*
SCHMIDT-RUPPIN STRAIN
TUMOR, ISOZYME PATTERN, RAT
(0424)
TUMOR-SPECIFIC TRANSPLANTATION
ANTIGEN, IMMUNE RESPONSE, RAT
(0474)
SPECIFIC RNA, DETECTION,
CHARACTERIZATION (3115)
SPIKE PROTEINS, IDENTIFICATION
(1747)
TEMPERATURE-DEPENDENT ALTERATIONS,
SUGAR TRANSPORT, CYTOSINE
ARABINOSIDE (3128)
TEMPERATURE-SENSITIVE MUTANT,
SURFACE GLYCOPROTEIN, SURFACE
GLYCOLIPID, TRANSFORMED CELL,
CHICK EMBRYO (1738)
THERMOSENSITIVE MUTANT, CHICK
EMBRYO (2555)
THYMECTOMY, CELL-MEDIATED IMMUNITY
RAT (5324)
TRANSFORMATION
CELL OVERGROWTH, CHICK (1412)
DNA SYNTHESIS INHIBITION,
ARABINOFURANOSYL ADENINE,
RAT (3754)
GENOME INTEGRATION, CHICKEN CELL
(3813)
VIRAL GENOME COPIES, PROVIRUS
THEORY (4554)
TRANSFORMED CELL
GLUCOSE METABOLISM, CHICK
EMBRYO (4558)
PHOSPHOLIPID, ACYL GROUP CHANGE
CHICKEN (5248)
TUMOR-SPECIFIC ANTIGENS, MOUSE
(1057)
VIRUS INDUCTION, HAMSTER (3801)
TRANSFORMED CELL LINES, CHROMOSOME
STUDY, HAMSTER (5899)
TUMOR, TRANSPLANTATION, RAT, MOUSE
(5889)
TUMOR GROWTH, BURSECTOMY, HYPO-
GAMMAGLOBULINEMIA, CHICKEN
(5239)
TUMOR IMMUNOLOGY, HAMSTER (4502)
TUMORIGENESIS, IMMUNOLOGICAL
INTERFERENCE, RAT (2625)
VITAMIN A, ENHANCING EFFECT,
CHICKEN (3112)

VIRUS - CONTINUED

ROUS SARCOMA MUTANT, CELL TRANSFORMA-
TION, TEMPERATURE CHANGE, CHICK
EMBRYO (1749)

SARCOMA

GENETIC LINKAGE, CELL RESPONSE,
FOWL (1323)
LEUKEMIA, PRODUCTION, ANTIGENS,
HYBRID CELL, MOUSE, HAMSTER
(4565)

SCHMIDT-RUPPIN ROUS, CHROMOSOME
ABNORMALITY, TUMOR ULTRASTRUCTURE,
RAT (6081)

SCHMIDT-RUPPIN ROUS SARCOMA

GLIOMA, ULTRASTRUCTURE, DOG
(0735)*

3-METHYLCHOLANTHRENE, TRANSFORMA-
TION, HUMAN CELL (0691)

TUMORIGENESIS, SQUIRREL, MONKEY
(1028)

- SENDAI INFECTION, LIPID METABOLISM,
FIBROBLASTS, EMBRYO, CHICK (3129)
SHOPE, PAPILLOMAS, DNA REPLICATION,
MOLECULAR HYBRIDIZATION, RABBIT
(5881)
SHOPE FIBROMA
CYTOTOXIC ANTIBODY, IMMUNE SERUM,
RABBIT (2604)
DNA, COMPOSITION (2562)*
DNA SIZE (5241)
DNA SYNTHESIS, RABBIT CELLS, IN
VITRO (0682)
SHOPE PAPILLOMA, RABBIT KIDNEY
VACUOLATING, SPONTANEOUS PAPILLOMA,
RABBIT (5259)
SIMIAN ADENO
AUTOCYTHONOUS TUMOR CELL, HOST
RESISTANCE, HAMSTER (0471)
SIMIAN ADENO 7
RNA, TRANSFORMED CELL, HAMSTER
(5251)
VIRAL DNA FRAGMENTS, TUMORIGENESIS
HAMSTER (0128)
SIMIAN ADENOVIRUS SA7, GROWTH,
ARGININE STARVATION (5937)*
SIMIAN ADENOVIRUS SA7(C8), TUMOR
INDUCTION, HAMSTER (5938)*
SIMIAN FOAMY, MASON-PFIZER, COMPARA-
TIVE MORPHOLOGY, MONKEY (4556)
SIMIAN SARCOMA, FIBROSARCOMA, MONKEY
(1320)
SIMIAN SARCOMA TYPE 1, FOCUS ASSAY,
NONTRANSFORMING ASSOCIATED VIRUS,
ULTRASTRUCTURE (3153)*
SIMIAN TUMOR, ISOLATE, CYTOPATHIC
EFFECTS, CELLS, MONKEY HUMAN (3134)
SNYDER-THEILEN FELINE SARCOMA,
BIOLOGICAL PROPERTIES, CAT CELL
(1014)
VIRUS - CONTINUED
SV40
ABORTIVE INFECTION, ANTIGEN
PRODUCTION, DNA SYNTHESIS, MOUSE
(0434)
ADENO
CELL SURFACE, DNA SYNTHESIS
(0433)
HAMSTER (0131)
IMMUNITY, TOLERANCE (0312)*
ANTIBODY, SERUM, POLIO
IMMUNIZATION, HUMAN (1039)*
ANTIBODY FIXATION, HAMSTER (0740)*
ANTIGEN, TRANSFORMED CELL, MONKEY
(5333)
S ANTIGEN, HAMSTER (5329)
ANTIGEN SYNTHESIS, INHIBITION,
YABA TUMOR VIRUS, MONKEY CELL
(1347)
CAPSID PROTEIN I SYNTHESIS,
REPLICATION (3768)
CELLULAR DNA SYNTHESIS, MONKEY
(1030)
DELAYED HYPERSENSITIVITY, MOUSE
(3882)
DEOXYNUCLEOPROTEIN COMPLEX (3809)
DNA
REPLICATION, INITIATION POINT
(3776)
SEQUENCE HETEROGENEITY (4546)
STRAIN DIFFERENCE (3741)
TRANSFORMATION, MEMBRANE ALTERA-
TIONS, HUMAN, HAMSTER (3094)
TRANSFORMED CLONES, MOUSE (5915)
DNA CLEAVAGE, RESTRICTION ENDO-
NUCLEASE, HEMOPHILUS INFLUENZAE
(1752)
DNA HYBRIDIZATION, RNA (5235)
DNA MOLECULE, COVALENT JOINING
(5895)
DNA REPLICATION
MOLECULAR ORIGIN (5231)
MONKEY (0718)
ULTRASTRUCTURAL STUDY (5909)
DNA SYNTHESIS
ETHIDIUM BROMIDE, MONKEY (4566)
GEL ELECTROPHORESIS ANALYSIS
(5227)
MURINE SARCOMA VIRUS REPLICATION
EMBRYO CELLS, MOUSE (4534)
TEMPERATURE-SENSITIVE MUTANT
(5216)
DNA SYNTHESIS INDUCTION,
MITOCHONDRIA, MONKEY (0427)
EFFECT ON CHROMOSOME, POIKILO-
THERMIC CELLS, TEMPERATURE
RESPONSE (2584)*
ENDONUCLEASE ACTIVITY (2513)
ENDONUCLEASE ACTIVITY, DNA (3088)
FETAL CELL, TRANSFORMATION, HUMAN
(1754)
FLAT TRANSFORMED CELLS, ISOLATION,
MOUSE (1755)
GANGLIOSIDE DETERMINATION, GAS
CHROMATOGRAPHY, MOUSE (1351)*
GLUCOSE METABOLISM, HUMAN CELL
(1367)*
IMMUNIZATION, ROUTE OF INOCULATION
HAMSTER (3886)
INFECTED CELL
DNA SYNTHESIS REINITIATION,
HAMSTER (1751)
NUCLEOPROTEIN COMPLEX, MONKEY
(1348)
PROTEIN SYNTHESIS, MONKEY (5263)
INFECTED TRANSFORMED CELLS,
TRANSFER RNA, ALTERED PATTERNS
(3089)
INFECTION
ANTIBODY, HUMAN (3034)
CHROMOSOME ABERRATION, HELA
CELL (1029)
PROTEIN SYNTHESIS, CELLS,
MONKEY (3140)
RESISTANCE, MONKEY (0428)
INFLUENZA, TUMOR IMMUNITY, MOUSE
(0151)
INTERFERON, RNA TRANSCRIPTION,
MONKEY (0130)
MACROPHAGE
DNA SYNTHESIS, MOUSE (0148)
TRANSFORMATION, MOUSE (0432)
MITOCHONDRIAL DNA, REPLICATION,
HUMAN, MONKEY, RODENT (5894)
MOLONEY SARCOMA, MOUSE EGG,
SUSCEPTIBILITY (1753)
NEUTRALIZING ANTIBODIES,
GENITOURINARY CARCINOMA, HUMAN
(3054)
NOVIKOFF ASCITES HEPATOMA,
ASPARTYL-TRNA (4083)*
ONCOGENESIS, INTERRUPTION;
CYTOSTATIC ANTIBODY, HUMAN FETAL
ANTIGEN, HAMSTER (0717)
PARA ADENOVIRUS, TRANSFORMED
CELL, CHROMOSOME, HAMSTER
(0431)
POLYOMA, TRANSFORMED CELL,
BIOCHEMICAL CHANGES, MOUSE

- (1032)
 POLYPEPTIDES, DEOXYNUCLEOPROTEIN
 COMPLEX (4516)
 RECOMBINANTS, DNA OLIGOMER INFEC-
 TION, KIDNEY CELLS, MONKEY
 (3060)
 RECOVERY FROM TRANSFORMED CELLS,
 INFECTIOUS DNA, MONKEY (5206)
 RELATED PAPOVAVIRUS, INFECTION,
 HUMAN, REVIEW (3612)
 REPLICATING DNA (5243)
 REPRESSION, INDUCTION, MONKEY CELL
 (5205)
 RESISTANCE TO INFECTION, MONKEY
 CELL (5879)
 RESISTANT CELL LINE (3752)
 REVERTANT CELL LINE, CONTACT
 INHIBITION, SIALIC ACID, MOUSE
 (0716)
 RNA, MOLECULAR SIZE, MONKEY CELL
 (1346)
 RNA SYNTHESIS, ALPHA-AMANITIN,
 MONKEY CELLS (5893)
- VIRUS - CONTINUED**
 SARCOMA, TRANSFORMED CELL,
 RADIATION SERUM GROWTH FACTOR,
 MOUSE (0720)
 SKIN FIBROBLASTS, TRANSFORMATION,
 DOWN'S SYNDROME, HUMAN (0435)
 STRUCTURAL PROTEIN, PHOSPHOPRO-
 TEINS (5230)
 SURFACE ANTIGEN, TUMOR, MOUSE
 (0485)*
 SYNTHESIS, ASSEMBLY (3048)
 TEMPERATURE-SENSITIVE MUTANT,
 INFECTION, MONKEY CELL (4542)
 TRANSCRIPTION, STRAND ORIENTATION,
 BSC-1 CELL (4541)
 TRANSFORMATION
 AMINO ACID DEPRIVATION,
 DNA SYNTHESIS, KIDNEY CELLS,
 HAMSTER (3063)
 CONCANAVALIN A RECEPTOR, HAMSTER
 (4568)
 HAMSTER CELL (4562)
 HOST CELL ROLE, HAMSTER (3830)*
 INHIBITION, 7,12-DIMETHYLBENZ-
 (A)ANTHRACENE, 3-METHYLCHOL-
 ANTHRENE, MOUSE (4504)
 NEOANTIGENS, FIBROSARCOMA CELLS,
 HAMSTER (5349)
 SHEEP CELLS (4607)*
 SPHINGOMYELIN BIOSYNTHESIS,
 MOUSE (4549)
 TRANSFORMED AMNION CELL, STRAIN
 LONGEVITY, HUMAN (1756)
 TRANSFORMED ASTROCYTE, ADENYLATE
 CYCLASE, PHOSPHODIESTERASE,
 HAMSTER (1750)
 TRANSFORMED CELLS
 CONTACT INHIBITION, ULTRA-
 STRUCTURE, MOUSE (0721)
 GROWTH, SERUM FACTOR, MOUSE
 (0429)
 METHIONINE DEPRIVATION, DNA
 SYNTHESIS, MOUSE (1349)
 RNA SEQUENCES (0430)
 SUPERINFECTION, MONKEY (3755)
- TUMOR**
 GENERATIONS, HAMSTER (5242)
 LACTATE AND MALATE DEHYDROGENASE
 HAMSTER (4582)*
 TUMOR ANTIGEN, TUMOR IMPRINT TEST,
 HAMSTER (5321)
 TUMOR IMMUNITY, CYTOSTATIC
 ANTIBODY, RAT (1042)
 TUMOR-SPECIFIC SURFACE ANTIGEN,
 HAMSTER, MOUSE (0715)
 TUMOR SPECIFIC TRANSPLANTATION
 ANTIGEN, ASSAY, MOUSE (0458)
 TUMORIGENIC ACTIVITY, UV RADIATION
 HAMSTER (3092)
 UMBILICAL CORD LEUKOCYTE, CULTURE,
 RADIATION, CHEMICAL CARCINOGEN,
 HUMAN (0719)
 VIRAL DNA, INCORPORATION, CELL
 CYCLE (0129)
 VIRUS-INDUCED PROTEINS, CV-1 CELLS
 (3038)
 XY-GONADAL DYSGENESIS, SUSCEPTI-
 BILITY, HUMAN (4514)
- VIRUS - CONTINUED**
 SV40 GENOME, TRANSFORMED MAMMALIAN
 CELLS, REVIEW (4315)
 SV40-LIKE, BRAIN, HUMAN (4517)
 SV40 PROTEINS, REVIEW (4335)*
 SV40 TEMPERATURE SENSITIVE MUTANT,
 TRANSFORMATION, T ANTIGEN SYNTHESIS,
 MOUSE (4526)
 SV40-TRANSFORMED CELL, HYBRID,
 ANTIGENICITY, CHROMOSOME, MOUSE, RAT
 (4510)
 SV40-TRANSFORMED CELLS
 AGGLUTINATION, PHYTOAGGLUTININS
 (2583)*
 CARBOHYDRATE COMPONENTS, MOUSE
 (2559)
 CONTACT-INHIBITED REVERTANT CELL
 LINES, CONCANAVALIN A (2514)
 KIDNEY, MONKEY (2574)*
 TEMPLATE, DNA TEMPLATE, DNA POLYMERASE
 ROUS SARCOMA VIRUS (1739)
 TOBACCO MOSAIC, BRONCHOGENIC CARCINOMA
 PATHOGENESIS, SMOKERS (4588)*
 TRANSFORMATION
 CELLULAR GROWTH, REVIEW (0603)
 HUMAN, ANIMAL, REVIEW (5046)*
 SV40, BASIC RESEARCH, REVIEW
 (5051)*
- TUMOR**
 CARCINOGENESIS, REVIEW (5753)*
 ETIOLOGY (0318)*
 TUMOR ANTIGEN, CUTANEOUS HYPER-
 SENSITIVITY, HAMSTER (0705)
 TUMOR INDUCING, ADENOVIRUS TYPE 12,
 MITOCHONDRIA, HAMSTER (2528)
 TURKEY HERPESVIRUS
 COURSE OF INFECTION, TISSUES,
 CHICKEN (5273)
 PATHOGENICITY, MARMOSET MONKEYS
 (5282)*
 VACCINE, CANCER, EPIDEMIOLOGY (0221)*
 VACCINIA
 DNA, POLYADENYLIC ACID (1766)*
 METHYLCHOLANTHRENE, NEOPLASTIC
 EFFECT, GENETIC FACTOR, MOUSE
 (1319)
 3-METHYLCHOLANTHRENE, COMBINED
 CARCINOGENICITY, GENETIC FACTOR,
 MOUSE (3121)
 3-METHYLCHOLANTHRENE, SKIN TUMORI-
 GENESIS, MOUSE (2486)
 VARIOLA, GROWTH, HYPERPLASTIC FOCUS
 FORMATION, HELA CELLS (3037)
 VESICULAR STOMATITIS PSEUDO TYPES,
 EMBRYO CELLS, MOUSE (4771)*
 VIRAL DNA, HOST DNA, HOMOLOGY, MONKEY,
 MONKEY CELL (3816)

- VIRAL DNA GENOMES, MAMMALIAN CELL ORGANIZATION, CARCINOGENESIS MECHANISMS, REVIEW (3611)
VIRAL ETIOLOGY, GARDNER'S SYNDROME, HUMAN, REVIEW (0620)*
VIRAL GENOME, CARCINOGENESIS, REVIEW (5757)*
VIROLOGY, PRIMATE, REVIEW (1212)*
VIRUS-LIKE PARTICLE
LARYNGEAL PAPILLOMA, HUMAN (1497)*
MAMMARY MILK, HUMAN (1693)
OOGONIA, OOCYTES, GUINEA PIG (5268)
RETICULUM CELL SARCOMA, EYELID CASE REPORT (6166)*
TRANSMISSIBILITY, ULTRASTRUCTURE, FIBROSARCOMA, CAT (1699)
VISNA, TRANSFORMATION, ASTROCYTE, HUMAN (5898)
VIRUS - CONTINUED
WOUND TUMOR
GROWTH (5249)
POLYPEPTIDE COMPOSITION, ULTRA-STRUCTURE (5213)
RNA, 3' TERMINUS (5217)
WOUND TUMOR
GROWTH, VECTOR CELL MONOLAYERS, PLANTS (4609)*
INFECTIVITY, INSECT VECTOR (1362)*
YABA
PLAQUE FORMATION, KIDNEY CELL, MONKEY (0145)*
1211, INFECTION MONKEY (1073)*
YABA POX
ENZYME ACTIVITIES (1004)
IMMATURE PARTICLE FORMATION, MONKEY (0687)
VITAMIN A
BENZO(A)PYRENE METABOLISM, MODIFICATION, CELL CULTURES, HAMSTER (4362)
DEFICIENCY, SQUAMOUS METAPLASIA, TRACHEA, HAMSTER (3685)
7,12-DIMETHYLBENZ(A)ANTHRACENE, SKIN CARCINOGENESIS, INHIBITION, MOUSE (0638)
ENHANCING EFFECT, ROUS SARCOMA, CHICKEN (3112)
EPITHELIAL CELL DIFFERENTIATION, MODE OF ACTION (4487)*
FIBROSARCOMA, RADIATION RESPONSE, IMMUNE RESPONSE, MOUSE (3730)
GLYCOPROTEIN SYNTHESIS, SKIN TUMORS, HUMAN (4378)
LYMPHOPROLIFERATIVE LESION, SKIN LESION, HAMSTER (5786)
3-METHYLCHOLANTHRENE, LUNG TISSUE, MOUSE (4425)
SARCOMA INCIDENCE, ROUS SARCOMA VIRUS, CHICK CELLS (1774)*
VITAMIN B2
DEFICIENCY, EPITHELIAL NEOPLASIA, ARYL HYDROCARBON HYDROXYLASE, MOUSE (3668)
VITAMIN B6
TRYPTOPHAN METABOLISM, NICOTINAMIDE ADMINISTRATION, HODGKIN'S DISEASE PATIENTS (4921)*
VITAMIN B12
BINDING, SERUM, CHRONIC MYELOID LEUKEMIA, HUMAN (1960)
DISTRIBUTION, NEUROBLASTOMA, INFANT (3503)*
FOLIC ACID, DNA-THYMIDINE SYNTHESIS, MOUSE (0553)
20-METHYLCHOLANTHRENE CARCINOGENESIS, ADRENAL CORTEX FUNCTION, MOUSE (5185)*
TUMOR GROWTH
HUMAN, REVIEW (1216)*
RAT, MOUSE, HAMSTER, GUINEA PIG, (5708)
VITAMIN B15
9,10-DIMETHYL-1,2-BENZANTHRACENE, MAMMARY GLAND TUMOR, RAT (3667)
VITAMIN K1
SYNTHETIC SUBSTITUTES, INCREASES IN TUMOR NAD+ LEVELS (4485)*
VULVA
BIZARRE LEIOMYOMA, CASE REPORT (5682)*
CARCINOMA, LEUKOPLAKIA, CLINICAL STUDY REVIEW (4170)*
GRANULAR CELL TUMOR, HISTOGENESIS, ULTRASTRUCTURE, REVIEW (3626)*
HEMANGIOPERICYTOMA, METASTASIS TO BONE CASE REPORT (5542)*
HYDRADENOMA PAPILLIFERUM, ULTRA-STRUCTURE, HUMAN (5592)*
INTRAEPITHELIAL CARCINOMA, CLINICAL STUDY (6325)*
MALIGNANCY, CONDYLOMA ACUMINATUM, PAGET'S DISEASE, CARCINOMA, MALIGNANT MELANOMA, CHROMOSOME, HUMAN (3940)
MALIGNANT DISEASE, CLINICAL STUDY (4981)*
MELANOMA, CLINICAL STUDY (5483)*
PAGET'S DISEASE
CASE REPORT (1413)
ULTRASTRUCTURE, CASE REPORTS (6324)*
PRURITUS, TRICHOMONAS, CANDIDIASIS, CANCER, HUMAN (6224)*
WALDENSTROM'S DISEASE
BETA 1 A/C CONCENTRATION, SERUM, HUMAN (5354)
WALDENSTROM'S MACROGLOBULINEMIA
IGM HEAVY CHAIN, LEUKEMIA, CASE REPORT (0773)*
WALKER'S CARCINOMA
CHROMATIN TRANSCRIPTION, DNA REPRESSION, TRANSFORMATION PROCESS (4090)*
CYTOGENETICS, METASTASES, RAT (4110)*
HEPATOMA, 1-CARBON GROUP METABOLISM, RAT (4210)*
LIGHT, SEX FACTOR, SURVIVAL, RAT (6218)*
METABOLITE EFFECTS, RAT ORGANS (6381)*
WART
ATOPIC SYNDROME, COINCIDENCE, HUMAN (1110)*
CUTANEOUS PAPILLOMAS, POPOVA VIRUS, OPOSSUM (3749)
GLUCOSE-6-PHOSPHATE DEHYDROGENASE, HUMAN (0396)
PAPILLOMA VIRUS, HUMAN (4509)
WARTHIN'S TUMOR
ULTRASTRUCTURE, HUMAN (0795)*
WHEAT GERM AGGLUTININ
AGGLUTINATION, ROUS SARCOMA VIRUS, TRANSFORMED CELLS (5914)
MEMBRANE BINDING SITE, TUMOR CELL (4864)
WHITE BLOOD CELL
ANTIGENICITY, CHRONIC LYMPHOCYTIC LEUKEMIA, HUMAN (4620)
WILM'S TUMOR
ABDOMINAL TUMORS, CLINICAL STUDY,

CHILDREN (5449)
 BILATERAL, CASE REPORTS, REVIEW
 (4352)*
 BROTHERS, CASE REPORT (1163)*
 CANCER PROGRESSION, EPIDEMIOLOGICAL
 STUDY, ENGLAND (4830)*
 CELLULAR IMMUNITY, NEUROBLASTOMA,
 HUMAN (4731)*
 CIRCULATING MUCIN, PATHOLOGY, CHILDREN
 (4228)*
 IMPERFORATE ANUS, 45,XO CHROMOSOME,
 TURNER'S SYNDROME, CASE REPORT
 (1139)*
 KIDNEY, 2-MUTATION MODEL (3238)
 MYOGENESIS, ULTRASTRUCTURE, CASE
 REPORT (5485)*
 NEPHROBLASTOMA
 RAT (2134)*
 ULTRASTRUCTURE, HUMAN (4973)*
 NEUROBLASTOMA, CELL POPULATION
 KINETICS, HUMAN (4221)*
 RENAL TRANSPLANT, IMMUNOSUPPRESSION,
 HUMAN (4276)*
 WOOD DUST
 CANCER, OCCUPATIONAL HAZARD, BOOT AND
 SHOE INDUSTRY, REVIEW (4360)*
 FURNITURE WORKER, ETHMOID SINUS,
 ADENOCARCINOMA, INCIDENCE (1270)
 WOUND
 CHRONIC, MALIGNANT CHANGE, HUMAN,
 REVIEW (1507)
 CICATRIZATION, CANCER, RAT (4149)*
 X-IRRADIATION
 EHRlich ASCITES TUMOR, TETRAPLOID
 CELLS, MOUSE (2478)*
 YEAST
 ANTITUMOR IMMUNITY, SACCHAROMYCES
 CEREVISIAE (1818)
 ZINC
 CONCENTRATION, CARCINOMA, LIVER
 TISSUES, HUMAN (2447)*
 CONTENT, AVIAN LEUKOSIS COMPLEX,
 TISSUES, FOWL (5527)*
 DIET DEFICIENCY, TUMOR INHIBITION,
 MOUSE, RAT (3306)
 DIETARY, CARCINOGENESIS INHIBITION,
 DIMETHYLBENZANTHRACENE, HAMSTER
 (1259)
 GRANULOCYTE, CARCINOMA, UTERUS, HUMAN
 (0571)*
 METABOLISM, BLOOD GRANULOCYTES, HUMAN
 (2897)*
 TESTICULAR TERATOMA, INDUCTION,
 JAPANESE QUAIL (1547)

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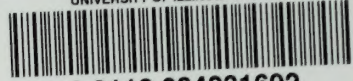
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